

A-20 Thematic Poster - A Wonder Drug for Healthy Aging: Physical Activity

Wednesday, May 31, 2017, 9:30 AM - 11:30 AM
Room: 505

80 Chair: Loretta DiPietro, FACSM. *The George Washington University, Washington, DC.*
(No relationships reported)

81 Board #1 May 31 9:30 AM - 11:30 AM
Intermittent Walking has Similar Effects on 24-Hour Glycemia as a Calorically Equivalent Continuous Walk in Older Adults

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Reported Relationships: K. Lyden: Consulting Fee; PAL Technologies.

Older adults spend more time engaged in sedentary behavior (SB) than any other segment of the population. Interrupting sedentary time with short bouts of walking improves 24-hour glycemic control compared to uninterrupted sitting. However, it is not known if short-walking bouts are as beneficial to 24-hour glycemia as a single bout of continuous exercise. **Purpose** To compare the effectiveness of multiple, short intermittent walking bouts and one, calorically equivalent continuous bout of walking on 24-hour glycemia in older adults. **Methods** Healthy, overweight/obese older adults (N=18, 67 ± 5 y, BMI = 32.2 ± 4.3 kg/m²) completed two, 24h conditions in a whole room indirect calorimeter; 1) Intermittent walking (IW): 1.5 min of moderate intensity treadmill walking (36 min total) every 30 minutes and 2) continuous walking (CW): 36 min continuous, moderate intensity treadmill walking performed in the morning (~8AM). Outside of the prescribed walking times, subjects remained in SB for the remainder of the waking day. Continuous glucose monitoring was used to measure interstitial glucose concentrations every 5 minutes. Energy and macronutrient intake was standardized between conditions. **Results** 24-hour energy expenditure (2257 ± 329 vs. 2165 ± 302 kcal, mean ± SD) and RQ (0.84 ± 0.03 vs. 0.84 ± 0.03) were similar during IW and CW, respectively. Peak postprandial glucose following dinner was lower (p<0.05) during IW (120.4 ± 10.7 mg/dl) compared to CW (135.3 ± 15.3 mg/dl). No differences were observed in any other 24 hour glycemia variables, including 24 hour area under the glucose curve (IW = 154862 ± 12724 mg/dl, CW = 158096 ± 15156 mg/dl), glycemic variability (standard deviation of 24 hour glucose concentrations) (IW = 12.2 ± 4.4 mg/dl, CW = 12.2 ± 4.2 mg/dl), and peak postprandial glucose concentrations following breakfast (IW = 144.0 ± 22.7 mg/dl, CW = 144.8 ± 27.2 mg/dl) and lunch (IW = 137.9 ± 17.1 mg/dl, CW = 139.2 ± 17.8 mg/dl). **Conclusion** These results suggest IW had similar effects as CW on 24-hour glycemia, although the postprandial glucose response to meals consumed later in the day may be lower with IW. IW may improve cardiometabolic health in older adults.

82 Board #2 May 31 9:30 AM - 11:30 AM
Mobility Improvement After an Exercise Program for Older Adults: Role of Initial Mobility

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Basic mobility tasks are often used to assess improvement in response to physical activity interventions for older adults. However, it can be argued that if strength and endurance capacities are adequate prior to engaging in a program of exercise, further increases in capacity are not expected to alter basic tasks. Usual Gait Speed (UGS), 6 Minute Walk (6MW), and Timed Up and Go (TUG) are often used in research evaluate the efficacy of an exercise training program for older adults. However, the change in these measures has not been evaluated in relation to initial mobility. **PURPOSE:** To evaluate the improvement in basic mobility tasks in response to a ten-week community based exercise program for older adults with high or low functional ability. **METHODS:** Sixty-one older adults (age= 72.7 yrs±7.9); BMI=32.3±7.2) completed the 10-week Physical Activity for Seniors for Life (PALS) group exercise and lifestyle behavior change program. TUG (time in seconds to rise from a chair, walk 3 meters, return to chair and sit), 6MW (distance covered in 6 minutes), and UGS (meters/second to walk 6 m distance) were measured before and after the exercise program. Participants were divided into upper and lower functional groups based on the median for each mobility task. Repeated measures ANOVA and Effect Size (Cohen's d) were used to examine mean differences within the two groups. **RESULTS:** After the exercise program, the lower functional group showed significant improvement in all basic mobility tasks (p<0.001). The upper functional group showed significant improvement

in 6MW (p<0.001) and TUG (p=0.006), with no significant change in UGS (p=0.816). Importantly, the lower functional group demonstrated much higher effect sizes in all three tests (6MW: 763 vs 1121 feet, d=0.936; TUG: 13.3 vs 11.2 seconds, d=0.858; UGS: 6.3 vs 5.4 seconds d=0.800), pre, post respectively, while the higher functional group showed only moderate or low effect sizes, 6MW (1414 vs 1522 feet, d=0.562), TUG (9.1 vs 8.3 seconds d=0.577), UGS (4.65 vs 4.62 seconds d=0.041) pre, post respectively. **CONCLUSION:** These results suggest that UGS may be better suited for use with a frail population, while TUG and 6MW may be useful across a wider range of functional ability in older adults.

83 Board #3 May 31 9:30 AM - 11:30 AM
Unemployed Older Adults' Social Participation was Associated with More Physical Activity and Less Sedentary Time

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PURPOSE: Social participation provides health benefits for older adults, but it is not known whether social participation is associated with their being more physically active or less sedentary. We examined these associations in a population-based sample of older Japanese adults.

METHODS: A mail survey conducted in 2010 and gathered data from 1146 community-dwelling, non-working older adults (mean age: 70.1 years, 43% men) on social participation, physical activity, sedentary time and socio-demographic characteristics. Median splits were used to categorize social participation, physical activity and sedentary behavior as either 'higher' or 'lower'. Multivariate logistic regression analyses were used to calculate odds ratios (ORs) for the associations of higher versus lower social participation with being physical active and having higher sedentary time. Similar analyses were conducted after classifying sedentary behaviors into two distinct types: passive sedentary behaviors (consisting of "television viewing", "sitting around", and "listening or talking while sitting") and mentally-active sedentary behaviors (consisting of "computer use" and "reading books or newspapers")

RESULTS: Those with higher social participation had a significantly greater odds of higher physically activity (OR=2.10, [95% confidence interval (CI): 1.44-3.06] among men; OR=1.93, [1.39-2.68] among women); and a significantly lower odds of higher sedentary time among men (OR=0.62, [0.42-0.90]), but not among women (OR=0.80, [0.58-1.11]). Those with higher social participation had significantly lower passive sedentary time (OR=0.55, [0.38-0.81] for men; OR=0.72 [0.51-0.99] for women), but this was not the case for mentally-active sedentary time (OR=1.36, [0.91-2.02] for men; OR=1.17 [0.83-1.63] for women).

CONCLUSIONS: Promoting social participation among older adults may be effective for increasing their physical activity and reducing sedentary time.

84 Board #4 May 31 9:30 AM - 11:30 AM
Effects of Stair Climbing on Leg Muscle Strength in Older Adults Attending Physical Activity Programs

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Purpose: Stair climbing can be a strenuous task and stair accidents/injury are common among older adults. We evaluated the effectiveness of daily stair climbing on leg muscle strength in older adults participating in weekly community physical activity programs for 6 months. **Methods:** Seventy-four healthy older adults (50 women, 24 men, mean age, 73.5 ± 5 years) were recruited. Participants attended weekly physical activity programs at their community center and recorded their daily walking and stair climbing steps using a pedometer, Omron, HJA-403C, which detects both types of steps. Prior to and after the 6-month study period, height, weight, and leg strength (i.e., abductor muscle strength, adductor muscle strength, and knee extensor strength) were measured. During the study period, the instructors encouraged participants to engage in stair climbing by explaining the health benefits, providing information on locations of stairs nearby, and listening to participants' experiences on routine stair use. A paired t-test was used to determine the changes in steps and leg strength before and

after the 6-month study period, and Pearson correlation analysis was used to identify correlations between the stair climbing steps and leg strength. **Results:** Forty-nine participants (34 women, 15 men) completed the study. At the baseline, the participants recorded an average of 120 stair steps per day, which was approximately 2% of their daily total walking steps. After the 6-month study period, the mean walking steps ($6,607 \pm 3,235$ steps vs. $7,556 \pm 2,715$ steps) and stair steps (119 ± 90 steps vs. 166 ± 123 steps) increased significantly ($p \leq 0.01$). There were no significant changes in leg muscle strength (Pre-test vs. Post-test: Adductor, 0.35 ± 0.11 vs. 0.35 ± 0.10 kg/kg, Abductor 0.41 ± 0.11 vs. 0.44 ± 0.10 kg/kg). However, in men the correlation coefficient between the stair steps and abductor muscle strength was observed (Pre-test: $r=0.428$, $p=0.04$, Post-test: $r=0.556$, $p=0.03$). **Conclusions:** Stair-use campaigns increased routine daily stair use (about 50 steps) in older adults. This did not significantly change leg muscle strength, however in men the relationship between the stair steps and abductor muscle strength was observed. In a future study, cross-sectional evaluations of stair steps and leg muscle strength will be examined.

85 Board #5 May 31 9:30 AM - 11:30 AM
Effects of Tai Chi on Mobility in Older Adults with Multisite Pain

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Chronic pain is associated with impaired mobility and risk of falls in older adults. **PURPOSE:** To examine the effects of Tai Chi on mobility in older adults with multisite pain and risk of falls. **METHODS:** Fifty-four community-dwelling older adults (≥ 65 years) with multisite pain who reported falling in the previous year or using an assistive device were randomized to gentle body exercise or mind-body exercise (Tai Chi), each offered twice weekly for 12 weeks. Assessments were performed at baseline and within 2 weeks after completing the intervention. Mobility was measured in 2 conditions: single-task walking and dual-task walking with a cognitive attentional challenge, by using a 16-foot sensorized gait mat. Paired t-tests were used to assess changes within each group, and student t-tests were used to assess differences between groups. **RESULTS:** Twenty-three participants in the body exercise group and twenty-two participants in the Tai Chi group completed the study. The body exercise intervention did not change any gait measures. However, the Tai Chi intervention significantly improved single-task stride time (from 1.20 ± 0.11 s to 1.16 ± 0.10 s, $p < 0.05$) and swing time (from 31.77 ± 3.20 % to 32.23 ± 2.82 %, $p < 0.05$), and decreased dual-task gait asymmetry (from 5.40 ± 3.92 to 2.87 ± 3.07 , $p < 0.05$). Also, comparing the 2 interventions, participants in the Tai Chi group versus the body exercise group significantly decreased dual-task gait asymmetry from baseline to the post-intervention assessment (body exercise: 0.33 ± 3.54 vs. Tai Chi: -2.53 ± 4.41 , $p < 0.05$). **CONCLUSION:** Tai Chi improved several single-task and dual-task gait measures in older adults with multisite pain and risk for falls. A larger study is required to examine the effectiveness of Tai Chi on mobility and fall risk in older adults with multisite pain. (Supported by NIH Grant R21 AG043883)

86 Board #6 May 31 9:30 AM - 11:30 AM
A 3-Month Dalcroze Eurhythmics Intervention May Improve Gait Speed in Community Dwelling Elderly Participants

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Falls lead to lower quality of life, reduced independence, and increased mortality in the elderly. Many falls occur while walking, especially when performing other tasks simultaneously. Dalcroze eurhythmics (DE) is a music-based movement training program that emphasizes multitask coordinated movement. A previous 6-mo DE study in the elderly demonstrated significant improvements in gait and balance. However, the effects of a short-term DE intervention on fall risk-related outcomes is unknown. **PURPOSE:** To determine if a 3-mo DE intervention improves measures of gait and balance, self-perceptions of health, and fear of falling in a community-dwelling elderly cohort. We hypothesized that improvements would be detected in all outcome measures after the intervention. **METHODS:** 9 participants (8 females, 1 male; age 79.0 ± 12.3 y) completed the intervention. DE sessions, led by a certified DE instructor, were held 1x/wk at a community senior program. Pre and post-testing sessions occurred 1 wk before the program began, and 1 wk after the last session, respectively. Gait speed (m/sec) was determined by the 6-m walk test (6MWT). Dual-

task gait speed was determined from repeating the 6MWT, but while participants counted backward from 50. Balance and coordinated stability was assessed using a Swaymeter test. Participants' perceptions of overall, physical, and mental health was assessed by SF-12 questionnaires. Fear of falling was assessed with the Tinetti Falls Efficacy Scale. Paired t-tests were used to compare mean differences. **RESULTS:** Gait speed improved significantly post-intervention (0.92 ± 0.11 vs 1.04 ± 0.12 m/sec, $p=0.0005$). Trends toward significance existed for improvements in SF-12 total score (91.5 ± 4.4 vs 100.6 ± 3.9 , $p=0.08$), and mental component score (52.8 ± 3.3 vs 58.0 ± 2.3 , $p=0.06$), and Swaymeter results (10.0 ± 1.5 vs 7.9 ± 1.7 deviations, $p=0.07$). No differences were found for SF-12 physical component scores or in fear of falling after the intervention. **CONCLUSION:** Participating in Dalcroze eurhythmics for 3 mo may improve gait speed under single and dual task conditions. This movement training approach could be considered for use by community senior programs as a possible fall risk reduction intervention for the elderly.

87 Board #7 May 31 9:30 AM - 11:30 AM
Yearlong Walking Exercise Improves Depression and Health-related Quality of Life in Older Adults

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Previous studies suggest that moderate-intensity aerobic exercise and strength training are effective for improving depression and health-related quality of life (HRQL) in older adults. However, the effects of long-term walking exercise on depression and HRQL in older adults has not been determined. **PURPOSE:** The purpose of this study was to assess the effectiveness of 12 months of walking exercise in improving depression and HRQL in older adults. **METHODS:** We divided 180 apparently healthy older adults into 2 non-randomized groups: a 12-month walking exercise group ($n = 110$, 60 men and 50 women; mean age, 72.2 ± 6.4 years) and a non-walking exercise group ($n = 70$, 39 men and 31 women; mean age, 72.6 ± 3.8 years). The Center for Epidemiological Studies Depression Scale (CES-D) and the Medical Outcomes Study 36-Item Short-Form Health Survey version 2 (SF-36v2) were used to measure depressive symptoms and HRQL. In Japanese, SF-36v2 scores are summarized in physical HRQL scores (physical component summary [PCS]), mental HRQL scores (mental component summary [MCS]), and role / social HRQL scores (role / social component summary [RCS]) (Suzukamo et al. 2011). Therefore, in the analysis of SF-36v2 scores, we evaluated PCS, MCS, and RCS. **RESULTS:** Participants in the walking exercise group showed significant improvement in CES-D scores (11.0 ± 4.1 points vs. 9.7 ± 4.8 points, $p < 0.001$), MCS scores (54.5 ± 9.1 vs. 56.8 ± 8.6 , $p = 0.005$), and RCS scores (49.4 ± 9.4 vs. 52.8 ± 9.0 , $p < 0.001$) compared to the baseline values. Overall, the average step counts per day of the walking exercise group participants significantly increased, compared to the baseline values (7747 ± 1782 steps / day vs. 8736 ± 2701 steps / day, $p < 0.001$). **CONCLUSIONS:** Twelve months of walking exercise may be effective for improving CES-D, MCS, and RCS scores in older adults.

88 Board #8 May 31 9:30 AM - 11:30 AM
Physical Activity and Sedentary Behavior of Older Adults Related to Physiological Metrics of Walking Effort

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Older adults spend nearly ten hours of the waking day in sedentary activities that increase risk for chronic disease progression and loss of physical function. It is important to understand how the physiological demands of ambulation contribute to ambulatory and sedentary behavior so effective interventions can be implemented in this at-risk population. **PURPOSE:** To determine whether neuromuscular, pulmonary, and cardiac demand during a fixed-paced walk explain variance in sedentary behavior and walking activity in community-dwelling older adults. **METHODS:** Twelve women and thirteen men, 77 ± 9 yr, 74.6 ± 15.5 kg, 26.0 ± 4.3 kg/m², performed a four-minute, steady-state walk on a treadmill at 1.25 m/s¹ while activation of the vastus lateralis muscle, heart rate, and minute ventilation were recorded. ActivPAL accelerometers were used to record time spent walking and sedentary over 96 consecutive hours. Sleep logs were used to calculate time spent awake during the monitoring period. Walking time and sedentary time were then recorded as percent of the waking day. Stepwise regression determined whether peak muscle activation, minute ventilation, and heart rate predicted sedentary and walking time. **RESULTS:**

Participants spent $56 \pm 11\%$ (9.0 ± 1.9 hr) of the waking day sedentary and $12.5 \pm 3.0\%$ (2.0 ± 0.5 hr) walking. Partial correlations from stepwise regression showed that sedentary time was positively related to muscle activation during walking ($r = 0.56$, $p = 0.011$), but not to ventilation ($r = 0.23$, $p = 0.346$) or heart rate ($r = 0.03$, $p = 0.915$). In contrast, walking time was inversely related to minute ventilation ($r = -0.57$, $p = 0.008$), but was not related to muscle activation ($r = -0.04$, $p = 0.881$) or heart rate ($r = 0.14$, $p = 0.569$). **CONCLUSIONS:** Physical activity and sedentary behavior are independent disease risk factors and this study's results indicate that different aspects of physical function may contribute to their variability in older adults. Time spent sedentary was related to the degree of neuromuscular demand during walking suggesting that older adults who have high muscle activation during ambulation are more likely to engage in sedentary behavior. Time spent walking was inversely related to pulmonary demand suggesting that those who walk with a high ventilatory rate are less likely to engage in walking activity.

A-21 Thematic Poster - Children and Adolescents

Wednesday, May 31, 2017, 9:30 AM - 11:30 AM
Room: 304

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(No relationships reported)

90 Board #1 May 31 9:30 AM - 11:30 AM

Fitness and Body Composition Outcomes in Adolescent Athletes Consuming Chocolate Milk or Gatorade Post-Exercise

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Purpose. This study examined fitness and body composition outcomes for adolescents consuming chocolate milk (CM) or a carbohydrate/electrolyte (CHO) drink throughout a school-sponsored summer strength and conditioning program. **Methods.** Participants were 100 high school athletes (M age = 15.1, $SD = 1.3$; 78% male; 46% Afr. Amer.). Measures included a bench press (BP), squat, power clean, bodyweight, and hand-held BIA body fat assessment. BP and squat were combined for a composite strength score (CSS). Participants completed 4 days/week of strength and conditioning training for 6 weeks. The workouts consisted of a 1-hour free weight resistance training session followed by 1-hour of on-field agility drills and conditioning sprints. Participants were randomly-assigned to receive either CM (16 oz, 300 Cal, 5g fat, 360 mg Na, 44 g carbs, 16 g protein) or CHO (28 oz, 0 g fat, 320 mg Na, 42 g carbs, 0 g protein) immediately post-exercise. **Results.** A 2-way repeated measures ANOVA showed no bodyweight changes from pre- to post-test ($p = .071$, $d = .06$). Additionally, there was not a significant change in body fat percentage ($p = .89$, $d = .03$). No interactions presented by condition for weight ($p = .49$, $\eta_p^2 = .005$) or body fat ($p = .43$, $\eta_p^2 = .006$). Both groups showed an improvement in power clean ($p < .001$, $d = .22$) across time with no interactions. However, the CSS showed a significant condition by time interaction ($p = .044$, $\eta_p^2 = .08$) wherein the CHO group did not significantly increase over time ($p = .406$) while the CM group significantly improved in CSS from pre- to post-test ($t = -4.153$, $p < .001$). Paired samples t-tests of the separated BP and squat showed that the CHO group significantly decreased in mean BP (7.26 lbs, $p = .044$) but had no change in squat (17.7 lbs, $p = .154$). The CM group showed significant increases in both BP (9.06 lbs, $p = .039$) and squat (36 lbs, $p < .001$). **Discussion.** This is the first study comparing the impact of CM and CHO on athletic outcomes in an adolescent population in a field-based environment. The use of CM appears to have provided a moderate benefit for increases in strength. This study replicates the findings of laboratory studies, and extends them by showing a benefit in adolescent athletes in a naturalistic setting. Future research will benefit from longer study durations with larger numbers of participants.

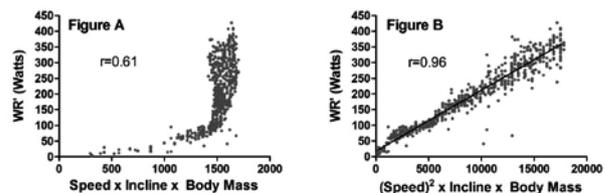
91 Board #2 May 31 9:30 AM - 11:30 AM

A Novel Approach To Calculate Work Rate On A Treadmill (TM) In Early-and Late-pubertal Children

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Childhood obesity and children who survive previously fatal diseases and conditions highlight the need for rigorous metrics of fitness in children and across the lifespan. Cardiopulmonary exercise testing (CPET) data in children must be scaled to the magnitude of the metabolic perturbation. In CPET using cycle ergometry (CE), the external work (WR) is readily determined. With TM testing WR is hard to estimate from its key elements of speed, incline, and body mass (S, I, M) given the complexity of the mechanics of energy cost as S and I change. **PURPOSE:** To estimate WR associated with TM exercise (S,I,M) in early and late pubertal boys. **METHODS:** Our strategy involved: 1) Using CE to establish the regression coefficient (a) and intercept (b) from the linear equation $\dot{V}O_2 = aWR + b$; 2) assuming the same relationship we estimated work rate (WR') from the $\dot{V}O_2$ measured on TM using S, I, M (Fig A) and S^2, I, M (Fig B); 3) analyzed the regression parameters from the function $WR' = a(S^2, I, M) + b$ in 10 early pubertal (mean age 9.8 y/o, tanner stage 1-2) and 10 late pubertal boys (15.8 y/o, tanner stage 4-5), performed CPET on CE and TM. **RESULTS:** WR' was moderately and non-linearly correlated with S I M (mean $r = 0.61$, Fig A). However mean $r = 0.96$ and linear relationship was found with $WR' = a(S^2 I M) + b$, (Fig B). Further, the slope (a) was significantly higher in the younger (0.0395 ± 0.006) compared with the older boys (0.0316 ± 0.008 , $p = 0.017$). **CONCLUSION:** This approach enables CPET data interoperability between TM and CE. WR' seems to be a square function of S, making it a linear function of kinetic energy (MS^2). CPET slopes (e.g., $\Delta \dot{V}O_2 / \Delta WR$ or $\Delta HR / \Delta WR$) can be calculated and provide useful insights into disease mechanisms and progression in children and adults, when maximal efforts are questionable. The maturational related differences between WR' and SIM suggest a biological difference in the efficiency of muscular work as children grow and develop. Supported by NIH P01HD-048721 & PERC System Biology Fund

Data from a representative 17 y/o boy



92 Board #3 May 31 9:30 AM - 11:30 AM

Effectiveness of the Scaling Method in Normalizing Strength Measurement of U.S. Children And Youth

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PURPOSE: Studies have shown that body size may affect athletes' performance in fitness tests. Thus, individuals with larger body mass (BM) often exhibit a greater amount of muscle tissue and perform well on certain fitness tests when the load is "absolute" (i.e., the load, e.g., a 10 kg dumbbell, keeps the same across the test takers). To account for this effect, it is common practice to normalize athlete performance by simply dividing the outcome variable by BM. Yet, the effectiveness of this approach has not been well studied in children and youth. Using the data from the 2012 NHANES National Youth Fitness Survey (NNYFS), this study was to explore and evaluate possible scaling methods to eliminate the effect of body mass on children's performance in fitness tests, especially strength tests. **METHODS:** 1640 participants (50.2% male; aged 3-15 yr.) took part in the physical fitness tests. Lower body muscle strength (LBMS) was derived from knee extension tests and hand grip strength (HGS) was determined by the handgrip dynamometer. Five different scaling methods (dividing the outcome variable by BM, BM^2 , BM^3 , square root (SQRT) of BM, and natural logarithm (ln) of BM) were applied and the correlations between test results and BM (kg) before and after scaling were examined in each method. **RESULTS:** Results from the correlation analysis showed that BM is highly correlated with strength measures in both boys (LBMS: .702, HGS: .793) and girls (LBMS: .666,

HGS: .790). By dividing by BM, the overall correlation coefficients were significantly decreased (LBMS: .687 to -.102, HGS: .780 to -.258) and the body size effect was better adjusted in boys (LBMS: -.044, HGS: -.171) than in girls (LBMS: -.173, HGS: -.412) using the scaling method.

	Scaling Method	LBMS (pounds)	HGS (kg)
Boy	None	.702	.793
	/BM	-.044	-.171
	/BM ²	-.658	-.823
	/BM ³	-.673	-.776
	/SQRT(BM)	.444	.530
	/ln(BM)	.596	.695
Girl	None	.666	.790
	/BM	-.173	-.412
	/BM ²	-.698	-.834
	/BM ³	-.716	-.778
	/SQRT(BM)	.348	.417
	/ln(BM)	.529	.653
Overall	None	.687	.780
	/BM	-.102	-.258
	/BM ²	-.676	-.824
	/BM ³	-.693	-.774
	/SQRT(BM)	.406	.483
	/ln(BM)	.569	.669

CONCLUSION: The effect of body size on measurement of LBMS and HGS could be adjusted by simply dividing by BM and the effect was more significant in boys.

93 Board #4 May 31 9:30 AM - 11:30 AM
Interpopulation Variations in Height Growth: a Potential Explanation for Differences in Adolescent Swim Performance

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Maturation-based superiority in adolescent sport performance has been well documented. Because the timing of maturational events differs among ethnic or geographically-disparate populations, we hypothesized that interpopulation variations in physical growth patterns may be related to differences in athletic performance. **PURPOSE:** To determine the relationship between height growth and swim performance progression for two geographically disparate populations (Japanese, JPN; and the U.S., US) and the extent to which interpopulation variations in height growth are related to respective swim performance progression. **METHODS:** Growth reference data were acquired for JPN (MEXT, 2000) and US (Kuczumski et al., 2002). All performance times (sec) in 50-meter long course freestyle (50Fr) for JPN (N = 46900) and US (N = 60739) in 2008 were compiled from each swimming federation's database. For each age within each sex, a t-test was performed to compare 50Fr between JPN and US. Pearson correlation coefficient was used to evaluate 1) the strength of the relationship between age-related median height and median 50Fr for each sex within each country and 2) the extent to which interpopulation variations in age-related height growth (expressed as JPN to US ratio) are related to those in age-related 50Fr progression for each sex. **RESULTS:** As compared with the respective US cohort, age-related peak height gains occur approximately two years earlier for JPN (10 vs 12 yr in girls; 12 vs. 14 yr in boys). The 50Fr was faster for JPN girls aged 7 to 11 yr and JPN boys aged 7 to 9 yr ($p < 0.001$), not different for girls at 12 yr and boys at 10 and 11 yr, and slower at 13 yr and older for JPN girls and 12 and older for JPN boys ($p < 0.001$). Median height was correlated with median 50Fr during adolescent ages for US girls and boys ($r(12) = -0.97, p < 0.001$), JPN girls and boys ($r(9) = -0.97, p < 0.001$). The JPN to US ratio in height growth was also correlated with that in 50Fr progression in girls ($r(9) = 0.71, p = 0.015$), but not in boys ($r(9) = 0.49, p = 0.12$). **CONCLUSIONS:** Maturation-related superiority in swim performance is not only observable within a population but also between populations. Interpopulation variations in the timing of maturational events (as measured by age-related peak height gain) partially explain differences in adolescent athletic performance.

94 Board #5 May 31 9:30 AM - 11:30 AM
Activity Profile of Pokemon GO in College Students
 Charles Fountaine, Emily Springer, Jasmine Sward. *University of Minnesota Duluth, Duluth, MN.* (Sponsor: John R. Keener, FACSM)
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 (No relationships reported)

Since its debut in July 2016, Pokemon GO has been a wildly popular mobile gaming app. In contrast to many previous exergames, Pokemon GO requires the user to be physically active. However, the extent to which Pokemon GO contributes to physical activity is unknown. **PURPOSE:** to investigate the activity profile of playing Pokemon GO for 60 minutes in college students.

METHODS: College students (n=24, n=15 female) were fitted with an accelerometer, pedometer, and heart rate monitor to assess the activity demands during a 60-min bout of playing Pokemon GO. Troiano accelerometer cut points were utilized to estimate time spent in sedentary, light, moderate, and vigorous physical activity.

RESULTS: Descriptive statistics for heart rate (average and peak), total steps, and time (min) spent in sedentary, light, moderate, and vigorous physical activity are displayed in the table below. On average, 82.7% ± 10.1% of the play time was spent in moderate-intensity physical activity.

CONCLUSIONS: The results of this study suggest that playing one hour of Pokemon GO can be an effective means of accumulating recommended levels of physical activity.

Avg. HR (bpm)	Peak HR (bpm)	Steps	Sedentary (min)	Light (min)	Moderate (min)	Vigorous (min)
100.3 ± 11.3	133.8 ± 17.7	5992.1 ± 578.8	4.9 ± 3.0	6.1 ± 3.9	50.1 ± 5.3	0.15 ± 0.4

95 Board #6 May 31 9:30 AM - 11:30 AM
Associations Among Perceived Motor Competence, Motor Competence, Physical Activity, And Health-related Physical Fitness Of Children Ages 10-15 Years Old.

Emily M. Post¹, Dawn P. Coe, FACSM², Eugene C. Fitzhugh², Jeffrey T. Fairbrother². ¹The Ohio State University, Columbus, OH. ²The University of Tennessee, Knoxville, TN. (Sponsor: Dr. William Kraemer, FACSM)
 (No relationships reported)

PURPOSE: To examine the associations among perceived motor competence (PMC), motor competence (MC), moderate to vigorous physical activity (MVPA), and health-related physical fitness during middle childhood and early adolescence. **METHODS:** Participants were 47, 10-15-year-old youth (12.2 ± 1.64 yrs, 50.2 ± 16.2 kg, 157 ± 13.1 cm). Each participant made two visits, separated by at least 7 days, in East Tennessee or northwest Ohio, during which they completed the Bruininks-Oseretsky Test of Motor Proficiency, 2nd Edition, Harter's PMC questionnaire (Harter, 1978), and the FITNESSGRAM battery for health-related physical fitness. Actigraph GT3X+ accelerometers were worn for seven days to measure MVPA. **RESULTS:** There were significant ($p \leq 0.05$) positive correlations between physical fitness and both MC ($r_s = 0.44, p < 0.01$) and PMC ($r_s = 0.32, p < 0.05$). Additionally, a significant positive correlation was discovered between PMC and MC ($r_s = 0.47, p < 0.05$). There were no significant correlations between average daily MVPA and the other variables.

CONCLUSION: Results indicated that higher MC and PMC were associated with higher levels of health-related physical fitness. The interrelationship of these three variables was consistent with previous studies linking the development of fundamental motor skills to participation in complex movement behaviors, such as sports and other lifetime fitness activities, and the development and strengthening of PMC (Stodden & Robertson, 2009; Hands et al., 2008; Cliff et al., 2011; Zask et al., 2012; Barnett et al., 2010).

96 Board #7 May 31 9:30 AM - 11:30 AM
Tracking Physical Activity and Sedentary Behavior in Adolescents using a Mobile Application
 Todd Buckingham, Karin Pfeiffer, FACSM. *Michigan State University, East Lansing, MI.*
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 (No relationships reported)

During adolescence, sedentary time tends to increase while physical activity (PA) declines. Self-report measures of adolescents' activities are often prone to recall bias and are limited by their inability to detect simultaneous activities. Real-time measurements (Experienced Sampling Method, ESM) may address these limitations

by assessing activities when they take place. **PURPOSE:** To describe adolescents' after-school behaviors through use of a mobile application using ESM. The secondary purpose was to examine the feasibility and acceptability for adolescents to track their after-school PA and sedentary behaviors.

METHODS: Participants completed surveys on the behavior in which they were engaged at the time the survey was sent, using an app on their mobile device. The surveys occurred randomly, three times, from 3:30-9pm, for seven days. Participants also completed a 15-minute, telephone-based follow-up interview to assess ease and likeability of using the app on 5-pt scales (1=very easy, 5=very hard; 1=disliked a lot, 5=liked a lot). **RESULTS:** Thirty adolescents, 11-15 years old, submitted 560 surveys using the mobile device app (89% response rate). The adolescents most often reported engaging in "Other" activities (e.g., shopping, sitting) at 16.8% of total responses, followed by physical activity (14.3%). The least common activity was using their computer (1.6%). Two participants reported engaging in multiple activities at the same time (0.5%). Participants indicated the app was very easy to use (mean=1.5), and that they liked using the app (mean=3.9). On average, adolescents completed the survey in 0:08:06. However, from the time the survey was sent to the time they began the survey, it took the adolescents nearly 3 hours to begin.

CONCLUSIONS: To be considered ESM, participants must answer surveys immediately after they are sent. Although the mobile app appears to be appealing and easy to use, adolescents did not always answer the surveys in a manner that qualifies as ESM. Mostly, this was due to participants' lack of reliable access to their own mobile device. ESM may be an improvement over self-report recall surveys, but future investigators should note the limitations of using ESM with adolescents. Supported by the Michigan State University College of Education Summer Research Fellowship

97 **Board #8** **May 31 9:30 AM - 11:30 AM**
Fitness, Adiposity, Sports Participation, and Arterial Stiffness in Youth With Chronic Diseases or Physical Disabilities.

Tim Takken¹, Kristel Lankhorst², Frank Backx¹, Anne Visser-Meily¹, Eero A. Haapala³. ¹UMC Utrecht, Utrecht, Netherlands. ²HU University of Applied Sciences, Utrecht, Utrecht, Netherlands. ³University of Jyväskylä, Jyväskylä, Finland. (Sponsor: Jos J de Koning, FACSM, FACSM)
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 (No relationships reported)

PURPOSE: To investigate the associations of cardiorespiratory fitness, body adiposity, and sports participation, with arterial stiffness in 140 children and adolescents with chronic diseases or physical disabilities.

METHODS: Cardiorespiratory fitness was assessed using maximal exercise test with respiratory gas analyses either using shuttle run, shuttle ride, or cycle ergometer test. Cardiorespiratory fitness was defined as peak oxygen uptake (VO_{2peak}) by body weight or fat free mass (FFM). Body adiposity was assessed using waist circumference, body mass index standard-deviation score (BMI-SDS), and body fat percentage. Sports participation was assessed by a questionnaire. Aortic pulse wave velocity (PWV (PWVao)), as a measure of arterial stiffness, and augmentation index (AIX%), as a measure of peripheral arterial tone, were assessed by a non-invasive oscillometric tonometry device.

RESULTS: VO_{2peak} / body weight (standardized regression coefficient $\beta=-0.222$, 95% CI=-0.386 to -0.059, $P=0.002$) and VO_{2peak} / FFM ($\beta=-0.173$, 95% CI=-0.329 to -0.017, $P=0.030$) were inversely and waist circumference directly ($\beta=0.245$, 95% confidence interval (CI)=0.093 to 0.414, $P=0.002$) associated with PWVao. However, the associations of the measures of cardiorespiratory fitness with PWVao were attenuated after further adjustment for waist circumference. A higher waist circumference ($\beta=-0.215$, 95% CI=-0.381 to -0.049, $P=0.012$) and a higher BMI-SDS ($\beta=0.218$, 95% CI=-0.382 to -0.054, $P=0.010$) were related to lower AIX%.

CONCLUSIONS: Poor cardiorespiratory fitness and higher waist circumference were associated with increased arterial stiffness in children and adolescents with chronic diseases and physical disabilities. The association between cardiorespiratory fitness and arterial stiffness was partly explained by waist circumference.

A-22 Thematic Poster - Diseased Muscle: Cancer and Muscle Dystrophy

Wednesday, May 31, 2017, 9:30 AM - 11:30 AM
 Room: 404

98 **Chair:** Christopher G. Ballmann. *Samford University, AL.*
 (No relationships reported)

99 **Board #1** **May 31 9:30 AM - 11:30 AM**
The Effects Of Creatine And Creatinine On Rates Of Apoptosis In Doxorubicin-treated Myoblasts

Eric C. Bredahl, Sarah A. Kottensette, Nathaniel R. Marshall, Meghan K. Wagner, Kristen Drescher, Joan M. Eckerson. *Creighton University, Omaha, NE.* (Sponsor: Joan Eckerson, FACSM)
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 (No relationships reported)

Doxorubicin (DOX) is a powerful chemotherapy agent that is associated with a number of deleterious side effects, including skeletal muscle dysfunction and skeletal muscle wasting. Although the exact mechanisms behind the observed myotoxicity have yet to be fully understood, the direct effect of DOX can generally be attributed to the generation of reactive oxygen species (ROS) and interference with DNA replication. Conversely, creatine (Cr) supplementation has been shown to have a therapeutic role in several disease states characterized by muscle atrophy, which is a hallmark of DOX treatment. Yet, there has been no investigation into the effects of Cr or creatinine (CrN) on DOX-induced apoptosis. **PURPOSE:** To investigate the effects of Cr and CrN treatment on DOX-induced apoptosis. **METHODS:** Rat skeletal muscle cells (RKSMC) were cultured in skeletal muscle growth medium until they reached 90-95% confluency. Cells were then collected and seeded on to a 96-well plate at a density of 10,000 cells/ml containing fresh skeletal muscle growth media and allowed to recover for 24 hours. Cells were then exposed to fresh growth media containing either 1.5 μ M of DOX, 10 mM of Cr, 10 mM CrN, 1.5 μ M DOX + 10 mM Cr, or 1.5 μ M DOX + 10 mM CrN for an additional 24 hours. Rates of apoptosis were then assessed using an Annexin V apoptosis detection kit (BD Pharmagen) and high contrast staining. **RESULTS:** In the cells treated with DOX, 31 \pm 5.9% of imaged cells were undergoing apoptosis, which was significantly higher than the Cr (11.9 \pm 3.8%) and the CrN (10.1 \pm 4.9%) treated group ($P=0.04$ and $P=0.03$, respectively). No significant difference in rates of apoptosis was found between Cr+DOX, CrN+DOX, or the DOX treated groups. **CONCLUSION:** Initial evidence from this investigation does not support the use of Cr or CrN to protect against DOX-induced apoptosis.

100 **Board #2** **May 31 9:30 AM - 11:30 AM**
Timecourse Of Alterations In Myofiber CSA And Oxidative Phenotype In Progression Of Cancer-cachexia

Nicholas P. Greene¹, Jacob L. Brown¹, Megan E. Rosa¹, David E. Lee¹, Thomas A. Blackwell¹, Haley N. McCarver¹, Richard A. Perry, Jr¹, Lemuel A. Brown¹, Wesley S. Haynie¹, Michael P. Wiggs², Tyrone A. Washington¹. ¹University of Arkansas, Fayetteville, AR. ²University of Texas at Tyler, Tyler, TX. (Sponsor: Stephen F. Crouse, FACSM)
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 (No relationships reported)

Cancer-cachexia (CC), loss of muscle mass in cancer, is directly responsible for 20-40% of cancer-related deaths depending on type of cancer. Currently no efficacious therapies exist to reverse CC leading to the conclusion that efforts need to be focused on prevention of CC. Unfortunately, few studies have been performed to fully examine the progression of CC across the timecourse of development. **PURPOSE:** To examine phenotypic alterations in skeletal muscle across the timecourse development of CC in a murine tumor implantation model. **METHODS:** 1×10^6 Lewis Lung Carcinoma cells (LLC) or Phosphate Buffered Saline (PBS, control) were injected into the hind-flank of C57Bl6/J mice at 8 wks age, and tumor allowed to develop for 1, 2, 3 or 4 wks. Muscle fiber size was assessed by cross sectional area (CSA) of individual myofibers following H&E staining and muscle oxidative phenotype by succinate dehydrogenase (SDH) staining in sections of tibialis anterior muscle. Stress kinase signaling through p38 MAPK relative phosphorylation was assessed by immunoblot. A One-Way ANOVA was utilized to detect statistical significance with a Student-Newman-Keuls post hoc analysis to delineate differences between groups, significance was set at $P=0.05$. **RESULTS:** Mean myofiber CSA was significantly reduced by 3 wk following tumor implantation compared to PBS control (795 \pm 22 μ m² in 3 wk vs. 957 \pm 70 μ m² in PBS) and further reduced 4 wks post tumor implantation (556 \pm 43 μ m²). Percent of SDH positive (oxidative) myofibers was lower at 4 wks post implantation compared to all other groups (44 \pm 0.04% in 4 wk compared to 68 \pm 0.05% in PBS). Relative p38

MAPK phosphorylation was significantly greater in 4 wk post implantation compared to PBS, 1 and 2 wk (~3.4-fold greater than PBS in 4 wk), with no other significant differences among groups. **CONCLUSION:** Small changes in myofiber CSA can be seen as soon as 3 wk following tumor implantation in the LLC model. Reductions in portion of oxidative myofibers and increases in p38 MAPK signaling are not seen until 4 wks following tumor implantation. p38 MAPK isoforms α and β have been implicated in promoting atrophic signals through Atrogin/MURF and autophagy genes, and may in part explain the greater drop in myofiber CSA seen 4 wks following tumor implantation.

Funded by Arkansas Bioscience Institute

101 Board #3 May 31 9:30 AM - 11:30 AM
Effects Of Creatine Supplementation On Doxorubicin-induced Myotoxicity

Zoltan A. Torok, Raquel B. Busekrus, David S. Hydock,
University of Northern Colorado, Greeley, CO.

(No relationships reported)

Doxorubicin (DOX) is an effective chemotherapy treatment associated with several deleterious side effects, including skeletal muscle dysfunction. Previous research from our lab has shown that ex vivo creatine (Cr) pretreatment, prior to DOX incubation, attenuated DOX-induced fatigue in the EDL, but not the SOL. The effects of in vivo supplementation on DOX myotoxicity, however, are currently unknown. **PURPOSE:** To investigate the effects of in vivo Cr supplementation on DOX myotoxicity. **METHODS:** Male Sprague-Dawley rats were randomly assigned to the control (CON), doxorubicin (DOX), or creatine + doxorubicin (CR+DOX) group. CR+DOX received rodent chow supplemented with 3% creatine monohydrate and the CON and DOX received standard rodent chow. After two weeks of feeding, CR+DOX and DOX groups received a bolus (15 mg/kg) intraperitoneal (i.p.) DOX injection and CON received an i.p. saline injection as a placebo. Dietary interventions then continued for 5 more days. Forelimb grip strength was then measured as an indicator of in vivo muscle function and muscle fatigue was analyzed ex vivo using a 100 second fatigue protocol. **RESULTS:** When compared to CON, a significantly lower grip strength was observed in DOX (-23%, $p < 0.05$), and creatine monohydrate feeding attenuated this decrement in grip strength (-15% CR+DOX vs. CON, $p > 0.05$). In isolated muscle experiments to explore fatigue, solei (primarily type I muscle) from CON produced significantly less force than baseline at 60 s ($p < 0.05$) and solei from DOX produced significantly less force than baseline at 30 s ($p < 0.05$); however, CR+DOX produced significantly less force than baseline at 60 s ($p < 0.05$) suggesting that Cr feeding attenuated DOX-induced fatigue in type I muscle. In the primarily type II EDL, a significant decline in force production from baseline was observed at 50 s in CON and CR+DOX ($p < 0.05$) and at 20 s in DOX ($p < 0.05$) suggesting that Cr attenuated DOX-induced fatigue in type II muscle. **CONCLUSIONS:** A diet supplemented with Cr attenuated the decrease in grip strength and increase in fatigue that accompanies DOX treatment. These findings suggest that Cr supplementation may have use in managing DOX myotoxicity in cancer patients.

102 Board #4 May 31 9:30 AM - 11:30 AM
The Effect Of Resistance Training During Chemotherapy On Grip Strength In Rats.

Mackenzie D. Twaddell, Alison Tigner, Meghan K. Wagner, Eric Bredahl, Joan Eckerson, FACSM. *Creighton University, Omaha, NE.* (Sponsor: Joan Eckerson, FACSM)

(No relationships reported)

Doxorubicin (DOX) is a powerful chemotherapy agent associated with a number of harmful side effects, including cardiovascular and skeletal muscle dysfunction. Although it has been shown that aerobic and anaerobic exercise can minimize the degree of DOX-induced muscle dysfunction, few studies have examined the effect of resistance training (RT) during chemotherapy treatment on DOX-induced muscle dysfunction. **PURPOSE:** To examine the effect of RT exercise during DOX treatment on grip strength in rats. **METHODS:** Male Sprague-Dawley rats were randomly assigned to a RT (n=10) or sedentary (SED) group (n=10) for 10 wk. Animals in the RT group were housed in specialized cages where the food and water height was progressively elevated so that they achieved an erect bipedal stance to access their food and water. After the initial 10 wk training period, animals were further sub-divided into a RT+DOX (n=5), RT+saline (SAL) (n=5), SED+DOX (n=5), and SED+SAL (n=5). Rats in the RT groups continued to train for an additional 5 wk and, during this same time period, animals receiving DOX were given a weekly intraperitoneal injection (3 mg/kg) for 4 wk. Grip strength was measured every 5 wk during the 15 wk study using a rat grip strength meter. **Results:** At 5 wk, grip strength in the RT (16.3±1.5) group was significantly higher than the SED (18.3±1.05) group ($P=0.018$), however, there were no differences at 10 wk. Following the 5 wk treatment period with DOX or SAL, animals in the SED+SAL (14.6±0.9), RT+SAL (22.2±1.3), and RT+DOX (19.8±0.9) groups demonstrated significantly higher grip strength than those in the SED+DOX (16.8±1.0) group ($P < 0.0001$). **CONCLUSION:** These findings suggest that RT regimen during chemotherapy treatment may be effective for minimizing DOX-induced muscle dysfunction.

ACSM May 30 – June 3, 2017

103 Board #5 May 31 9:30 AM - 11:30 AM

Clarifying The Contradictory Data In The Effect Of Resveratrol In The Mouse Model Of DMD

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(No relationships reported)

PURPOSE: Resveratrol, a polyphenol found in grapes and red wine, that has been previously reported to improve muscle function in a mouse model of Duchenne muscular dystrophy, mdx mice. In 5-week old mdx mice after 8 weeks of treatment, significant improvements in rotarod performance and in situ peak tension of the triceps were observed. In addition, the total immune cell inflammation was significantly reduced, while significantly increasing IL-6 gene expression after 8 weeks of treatment. The aim of this study is to evaluate muscle and cardiac function of Resveratrol after 12 weeks of treatment using a comprehensive phenotyping platform.

METHODS: This study was performed on two groups (n=11-12); group 1: Normal diet and group 2: diet with Resveratrol) of mdx mice in a blinded manner. Mice were randomized based on body weight and evaluated using a series of functional (In vitro force contractions, Echocardiography), behavioral (Grip strength, open field digiscan and Rota-rod), and histological evaluations. To unmask the mild phenotype of the mdx mice we subjected all mice to treadmill running (12 m/min; 30 min) bi-weekly except during data collection timepoints.

RESULTS: Resveratrol treatment showed no changes in body weight, forelimb and hindlimb grip strength measurements, or latency to fall in comparison to the control group after 12 weeks of treatment. There was, however, a significant decrease in the vertical activity on the open field digiscan behavioral measurement. In vitro force measurements of the EDL showed no significant change in the maximal force or specific force after treatment in comparison to the control mdx mice. Further, evaluation of cardiac function (% ejection fraction or fraction shortening) using echocardiography showed no significant changes. Histological analysis showed no change in the number of degenerating, regenerating, of inflammatory cells after 12 weeks of treatment.

CONCLUSIONS: This study has showed that Resveratrol did not alter the disease phenotype of the mdx mice. The inconsistency between studies may have been brought about by various factors such as the testing facility, the chows, experimenters performing the experiments to name a few. Therefore, it is essential to have independent laboratories validate the pre-clinical data prior to proceeding onto human clinical trial.

104 Board #6 May 31 9:30 AM - 11:30 AM
Reliable And Reproducible Evaluation Of Therapeutic Interventions In The MDX Mouse Model Of DMD

Kanneboyina Nagaraju¹, Arpana Sali², Adati Phadke², Jack Vandermeulen², Heather Gordish-Dressman². ¹School of Pharmacy and Pharmaceutical Sciences, Binghamton, NY. ²Children's National Medical Center, Washington, DC.

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(No relationships reported)

PURPOSE: Preclinical efficacy evaluation in mouse models of human diseases is an important component of drug development. It has been reported that phase II clinical trial success rates have fallen in recent years, with a lack of efficacy being the most frequent reason for failure. Since most of the selected candidate therapeutics have gone through preclinical efficacy testing, this failure could be due to 1) the poor predictive power of disease models, 2) questionable targets, 3) lack of rigor in preclinical trial design, 4) poor control for potential bias, or 5) variable reporting standards. The quality and reproducibility of preclinical trials depend on the thoroughness of the preclinical study, including the design, execution, analysis, and reporting of the preclinical data. Here we have developed a comprehensive phenotyping system to ensure success rate of preclinical candidate evaluations for DMD.

METHODS: We subjected mdx mice for following assessments at early (8 weeks) and late (12 months) stages of the disease to represent ambulatory and non-ambulatory stages of the human disease. We assessed **Non-Invasive Repeated measures** (Open field activity measurement, Grip strength measurement (GSM), Bodyweight, Inflammation assessed by cathepsin activity using optical imaging, and Echocardiography) and **Terminal Endpoint measures** (Muscle function test (in vitro force contractions), Histological evaluations, Fibrosis measurements, Serum enzymes analysis).

RESULTS: Sample size/power estimates showed that EDL muscle specific force, Grip strength and % SF by echocardiography require 5, 11 and 8 mice per group at early stages of the disease and 2 mice/group for all 3 parameters at 12 months' age. Fibrosis in the heart is less apparent at early stages and require more mice (136/group) in comparison to old age (2mice/group) Cardiac assessment showed that both

Denver, Colorado

ejection fraction (EF) and fractional shortening (FS) significantly decreased by 11 months of age in the mdx mice. Evaluation of inflammation in live animals showed that inflammation is more at 2 months than at 12 months. **CONCLUSIONS:** Our data demonstrates that the quality and reproducibility of preclinical trials depend on not only on the parameter to be analyzed but also on the stage of the disease and sample size required to meaningfully interpret the data.

105 Board #7 May 31 9:30 AM - 11:30 AM
Exercise-Induced Leukocyte Infiltration in Skeletal Muscle under Chemotherapy
 Chia-Hua Kuo, FACSM. *University of Taipei, Taipei, Taiwan.*
(No relationships reported)

BACKGROUND: Weight training can cause muscle inflammation. However, inflammation mechanism is essential for increasing or maintaining muscle mass after challenge. **METHODS:** We examined leukocyte infiltration in rat muscle challenged by downhill running after adriamycin administration, which is used to systemically inhibit cell regeneration (2.5 mg/kg per body weight). **RESULTS:** Leukocyte infiltration in exercised muscle was completely eliminated in adriamycin-treated rats in exercised muscle. A significant proton leak was observed under adriamycin treatment. Results from long-term adriamycin treatment show a significant development of sarcopenia. **CONCLUSION:** Blocking cell proliferation eliminates muscle inflammation induced by exercise, which may account for development of sarcopenia and eventual death after prolonged chemotherapy.

106 Board #8 May 31 9:30 AM - 11:30 AM
The Effects of Impaired Arm Function on Quality of Life in Breast Cancer Survivors
 Sarah A. Sayyari¹, Bolette S. Rafn¹, Stanley H. Hung¹, Alison M. Hoens¹, Margaret L. McNeely², Chiara A. Singh³, Winkle Kwan⁴, Carol Dingle¹, Elaine C. McKeivitt¹, Urve Kuusk¹, Kristin L. Campbell¹. ¹*University of British Columbia, Vancouver, BC, Canada.* ²*University of Alberta, Edmonton, AB, Canada.* ³*Fraser Health Authority, Surrey, BC, Canada.* ⁴*BC Cancer Agency, Fraser Valley, BC, Canada.*
(No relationships reported)

PURPOSE: Treatment for breast cancer is associated with long-term impaired arm function typically characterized by pain, muscular weakness, poor range of motion or lymphedema, which can negatively impact quality of life (QoL). An appropriate definition for impaired arm function specific to women with breast cancer is needed to guide treatment decisions and evaluate efficacy of interventions. The purpose of this study is: 1) to explore the relationship between impaired arm function and QoL; and 2) to propose a definition for impaired arm function that may be utilized to identify women who could benefit from a targeted exercise intervention.

METHODS: Women with breast cancer were assessed for self-reported arm function and QoL at pre-surgery and 12 months post-surgery. Arm function was measured by the QuickDASH (Score: 0-100) and QoL was measured by the Functional Assessment of Cancer Therapy Breast (FACT-B+4). The minimally clinically important difference (MCID) of 14 for QuickDASH was used as a cut-off point to categorize participants as having impaired arm function. Pearson's correlations were used to examine the association between arm function and QoL. Further, independent t-tests tested the difference in QoL between participants with and without impaired arm function.

RESULTS: Thirty-seven women between ages 30-75 were enrolled. QuickDASH at 12-months post-surgery strongly correlated with the physical well-being subscale of the FACT-B+4 ($r=-0.58$, $p<0.01$). Moderate correlations were found between QuickDASH and the arm function subscale of the FACT-B+4 ($r=-0.49$, $p<0.01$) and the functional well-being subscale of the FACT-B+4 ($r=-0.33$, $p=0.05$). Applying the MCID of 14 points on QuickDASH displayed a difference in QoL between participants with and without impaired arm function in the same physical well-being ($p<0.01$) and arm function ($p<0.01$) subscales of the FACT-B+4.

CONCLUSIONS: QoL and arm function strongly correlate at 12-months following surgery for breast cancer. Applying the MCID for QuickDASH is effective in identifying participants whose impaired arm function is associated with decreased QoL. Utilizing this cut-off point may help identify women whose arm function has not recovered after treatment for breast cancer and who could benefit from a targeted exercise intervention.

A-23 Exercise is Medicine®/Thematic Poster - EIM On Campus

Wednesday, May 31, 2017, 9:30 AM - 11:30 AM
 Room: 101

107 **Chair:** Carena Sue Winters, FACSM. *Slippery Rock University, Slippery Rock, PA.*
(No relationships reported)

108 Board #1 May 31 9:30 AM - 11:30 AM
University Physical Activity Classes: Impact on Students' Body Weight and 1.5-Mile Run Performance
 Wenhao Liu, FACSM, Ethan E. Hull, Istvan Kovacs. *Slippery Rock University, Slippery Rock, PA.*
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(No relationships reported)

PURPOSE: Weight gain among university students is observed widely, which may result in decline in cardiorespiratory fitness. On the other hand, regular physical activity (PA) participation is considered an effective means to maintain and improve body weight and cardiorespiratory fitness. This study investigated impact of PA classes on university students' body weight and 1.5-mile run performance.

METHODS: Body weight and 1.5-mile run were assessed at the beginning (pretest) and end (posttest) of a semester for 126 students (mean age: 20.71±.99; 72 males and 54 females) who were enrolled in PA classes of a university in USA. Paired-samples t tests were used to examine differences in weight and 1.5-mile run performance between the two test points. In addition, based on the pretest performance in 1.5-mile run and ACSM's Fitness Categories for Maximal Aerobic Power (2014), students were categorized into three aerobic power groups by sex. Those with 1.5-mile run at top 20 percentiles were in Superior/Excellent Group (SEG), 40 to 79 percentiles in Good/Fair Group (GFG), and 1 to 39 percentiles in Poor/Very Poor Group (PVPG). Binomial tests were used to examine whether a significantly larger proportion of students in each group improved 1.5-mile run at the posttest.

RESULTS: Performance in 1.5-mile run was improved significantly ($p < .01$) for males (11:47±2:07 vs. 11:29±1:47) and females (14:15±2:28 vs. 13:54±1:55) at the posttest. As for body weight, it remained unchanged ($p > .40$) for both sexes (males: 180.83±32.11 vs. 180.61±31.10; females: 140.75±18.20 vs. 140.58±17.74). In addition, for both sexes SEG had smaller portions of students improving their 1.5-mile run (male: 7 improved vs. 11 not; female: 5 vs. 6); GFG had non-significantly larger portions of students improving their 1.5 mile run (male: 17 improved vs. 8 not; female: 15 vs. 8); finally, significantly larger portions of students in PVPG improved their 1.5-mile run performance (male: 23 improved vs. 6 not, $p < .005$; female: 16 vs. 4, $p < .05$).

CONCLUSIONS: PA classes are effective to control body weight among university students. In addition, PA classes can significantly improve students' 1.5-mile run performance, and it is especially true for students with relatively poor 1.5-mile run performance initially, especially those at the bottom 39 percentiles.

109 Board #2 May 31 9:30 AM - 11:30 AM
Pokemon Is Medicine: On (BYU) Campus
 Neil E. Peterson, Kielee L. Wiser, Hannah M. Schmidlein, Craig Nuttall, James D. LeCheminant. *Brigham Young University, Provo, UT.*
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(No relationships reported)

The Exercise is Medicine (EIM) global health initiative includes an "On Campus" component that encourages faculty, staff, and students to work together toward improving the health and well-being of the campus and surrounding community. **PURPOSE:** To describe the implementation of EIM On Campus at a large U.S. university in the mountain west. **METHODS:** A multidisciplinary EIM On Campus leadership team was assembled, comprised of faculty members from nursing (2) and exercise science (1), as well as university students (2). A physical activity event (Pokethon 3k Fun Walk) was planned using the currently popular Pokemon theme and promoted through flyers, posters, word of mouth, social media, and homecoming parade float. The event was guided by the following principles in order to attract participation from those who might otherwise not be active: 1) free of cost, 2) open to all, 3) use of a currently popular theme (Pokemon), 4) safe 3k route with plenty of nearby parking, 5) late morning start time, 6) free "lures" activated at all "Pokestops" within the Pokemon Go game along the 3k route, and 7) numerous prizes given at random to incentivize participation rather than speed. **RESULTS:** The Pokethon 3k Fun Walk event was held during Fall 2016. A total of 140 people were involved in the event: 5 (3.6%) were EIM On Campus leadership members and event organizers, 23 (16.4%) were volunteers, and the remaining 112 (80.0%) were event participants. Of the 112 participants, 72 (64.3%) were community members and the remainder

were university students. Verbal feedback included high levels of satisfaction and interest in making it into an annual event. **CONCLUSION:** The EIM On Campus leadership team successfully implemented an event to promote physical activity based on principles that would encourage participation. The next steps are to: 1) add more members to the EIM On Campus leadership team from diverse areas, 2) hold educational opportunities, and 3) implement the physical activity vital sign within the student health center.

110 Board #3 May 31 9:30 AM - 11:30 AM
**Exercise Is Medicine On Campus Week 2016:
 Increasing Campus-wide Integration And Coordination**

Zack Papalia, Melissa Bopp, FACSM, Christopher Bopp, Michele Duffey, Lori Gravish-Hurtack, Nancy I. Williams, FACSM. *Pennsylvania State University, University Park, PA.* (Sponsor: Melissa Bopp, PhD, FACSM)
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 (No relationships reported)

BACKGROUND: Exercise is Medicine on Campus (EIMOC) is an international initiative promoting physical activity (PA) participation on college campuses, targeting the decline in PA seen with the transition to college. Pennsylvania State University has been promoting EIMOC since 2010 and hosting annual EIMOC Week events since 2012. **PURPOSE:** To evaluate strategies for expanding EIMOC partnerships and collaborations across campus since 2015.

METHODS: EIMOC Week has been held each year since 2012. In an attempt to expand and enhance the impact of EIMOC, the EIMOC committee has worked to improve campus-wide integration and increase participation and support from other University entities. Following the 2016 EIMOC Week event, organizations that participated or provided support through the 2015-2016 campaign were interviewed regarding future goals, EIMOC impressions, barriers to collaboration, and general observations. Results were compiled, transcribed and coded for common themes.

RESULTS: Organizations working with EIMOC (n=15) were divided into three categories: University entities, student organizations, and community outreach. University entities (n=7) included University divisions and departments (e.g. academic unit, colleges), student health services, and campus recreation. Student organizations (n=4) were primarily undergraduate and graduate students groups, such as clubs. Community outreach entities (n=4) included private businesses and other off-campus organizations. All of the organizations strongly supported the concept of EIMOC, and were interested (93%) in supporting EIMOC in a mutually-beneficial fashion (i.e. referrals, increasing membership). Future goals included expanded collaboration (53%) and a more defined partnership (40%). Common barriers to collaboration were time (80%), logistics (80%), available resources (40%) and departmental/university rules and regulations (47%).

CONCLUSIONS: The current study offered insight on the challenges and potential success in expanding EIMOC on a large campus. As this EIMOC initiative enters its 7th year, expanding its reach and improving University-wide collaborations are key for sustained impact. Identifying common strategic goals and pooling resources across multiple entities may prove essential to the future of EIMOC.

111 Board #4 May 31 9:30 AM - 11:30 AM
**To Use The Reach, Effectiveness, Adoption,
 Implementation, Maintenance (reach) Methodology To
 Evaluate Exercise Is Medicine- On Campus Program
 (eim-oc)**

Renee Jeffreys - Heil, Patricia Bauer, Eric Shamus, Mitchel L. Cordova, FACSM. *Florida Gulf Coast University, Fort Myers, FL.* (Sponsor: Mitchel L. Cordova, FACSM)
 Email: rjeffreysheil@fgcu.edu
 (No relationships reported)

PURPOSE: To use the Reach, Effectiveness, Adoption, Implementation, Maintenance (RE-AIM) methodology to evaluate Exercise is Medicine- On Campus Program (EIM-OC).

METHODS: In 2015, the EIM-OC program at Florida Gulf Coast University (EIM@FGCU) was launched. The program consists of monthly EIM@FGCU events, a referral network, faculty/student research, and service learning projects (SLP). EIM-OC programs can be more than just referral networks, and offer multiple opportunities for students and faculty to utilize the EIM framework. This project uses the RE-AIM methodology to evaluate the effectiveness of 1 EIM-OC program.

RESULTS: *Reach:* During the 2015-2016 academic year, over 500 students attended EIM@FGCU on campus events, and 85 students were referred to the EIM@FGCU program by Student Health Services. Seven (7) different poster presentations were delivered and on average 22 ± 11 hrs of SLP were performed by exercise science (ES) students. *Effectiveness:* ES students in EIM@FGCU events report "... makes me want to learn more about adaptive training and working with various populations, clinical or otherwise". Of the 85 students referred, 16 participated in baseline assessment. There were 2 undergraduate student presentations at national meetings,

5 faculty presentations, and 3 in process faculty publications. *Adoption:* Starting in the 2016-2017 academic year, there was an increase in the number of EIM@FGCU Events (2015-2016- N = 5 to 2016-2017 - N= 10) with two additional referral sites were added (Center for Academic Achievement, and Counseling and Physiological Services). *Implementation:* Program implementation was designed to be low through the utilization of student SLPs. This project is currently funded through internal campus resources (\$10,500). The cost per referral is \$584 per person; however, when students impacted by monthly events is included the cost drops to \$20 per person. *Maintenance:* The amount of faculty/student scholarship is increasing. The change in physiological markers of participants in the program will not be known until the end of this academic year.

CONCLUSIONS: Because EIM-On Campus programs have broader implications than a simple referral networks, methodologies such as RE-AIM can be utilized to determine project effectiveness.

112 Board #5 May 31 9:30 AM - 11:30 AM
**Exercise Is Medicine On Campus: Case Study Of
 Resistance Training On Chronic Low Back Pain**

Michael D. Carnevale, Gregory Hannum, Bryan Rudd, Melissa W. Roti, FACSM. *Westfield State University, Westfield, MA.*
 (No relationships reported)

Low back pain (LBP) can be described as pain or discomfort in the lumbar spine. Due to the vast interconnected system of bones, muscles, nerves, discs, tendons and ligaments, this area of the body is susceptible to injury if not trained properly. "Sarah", a 49 year old female with chronic LBP, volunteered to participate in an 8-week Community Fitness Partners program, a Westfield State University Exercise Is Medicine On Campus initiative. Sarah was given a whole body exercise prescription based on FITT recommendations by the American College of Sports Medicine for individuals with chronic LBP. **Purpose:** To determine the effectiveness of resistance training and stretching for the treatment of LBP. Improvements in cardiovascular endurance and lean muscle mass, as well as weight management, were desired goals from the program. **Methods:** The initial meeting included goal setting, a health and fitness screening and a Par-Q to determine the individual's vital signs and whether she has a preexisting condition that would limit her participation in this exercise program. Subject characteristics included: Height= 1.65m Body Mass=57kg, BMI=21.9, and HRrest=56bpm. Sarah completed an 8-week full body concentric and eccentric resistance training program two times a week, along with at home physical activity and stretching. **Results:** Before participating in the program Sarah was not able to perform a single bilateral body weight squat through a full range of motion, without experiencing LBP. Sarah's pre-test results were push-ups= 6 repetitions, curl ups(crunches)= 44 repetitions, body weight squat = 0 repetitions. Post-training, Sarah can now perform multiple bilateral body weight squats through full range of motion at the ankle, knee and hip joints without experiencing LBP. Her post measurements include: push-up = 10 repetitions, curl-up= 50 repetitions, body weight squat= 5 repetitions. **Conclusion:** Within an 8-week resistance training program, a combination of static, dynamic, and PNF stretching was used to treat LBP and increase strength as well as activities of daily living. Sarah is also more comfortable and confident with exercise and in particular resistance training. She has gone from never taking part in a resistance training workout regimen to completing a 8-week resistance training program.

113 Board #6 May 31 9:30 AM - 11:30 AM
**An Exploration Of Exercise Is Medicine-on Campus
 Marketing And Engagement**

Amy Gyorkos, Lindsey DesArmo, Amy Campbell, Heather Peddie, Katelyn Morris, Chris Dondzila. *Grand Valley State University, Allendale, MI.* (Sponsor: Steve Glass, FACSM)
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The Exercise is Medicine-on Campus (EIM-OC) initiative is growing across the nation, requiring a need to share programming and implementation outcomes to grow the limited body of empirical evidence. **PURPOSE:** The purpose of this study was to provide descriptive data on the EIM-OC programming and associated promotional efforts at a Midwestern Masters Comprehensive University. **METHODS:** During October (official EIM-OC month), promotional efforts were achieved through campus-wide flyers, website banners, and a marketing Presidential video with associated photos. To further awareness a website and social media feeds were established (Facebook, Twitter and Instagram) and articles were published in University newspapers. **RESULTS:** Grand Valley State University has 22,081 undergraduates, 3,046 graduate students, and 2,500 faculty/staff. The total student participants for the EIM events included; Walk with the President (210 total; 127 females, 75 males, 1 non identified; 12 freshmen, 30 sophomores, 87 juniors, 69 seniors, and 4 graduate), Zumba Party (109 total; 106 females, 3 males), Discovery Scuba (8 total), Wheelchair Basketball (33 total), Faculty/Staff Pedometer Challenge (460 total; 115 teams, 133,454,370 total steps), and Celebrating EIM at GVSU (116 total). Compared to

the previous month, October increased EIM-OC website page views 144% (502) and increased return visits 192%. In addition, the Student Recreation Center increased usage by 23.2% from Aug-Oct when compared to the same months in the previous year. Facebook garnered 170 "Likes," reaching 1,115 people and engaged 357, while Twitter amassed 90 followers. **CONCLUSION:** A large, diverse sample of students and faculty were reached via various marketing outlets. Such descriptive data is warranted to share evidence of successful implementation and marketing of EIM-OC programming for other institutions to emulate in the larger goal of increasing participation from Colleges/Universities across the country.

114 Board #7 May 31 9:30 AM - 11:30 AM
Physical Activity Counseling in College Students
 Christopher M. Bopp, Melissa Bopp, FACSM, Zack Papalia.
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(No relationships reported)

Exercise is Medicine (EIM) is a global health initiative focused on encouraging health care practitioners to include physical activity when designing treatment plans for patients. EIM on Campus (EIM-OC) calls on institutions of higher education to promote physical activity (PA) as a vital sign of health. **PURPOSE:** The purpose of this investigation was to determine where college students obtain physical activity information and rates of physical activity counseling from health care practitioners. **METHODS:** Participants were college student volunteers (n=537, 56.7% male, 75% Caucasian) that completed a fitness assessment and online survey. Aerobic fitness, muscular endurance, body composition (BMI and bioelectrical impedance) and blood lipids were assessed. The survey assessed participant demographics, current PA, PA counseling at on or off-campus clinics and typical sources of information about PA. Independent t-tests and chi squares examined differences in PA counseling by fitness outcomes. **RESULTS:** 62% of our participants reported some counseling for PA. There were no differences in rates of counseling by BMI nor VO₂max, however, individuals with higher percent body fat were more likely to report counseling from their healthcare provider (t=2.76, p=0.006). There were no differences in counseling by current moderate or vigorous PA. Females were more likely to be counseled than males (X² = 4.39, p=0.04). Reports of counseling were higher at off-campus clinics than on-campus clinics (X² = 42.2, p<.001). Among our population 5% of participants obtained PA information online, 16.5% from peers, 73% from magazines, 51% from apps, 91% from TV, 40% from family, 17.7% from fitness professionals and 45% from health care practitioners. **CONCLUSIONS:** The current study provides insight into healthcare provider counseling for PA among college students. Off-campus healthcare providers were more likely to provide counseling, indicating an area of possible focus for further study. College students are typically not looking to a health care practitioner for their PA information, indicating that further information is needed on the role of healthcare providers and on-campus health clinics in counseling for PA among this young adult, typically healthy population.

115 Board #8 May 31 9:30 AM - 11:30 AM
Exercise Self-efficacy And Social Support In Community Training: An Exercise Is Medicine On Campus Initiative
 Troy R. Doming, Nicole R. Lanoie, Frank A. Hoyle, Melissa W. Roti, FACSM. *Westfield State University, Westfield, MA.*
(No relationships reported)

Exercise self-efficacy, an individuals' perceived confidence as it relates to a specific behavior, is positively related to behavior change and long term exercise adherence. Social aspects of exercise can also contribute to exercise self-efficacy. This is especially important in regards to the adult population due to the difficulty of transitioning to the maintenance phase of behavior change. **Purpose:** To determine the benefits that an EIMOC initiated Community Fitness Partners program has upon self-efficacy and social support, as monitored and structured exercise programs have been shown to improve upon these aspects. Individual personal training was completed in a group setting to expose participants to additional sources of social support. This study aims to investigate the relationship between this community setting, social support and exercise self-efficacy. **Methods:** Subjects aged 44.0 ± 13.2y volunteered to participate in an 8 week structured group community fitness partner program. Subject characteristics include: body mass (74.0 ± 20.8 kg), height (1.65 ± 0.08 m), % BF (28.0 ± 8.2), HRrest (68 ± 10 bpm), and BPre (124 ± 19 / 78 ± 9 mmHg). All subjects underwent pre and post participation screening to determine baseline and concluding health and fitness measures. Each individuals' perceived confidence levels related to exercise were determined by the Self-efficacy For Exercise (SEE) Scale (Resnick & Jenkins, 2000). Participants completed the Social Support and Exercise Survey to identify influences from friends and family regarding exercise participation (Sallis et al., 1987). Paired sample t-tests were used to determine differences pre to post program. **Results:** Pre and post measurements of SEE scores were 58.2 ± 18.8 and 63.7 ± 17.0 (p > 0.05). Pre and post measurements of family participation support

were 20.4 ± 11.4 and 24.0 ± 13.5 (p > 0.05), respectively while the friend participation support measured at 17.6 ± 7.5 and 19.2 ± 12.1 (p > 0.05). Although the social support and self-efficacy data did not reach statistical significance, there is still a notable positive trend. **Conclusion:** Overall most individuals experienced an increase in efficacy and social support values. Therefore, a group personal training protocol may be beneficial in the improvement of exercise self-efficacy and social support.

A-24 Thematic Poster - Energy Availability and Expenditure
 Wednesday, May 31, 2017, 9:30 AM - 11:30 AM
 Room: 403

116 Chair: Melinda Manore, FACSM. *Oregon State University, Corvallis, OR.*
(No relationships reported)

117 Board #1 May 31 9:30 AM - 11:30 AM
Dietary Carbohydrate Restriction Is Necessary For High-Fat Diet Induced Alterations In Substrate Oxidation During Exercise
 Gareth Fletcher¹, Elisa I. Glover², Janice L. Thompson, FACSM¹, Gareth A. Wallis¹. ¹*University of Birmingham, Birmingham, United Kingdom.* ²*GlaxoSmithKline UK, Brentford, United Kingdom.*
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(No relationships reported)

BACKGROUND: Manipulating the dietary intake of carbohydrate and fat results in differences in the circulating hormonal and metabolic milieu alongside differences in the myocellular substrate storage profile. These divergent metabolic profiles can dramatically impact substrate utilisation during exercise, with high fat low carbohydrate diets substantially elevating rates of fat oxidation compared to a low fat high carbohydrate diet. A caveat to prior studies employing a high fat diet is they are also typically restricted in carbohydrate, and so metabolic changes could be attributed to the manipulation of either macronutrient.

PURPOSE: To determine if a high fat diet both with (HF) and without restricting carbohydrate intake (N+HF) impacts substrate oxidation during exercise in endurance-trained women compared to a control diet that reflects normal intake (N).

METHODS: Over three separate periods of 5 days, in a randomised counterbalanced order, endurance trained women (means ± SD: age 34 ± 8 yrs; VO₂max 55.1 ± 2.5 ml/kg/min) were provided with 3 diets designed with the following macronutrient composition (% of energy intake [carbohydrate/fat/protein]): N (50/35/15); HF (20/65/15), and a hypercaloric (130% energy intake) N+HF (50/65/15). Post-diet intervention, in the overnight fasted state, subjects completed a 90min treadmill run at 65% VO₂max with indirect calorimetry employed over the exercise bout to determine substrate oxidation. Data was assessed for differences using a repeated-measures one-way ANOVA.

RESULTS: The relative contribution of fat oxidation to energy expenditure over the 90min exercise bout was significantly (p<0.01) greater after the HF trial (76 ± 9%) than N (57 ± 11%) or N+HF (59 ± 11%) with no significant differences between diets not limited in carbohydrate (N and NHF).

CONCLUSIONS: In contrast to when carbohydrate is restricted (HF), adding a comparable amount of fat to a control diet (NHF) did not augment fat oxidation during exercise. Thus the restriction of carbohydrate intake appears to be an obligatory step in eliciting dietary induced alterations in whole body substrate oxidation not greater fat provision. This work was funded through a BBSRCi CASE studentship with GlaxoSmithKline the industrial partner.

118 Board #2 May 31 9:30 AM - 11:30 AM
Metabolic and Behavioral Correlates of Low Energy Availability in Exercising Men
 Jay Petersen. *University of Nebraska at Lincoln, Lincoln, NE.*
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(No relationships reported)

Low energy availability (EA) has been identified as a primary driver of metabolic and endocrine aberrations characterizing the female athlete triad. Although it has been established that men engaged in sports that favor leanness and/or low body weights are also at risk of low EA, little is known about the etiology and metabolic effects of low EA in habitually active men.

PURPOSE: To assess the relationship between EA and body composition, metabolism, eating behavior traits, and health-related outcomes in young, exercising men.

WEDNESDAY, MAY 31, 2017

METHODS: Eighteen men (23.4±4.4 y; 81.8±10.2 kg; 9.8±3.5% body fat) participated in this cross-sectional study. EA was determined as the amount of energy remaining after subtracting the energy cost of exercise, both derived from 7-day diet and exercise logs, and was normalized for fat free mass (FFM) assessed by bioimpedance. Participants completed tests for resting metabolic rate (RMR) and aerobic fitness as well as questionnaires regarding exercise and diet habits, eating behaviors, and medical history. Based on their EA, participants were divided into tertiles: low EA (LEA): 19.9-31.5 kcal/kg FFM, moderate EA (MEA): 31.9-38.3 kcal/kg FFM, or high EA (HEA): 39.8-48.6 kcal/kg FFM.

RESULTS: BMI (LEA: 25.6±2.9 kg/m², MEA: 25.9±3.7 kg/m², HEA: 24.0±2.3 kg/m²) and body fat percentage (LEA: 11.0±4.6%, MEA: 10.5±2.8%, HEA: 8.3±2.8%) were similar among EA groups. The ratio of measured/predicted RMR was similar between LEA (0.96 ± 0.05) and HEA (0.93 ± 0.06) but lower in MEA (0.89 ± 0.06; p=0.03). Resting respiratory quotient was reduced in LEA (0.81 ± 0.09) when compared to MEA (0.90 ± 0.05; p=0.03) and HEA (0.93 ± 0.12; p=0.04). Compared to HEA, participants in LEA were more likely to report past weight fluctuations (p=0.05) and dieting (p=0.01). There were no differences among EA groups for eating behavior traits such as dietary restraint (p=0.29), emotional eating (p=0.36), and drive for thinness (p=0.40).

CONCLUSION: Despite being in an apparent energy deficit and showing evidence of increased fat oxidation, exercising men with LEA did not exhibit altered body composition or RMR suppression per se. Nevertheless, LEA seems to be connected to issues related to weight control and a history of dieting. Future research is needed to quantify the metabolic and endocrine consequences of LEA in exercising men.

119 Board #3 May 31 9:30 AM - 11:30 AM
Energy Availability Amongst Elite Rugby Union Players During Pre-Season Training

Katherine Black¹, Chloe Hindle¹, Claire Gibson¹, Joanne Slater¹, Dane Baker², Phil Healey², Rebecca McLay-Cooke¹, Rachel Brown¹, Brett Smith³. ¹University of Otago, Dunedin, New Zealand. ²Chiefs Super Rugby, Hamilton, New Zealand. ³University of Waikato, Hamilton, New Zealand.
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(No relationships reported)

In elite rugby union the pre-season training period is used to optimise players' strength, power, endurance and body composition. Given the increased training loads during this time, players could find themselves at risk of Low Energy Availability (LEA). A state of LEA can be caused by large energy expenditure in exercise (EEE) and/or low energy intake (EI), which reduces the amount of energy available for physiological functions. Despite the majority of the literature focusing on female athletes, it is possible that male athletes are also at risk of LEA, particularly during periods of increased training load such as pre-season.

PURPOSE: The purpose of this study was to examine the energy intake, energy expenditure and energy availability of elite male rugby union players during pre-season training.

METHODS: During this observational study, three-day diet records were collected for 23 Super Rugby players using video, photographs, checklists and recalls. Energy expenditure data was also collected via heart rate monitoring, GPS tracking and Activity Logs. Skinfold thicknesses (International Society for the Advancement of Kinanthropometry protocols) were used to assess body composition. Data was analysed based on groups established by training goals determined by the teams support staff: weight gain (n=8)/weight maintenance (n=8)/weight loss (n=7). One-way ANOVA was used to identify differences between groups, with post-hoc pairwise comparison of means, adjusted using Bonferroni.

RESULTS: For all participants exercise energy expenditure was 2,240 ± 1,140 kcal (mean ± SD). The average energy intake was 3799 ± 958 kcal.day⁻¹ for all participants. The weight loss group had significantly lower mean (± SD) energy availability (6.7 ± 6.4 kcal.kgFFM⁻¹.day⁻¹) than the weight maintenance (20.3 ± 7.6 kcal.kgFFM⁻¹.day⁻¹, p=0.003) and weight gain (28.6 ± 8.0 kcal.kgFFM⁻¹.day⁻¹, p<0.001) groups.

CONCLUSION: This research shows that NZ Super rugby players can, and do suffer from short-term LEA during the intense pre-season training period. However, as this study was observational, the results are only indicative of the three-day sampling period. Therefore, the duration of LEA cannot be determined from this study nor can any health or performance implications.

Supported by the University of Otago Research Grant

120 Board #4 May 31 9:30 AM - 11:30 AM
Energy Availability and Muscle Glycogen Levels in Division I Beach Volleyball Athletes

Marguerite B. Gilchrist¹, Toni M. Torres-McGehee¹, Meaghan Minori¹, Dawn M. Emerson², Kelly Pritchett³. ¹University of South Carolina, Columbia, SC. ²Kansas University, Lawrence, KS. ³Central Washington University, Ellensburg, WA.

(No relationships reported)

Beach volleyball is considered a lean body sport, which may increase the risk for low energy availability (LEA). There is currently limited research on beach volleyball athletes, particularly in terms of energy availability (EA) and muscle glycogen levels.

Purpose: To examine EA and muscle glycogen levels in beach volleyball athletes. A secondary purpose examined macronutrient intake. **Methods:** Local NCAA Division I female beach volleyball athletes (n=18; ages 19.9 ± 1.5 yrs; weight: 63.3 ± 5.1 kg; height: 174.5 ± 5.6 cm) participated in the study. EA and energy expenditure were measured via a 7-day food and activity log. Resting metabolic rate (RMR) was measured via indirect calorimetry. Muscle glycogen levels were evaluated for the gastrocnemius (GS), rectus femoris (RF) and biceps brachii (BB) pre and post-practice using the MuscleSound ultrasound device. **Results:** When examining RMR, 55.6% beach volleyball players did not meet the RMR caloric needs compared to their associated dietary intake. LEA was present in 94.4% of the participants. For proteins, 61.1% were under recommendations and 5.6% were over the recommendations. All beach volleyball players were under the recommendations for carbohydrates (CHO), and 33.3% were over the recommendations for fats while all others met the recommendations for fats. Repeated-measures analysis of variance indicated a main effect for GS and RF muscle glycogen pre-and post-practice across 5 days; however no specific interactions were found. No significant differences were found with BB measurements. Chi-square analysis revealed no significant differences for level of muscle glycogen vs. CHO intake. **Conclusion:** Beach volleyball athletes are at risk for LEA due to both the high energy expenditure demands of their sport and low nutritional intake. Health care professionals working with beach volleyball athletes should consider monitoring nutrition and implementing nutritional education sessions in order to prevent long term LEA and its negative health consequences. The MuscleSound device can be a good tool for determining if an athlete strays from their norm over time, but more research is needed in order to use this device as a tool for determining chronically low CHO intake.

121 Board #5 May 31 9:30 AM - 11:30 AM
A Novel Method Of Assessing Dietary Behavior Using a Wrist-Worn Accelerometer

Kyle N. Winfree, Natalia O. Dmitrieva, Timothy K. Behrens, FACSM. Northern Arizona University, Flagstaff, AZ. (Sponsor: Timothy K. Behrens, FACSM)
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(No relationships reported)

PURPOSE: To describe a novel way of estimating dietary behavior using a wrist-worn accelerometer. **METHODS:** The eating behaviors of one subject were captured via video recording while motions were concurrently recorded using a wrist-worn ActiGraph GT3X, set at 100Hz sample rate on the dominant wrist. The video recording and ActiGraph were synchronized at the start of data collection through action of a transient event visible in both data sources. Behaviors and motions, which included both eating and non-eating behaviors were captured for 30 min. A taxonomy was developed to code the video recording (e.g., fork to mouth, spoon away from mouth) and three raters identified the exact times of actions, to the nearest millisecond. Categorical assignments of each rater were used to identify "true" start and stop times of each movement; while similar, each was used separately to train a classifier. These categorical markings were then used to select data from the accelerometer. A feature set of each sample in the categorical sets, surrounding each category of action, were used to train a supervised machine learning naïve bayes classifier. The feature set consisted of mean, standard deviation, and binned spectral analysis of raw, first derivative (ddt), and angular derived measures; this totaled 110 measures across the original x,y,z and other resultant measures. Given the relatively small data set (i.e., 180,000 samples for 30 min), the training dataset was also used for testing this proof of concept. **RESULTS:** Adjusting for the prior probability of each categorical selection (i.e., ten categories of eating behaviors), the agreement for specific food actions between the video and the classifier predicted action was found to be 63%. Simplifying to consider cases of eating and non-eating only, agreement improved to 67%. Agreement was 66% when prediction results were condensed to "not eating," "drinking," and "eating." **CONCLUSION:** These findings present a plausible new method of estimating dietary behavior. Further refinement is necessary to generalize to larger and more diverse populations, though the potential of providing real-time, objective, dietary behavior analyses is a promising area for research and practice.

122 Board #6 May 31 9:30 AM - 11:30 AM
Effect Of Exercise-induced Weight Loss On 24 Hour Energy Metabolism
 Nicholas T. Broskey, Corby K. Martin, Jeffrey H. Burton, John W. Apolzan, Melissa Harris, Timothy S. Church, Eric Ravussin, Leanne M. Redman. *Pennington Biomedical Research Center, Baton Rouge, LA.*
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 (No relationships reported)

Exercise usually results in less weight loss than expected. It is therefore postulated that changes in energy expenditure (EE) and/or compensatory increases in energy intake (EI) occur to counteract energy deficits induced by exercise.

PURPOSE: Compare changes in all components of daily energy expenditure (24hrEE) after 24 weeks of exercise training between varying doses of exercise recommended for weight loss.

METHODS: Forty-one (28 F, 13 M) obese (35.2±3.7 kg/m²) middle aged (47.8±12.5 y), sedentary individuals from the Examination of Mechanisms of Exercise-induced Weight Compensation (E-MECHANIC) study were randomized to either a healthy living control group (HL, n=13) or a supervised, controlled aerobic exercise intervention that achieved 8 kcal/kg of body weight/week (KKW, n=14) or 20 KKW (n=14). 24hEE (metabolic chamber), total daily energy expenditure (TDEE, by doubly labeled water), energy intake (by Intake-Balance method), and VO_{2peak} (by graded exercise test) were measured before and after the intervention.

RESULTS: Compared to the HL group, VO_{2peak} increased in the 8 KKW (p=.004) and 20 KKW (p<.0001) groups. With 20 KKW, TDEE (and 24hrEE) increased (p=.04) and weight loss (-2.5±0.9 kg, p=.04) was significant but approximately half of what was expected based on the increase in energy expenditure from exercise. Fat mass (-2.1±0.8 kg, p=.02) but not fat-free mass (-0.4±0.3 kg, p=.79) was also significantly reduced. A 151 kcal/d energy deficit was detected at week 24. The increase in TDEE is attributed to the increased physical activity (p=.03) and not to changes in EE during sleep, arousal or the thermic effect of food. Besides physical activity, the largest change in EE was a reduction in spontaneous physical activity by ~15% (p=.04). With 8 KKW, there was no significant weight or body composition change and no significant increase in TDEE. An energy deficit of 23 kcal/d was detected at week 24. None of the components of EE were changed in the 8 KKW group.

CONCLUSIONS: Structured aerobic exercise that expends up to 1800 kcal/wk increased TDEE but produces less weight loss than expected possibly due to compensatory increases in EI and behavioral adaptations that could lead to reduced spontaneous physical activity.

123 Board #7 May 31 9:30 AM - 11:30 AM
Validity of Self-Reported Energy Intake Compared to Resting Metabolic Rate in Athletes
 Virginia R. Lemon¹, Jody Herman¹, Emily N. Werner, 19102¹, Jacqui Van Grouw¹, Rachel C. Kelley², Francesco Alessio¹, Michael L. Bruneau¹, Stella L. Volpe, 19102, FACSM¹. ¹*Drexel University, Philadelphia, PA.* ²*University of Florida, Gainesville, FL.* (Sponsor: Stella Lucia Volpe, FACSM)
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Energy intake (EI) is frequently under-reported by study participants and can be biased for reasons such as memory, incorrect estimation of portion sizes, deliberate manipulation, etc. It is important that EI is reported as accurately as possible when used for dietary assessment for research studies. **PURPOSE:** To compare self-reported EI from a Block Food Frequency Questionnaire (FFQ) to resting metabolic rate (RMR) in Collegiate Athletes, Reserve Officer's Training Corps (ROTC) Cadets and Midshipmen, and Masters Athletes. **METHODS:** This cross-sectional study included 21 Collegiate Athletes (8 females, 13 males) and 15 ROTC Cadets and Midshipmen (7 females, 8 males), 18 to 25 years of age. It also included 18 Masters Athletes (6 females, 12 males), 26 years of age and older. Indirect calorimetry was used to determine RMR. Participants completed a self-administered Block FFQ to assess dietary patterns over the previous year. A ratio ≤1.35 for EI to RMR was considered under-reporting of dietary intake on the FFQ. **RESULTS:** The mean ratio of EI to RMR for all participants was 1.24 (±0.38) and the frequency of under-reporting was 67% (n=36). Percentage of under-reporting was significant (p<0.01). Seventy-three percent of males (n=24) and 57% of females (n=12) under-reported EI. Sixty-two percent of all Collegiate Athletes, 73% of ROTC Cadets and Midshipmen, and 67% of Masters Athletes under-reported EI. Sex significantly affected reporting status (p<0.01), with males more likely to under-report than females. **CONCLUSIONS:** Significant under-reporting of energy intake was found in these athletes. Further analyses is required to determine why males in these three athlete populations were more likely to under-report than females. These represent data from an unfunded research project

124 Board #8 May 31 9:30 AM - 11:30 AM
Metabolomic Responses to Acute Aerobic and Anaerobic Exercise Bouts
 Joseph K. Pellegrino¹, Christopher E. Ordway¹, Sean P. Conway², Alan J. Walker¹, Marissa J. Bello¹, Anthony Poysstick¹, Eddie B. Capone¹, Nick Mackowski¹, David J. Sanders¹, Bridget A. McFadden¹, Morgan Hofacker¹, Peter J. Gillies¹, Shawn M. Arent, FACSM¹. ¹*Rutgers University, Rutgers Center for Health & Human Performance, New Brunswick, NJ.* ²*DURO Health, New York, NY.* (Sponsor: Shawn M Arent, FACSM)
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Purpose: To explore the acute serum metabolomic responses following single bouts of aerobic and anaerobic exercise in differentially-trained subjects. **Methods:**

Subjects (N = 40) were equally distributed into one of 4 groups (n = 10) based on a combination of sex [male (M) or female (F)] and training history [endurance (E) or resistance (R) trained] (M = 24 + 4 y, 160.5 + 17.2 kg, 12.8 + 5.7 %BF; F = 22 + 2 y 135.5 + 15.8 kg, 23.3 + 4.8 %BF). On separate days, 45 min aerobic (A) or weight-training (W) exercises were performed. Serum was collected pre, 0 & 60 min post exercise (T0, T1 & T2), and analyzed via UHPLC/MS for identification of 754 biochemicals. Principle components analysis (PCA) was used to define metabolite profiles. RMANOVA's for sex, training status, exercise type, and time were run with significance set at P < .05. **Results:** Both A and W increased glycolysis (A = 3.5 + .7 fold; W = 3.9 + 1.0 fold; P<.05), with a significantly greater activation for RW, P<.05. TCA activity (AVG = 1.5 + 0.3 & 1.9 + 0.3 fold; P<.05) also increased. Downstream TCA intermediates (succinate, fumarate, & malate) were increased at T1, particularly for succinate in E (P<.05), and returned to baseline by T2. During exercise, A increased fat metabolism as evidenced by elevation of multiple FFAs and acylcarnitines (i.e., palmitate increased 2.0 + 0.4 v 1.0 + 0.1 fold in A v W) and elevated ketone bodies at T1 in RA & EA. Across exercise conditions, E showed relatively lower FFA and BCAA catabolism than R at T2 (E v R changes from baseline: stearate = 1.4 + 0.3 v 1.4 + 0.2 fold; 3-hydroxyisobutyrate = 1.8 + 0.2 v 2.2 + 0.1, P<.05) and generally faster returns towards baseline for all metabolites. Sex-dependent differences in global metabolite profiles were more pronounced in E than R groups, including elevated FFA's and muted TCA intermediate levels and BCAA catabolism in FE during both A and W. **Conclusion:** The biological response to exercise is dictated by the metabolic demand of the exercise and the physiology of the exerciser, allowing exercise type and individual variation to alter the exercise metabolome. Data support greater TCA capacity in E and greater glycolytic power in R leading to differential fuel selection during exercise, particularly with matched mode. Females displayed lower TCA activity, yet higher FFA oxidation with sex differences most apparent in the E groups.

A-25 Free Communication/Slide - Respiratory Physiology
 Wednesday, May 31, 2017, 9:30 AM - 11:15 AM
 Room: 110

125 **Chair:** Michael Stickland. *University of Alberta, Edmonton, AB, Canada.*
 (No relationships reported)

126 May 31 9:30 AM - 9:45 AM
Inspiratory Flow Resistive Loaded Breathing and Inspiratory Muscle Induced Systemic Oxidative Stress
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Markers of oxidative stress such as F₂-isoprostanes (a marker of lipid peroxidation) are elevated in the blood of patients with chronic obstructive pulmonary disease (COPD) compared to healthy individuals. Oxidative stress may reduce quality of life and contribute to morbidity and mortality in patients with COPD but unfortunately its origin is unclear and, therefore, it cannot be treated effectively. The inspiratory muscles may contribute significantly to systemic oxidative stress in COPD because the work of breathing increases to overcome airway resistance. **PURPOSE:** To investigate whether the inspiratory muscles contribute to systemic oxidative stress during inspiratory flow resistive loaded breathing. **METHODS:** Four young healthy adults (3 males and 1 female) who were free from respiratory disease undertook inspiratory flow resistive

loaded breathing for 30 minutes. Subjects maintained breathing frequency at 15 breaths·min⁻¹, duty cycle at 0.5 and transdiaphragmatic pressure at 70% of maximum which was provided by a variable sized aperture with a length of 2 mm. Inspiratory muscle work was estimated by the diaphragm pressure-time product (PTP_{di}), which was calculated by multiplying breathing frequency by transdiaphragmatic pressure integrated over the period of inspiratory flow. Plasma samples were collected at rest (0 min), 5 and 30 minutes during, and 30 minutes after (+30 min) inspiratory flow resistive loaded breathing and analyzed for F₂-isoprostanes using isotope dilution mass spectrometry. Time comparisons were made using a one-way ANOVA with repeated measures. **RESULTS:** PTP_{di} increased (P<0.005) from 663 ± 102 (mean ± SD) at 0 min to 1931 ± 501 and 1618 ± 258 cmH₂O·s·min⁻¹ at 5 and 30 min, respectively. Plasma F₂-isoprostanes increased (P<0.05) from 154 ± 22 at 0 min to 197 ± 35, 229 ± 83 and 206 ± 58 pg·mL⁻¹ at 5, 30 and +30 min, respectively. **CONCLUSIONS:** Lipid peroxidation increased during, and remained elevated following, inspiratory flow resistive loaded breathing. Our novel data are the first to indicate that the inspiratory muscles may directly contribute to systemic oxidative stress during periods of increased inspiratory muscle work, such as those encountered in COPD. Supported by University of Southern Queensland Centre for Health Sciences Research sponsored research grant scheme.

127 May 31 9:45 AM - 10:00 AM

Competitive Runners Can Adapt To Nasal Breathing With Similar Peak Running Velocity And Lower Ventilation

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(No relationships reported)

PURPOSE: This study investigated the effect of breathing restricting to the nasopharynx (NB) versus the oropharynx (OB) in 10 mixed gender (5 males, 5 females) recreationally competitive runners (VO₂max = 40.10 ± 2.65 ml/kg/min). **METHODS:** Each subject performed a maximal graded exercise test (GXT) and a subsequent six minute high intensity steady state run (SSR) during random order NB and OB days. All runners had previously adapted themselves to nasal only breathing at all levels of running intensity. **RESULTS:** In the GXT trials the subjects exhibited no significant mean difference in time to exhaustion (TE) (NB = 428 ± 24 vs. OB = 421 ± 18 secs), absolute maximal oxygen consumption (VO₂max) (NB = 2.55 ± 0.25 vs. OB = 2.75 ± 0.25 L/min) or peak lactate (NB = 7.0 ± 0.76 vs. OB = 7.2 ± 0.76 mmols/dl). In the nasally restricted breathing condition they demonstrated a significantly lower mean ventilatory equivalent for oxygen (VE/VO₂) (NB = 35.20 ± 1.34 vs. OB = 41.30 ± 1.59) and carbon dioxide (VE/VCO₂) (NB = 29.4 ± 1.33 vs. OB = 32.8 ± 1.13) and peak ventilation (VE) (NB = 92.8 ± 10.8 vs. OB = 112.6 ± 16.8) with a significantly higher breathing frequency (RR) (NB = 39.2 ± 2.1 vs. OB = 49.4 ± 2.5) at VO₂max. During the SSR trials the subjects exhibited no significant difference lactate (NB = 9.05 ± 0.88 vs. OB = 7.92 ± 0.98 mmols/dl) and again demonstrated a significantly lower mean VE/VO₂ (NB = 32.43 ± 0.77 vs. OB = 36.70 ± 1.03), VE/VCO₂ (NB = 28.47 ± 0.68 vs. OB = 32.92 ± 0.92) and VE (NB = 84.4 ± 8.5 vs. OB = 102.1 ± 8.2) with a significantly higher RR (NB = 36.4 ± 1.8 vs. OB = 43.2 ± 2.3). **CONCLUSION:** This study confirms the ability of competitive recreational runners to adapt to breathing restricted to the nasopharynx during running at both a maximal effort and a subsequent high intensity steady state effort, with a lower VE and RR and without a loss in TE or VO₂max.

128 May 31 10:00 AM - 10:15 AM

Does Competitive Swimming During Puberty Affect Lung Development?

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(No relationships reported)

Whether or not competitive swimming (CS) accentuates lung development beyond genetically endowed growth has been widely debated. **PURPOSE:** Given that peak growth velocities for the lungs occur during puberty, this longitudinal study aimed to determine if one season of CS affected lung development in pubertal females. **METHODS:** Female swimmers (SWIM; n=11, 3.3±1.7 y of CS experience, 19±8 km swimming/week) and healthy active controls (CON; n=10) underwent pulmonary function testing before (PRE) and after (POST) one season of CS (7.3±0.5 months). The groups were matched for age (SWIM 12.4±0.8 vs CON 13.2±1.3; p=0.10), height (PRE 161±8 vs 158±7, POST 163±7 vs 161±7 cm; p=0.38) and weight (PRE 52±11 vs 46±5, POST 56±10 vs 49±6 kg; p=0.10). Sexual maturity rating was self-reported to be pubertal (Tanner stages 2-4) for all of the SWIM and 90% of CON. Changes in lung volumes, spirometry, diffusion capacity (DLCO), and maximal inspiratory (MIP) and expiratory (MEP) mouth pressures were compared using 2-way mixed model ANOVA. **RESULTS:** Despite having a similar body size as controls, swimmers had a larger

total lung capacity (TLC; PRE 4.73±0.73 vs 3.93±0.46, POST 5.08±0.68 vs 4.19±0.64 l; p<0.01). Forced vital capacity (PRE 3.92±0.71 vs 3.13±0.50, POST 4.15±0.61 vs 3.28±0.54 l; p<0.01) and peak expiratory flow (PRE 6.48±0.92 vs 5.70±0.86, POST 6.97±0.84 vs 6.00±0.77 l/s; p=0.03) were higher in SWIM. Although DLCO was greater in SWIM (PRE 23.4±2.6 vs 20.7±1.9, POST 24.1±1.9 vs 21.0±3.2 ml/min/mmHg; p=0.01), there was no difference when expressed relative to alveolar volume (PRE 5.1±0.6 vs 5.4±0.4, POST 4.9±0.6 vs 5.2±0.4 ml/min/mmHg/l; p=0.20). Both MIP (PRE 87±26 vs 71±24, POST 103±22 vs 79±26 cm H₂O, p=0.06) and MEP (PRE 112±17 vs 98±18, POST 114±13 vs 84±19 cm H₂O; p<0.001) were greater in SWIM. Changes from PRE to POST were similar between groups (interactions p>0.05). No association between CS training volume (km/week) and change in lung size (delta TLC) (r=-0.02, p=0.95) was found. **CONCLUSION:** This data shows that pubertal female swimmers already had larger lung capacities, higher flows, and greater indices of respiratory muscle strength compared to matched controls. One season of CS did not further accentuate this enhanced function, suggesting that CS during puberty did not affect lung development. Support: NSERC

129 May 31 10:15 AM - 10:30 AM

Operational Lung Volumes While Seated, Supine, and During Exercise in Obese and Nonobese Children

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(No relationships reported)

PURPOSE: The effects of adult obesity on lung function at rest, such as reductions in functional residual capacity and expiratory reserve volume, are well recognized. However, the effects of obesity on operational lung volumes at rest, while lying supine, and during exercise in obese children are unknown but could create meaningful respiratory limitations. **METHODS:** 11 nonobese (Ht: 143.3 ± 5.2 cm; Wt: 35.8 ± 3.8 kg; BMI percentile: 50 ± 21; Body fat: 27 ± 6%) and 12 obese (Ht: 149.7 ± 6.7 cm; Wt: 65.8 ± 14.4 kg; BMI percentile: 97.5 ± 1.4; Body fat: 46 ± 3%) children underwent dual energy x-ray absorptiometry, pulmonary function testing, and measurement of operational lung volumes when seated upright, while supine, during constant load cycling at 40W, and during maximal exercise testing. **RESULTS:** Ratio of forced expiratory volume in the first second and forced vital capacity (FEV₁/FVC) was lower in obese compared with nonobese children (83.6 ± 4.1 vs. 88.6 ± 4.1%; P = 0.004). Functional residual capacity (FRC) was lower in obese compared with nonobese children when seated upright (38.5 ± 4.8 vs. 49.3 ± 4.0%TLC; P < 0.001) and while supine (35.0 ± 6.4 vs. 45.4 ± 6.5%TLC; P < 0.001). Three children (2 obese) experienced expiratory flow limitation (EFL) while supine. Both end expiratory lung volume (EELV) and end inspiratory lung volumes (EILV) were lower during exercise at 40W (P < 0.01) and EILV was lower at peak exercise (P = 0.048) in obese compared with nonobese children. EELV did not change from rest to exercise at 40W or peak exercise in nonobese children. In obese children, EELV was higher at peak exercise (44.4 ± 4.7%TLC) compared with rest and exercise at 40W (40.5 ± 4.1 and 38.7 ± 3.1%TLC, respectively; P < 0.05). None of the nonobese children experienced EFL during exercise. In obese children, one experienced EFL during exercise at 40W (44%tidal volume; V_T) and seven experienced EFL at peak exercise (37 ± 22%V_T). Higher levels of fat mass were associated with lower levels of FRC when seated (r = -0.88; P < 0.001) and while supine (r = -0.65; P = 0.003), and EELV during exercise at 40W (r = -0.68; P = 0.001). **CONCLUSIONS:** Obese children demonstrate low lung volume breathing when seated, while supine, and during exercise, which may contribute to an obstructive breathing pattern at rest as well as EFL and dynamic hyperinflation during peak exercise.

130 May 31 10:30 AM - 10:45 AM

The Effect Of Thoracic Gas Compression On Forced Expiratory Flows Is Increased At High-altitude

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It is well-known that the maximal expiratory flow-volume (MEFV) curve may be underestimated due to the confounding effects of thoracic gas compression (TGC) at sea-level. This artefact, if not addressed, reduces the sensitivity/specificity of pulmonary function testing to detect expiratory flow-limitation and changes in bronchomotor tone. The magnitude of TGC artefact increases the more compressible is the gas inhaled. With this in mind, we reasoned that magnitude of TGC artefact would be greater at high-altitude (> 2,400 m) where the density of air is lower, and its

compressibility increased. **PURPOSE:** To determine whether high-altitude engenders a greater magnitude of TGC artefact on the MEFV curve. **METHODS:** Twenty-four adults (10 women; 44 ± 15 yrs) with normal baseline pulmonary function (>90% pred.) completed an 11-day sojourn at Mt. Kilimanjaro. Participants were assessed at Moshi (Day -1, 843 m) and at Barafu Camp (Days 8-9, 4,837 m). Typical MEFV curves with no TGC correction were obtained in accordance with ATS/ERS guidelines. MEFV curves were then corrected for TGC by performing 7-9 vital capacity manoeuvres at varying degrees of expiratory effort. Both MEFV curves were further corrected to account for differences in gas-density between altitudes. **RESULTS:** At both altitudes, peak expiratory flow rate (PEFR), and forced expiratory flows at 75, 50 and 25% of vital capacity (FEF_{75%}, FEF_{50%}, and FEF_{25%}, respectively) were higher after correction for TGC ($P < 0.05$). The magnitude of change in the MEFV envelope incurred by TGC-correction was relatively greater at Barafu Camp compared with data at Moshi for FEF_{50%} ($\Delta 16 \pm 19\%$ v $\Delta 3 \pm 5\%$, $P < 0.05$) and FEF_{25%} ($\Delta 34 \pm 40\%$ v $\Delta 15 \pm 16\%$, $P < 0.05$). Once corrected for TGC and gas-density, we observed that PEFR, FEF_{75%}, FEF_{50%}, and FEF_{25%} were lower at Barafu Camp compared with data at Moshi ($P < 0.05$). **CONCLUSIONS:** Our data further emphasize what is already well-known at sea-level: that is, the MEFV envelope is significantly underestimated if no attempt is made to correct for TGC. More importantly, however, we show that the underestimation of the MEFV curve due to TGC is worsened upon ascending to higher altitudes, particularly for those expiratory flows occurring over the effort-independent portion of the MEFV envelope.

131 May 31 10:45 AM - 11:00 AM

Effect of Acute Expiratory Loading on Abdominal Muscle Function and Exercise Tolerance in Healthy Humans

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Heavy-intensity whole body exercise sustained to the limit of tolerance elicits fatigue of the diaphragm and expiratory abdominal muscles. Such respiratory muscle fatigue is likely involved in exercise limitation in healthy humans. Acute submaximal inspiratory muscle loading causes a transient increase in diaphragm excitability and inspiratory muscle strength, and may enhance subsequent exercise performance. Whether loading of the expiratory muscles has a similar ergogenic effect is unknown. **PURPOSE:** To determine the effect of acute expiratory muscle loading on expiratory abdominal muscle function and exercise tolerance in healthy humans. **METHODS:** Using a single-blind, placebo-controlled design, nine male subjects [$\dot{V}O_{2peak} = 50.1 \pm 3.8$ (SD) ml·kg⁻¹·min⁻¹] cycled at ≥90% of $\dot{V}O_{2peak}$ to the limit of tolerance after 1) 2 × 30 expiratory efforts against a pressure-threshold load of 40% maximal expiratory pressure (MEP) (EML-EX), and 2) 2 × 30 expiratory efforts against a pressure-threshold load of 10% MEP (SHAM-EX). Abdominal muscle function was assessed before and after expiratory muscle loading and 5 min after exercise by measuring 1) the gastric pressure response to maximal voluntary expiratory efforts ($P_{ga_{max}}$), and 2) gastric twitch pressure ($P_{ga_{tw}}$) in response to magnetic stimulation of the thoracic nerve roots. **RESULTS:** From before to after expiratory muscle loading in EML-EX, there was no change in non-potentiated $P_{ga_{tw}}$ (30.3 ± 10.6 vs. 32.9 ± 10.3 cmH₂O, $P = 0.232$), potentiated $P_{ga_{tw}}$ (36.3 ± 8.0 vs. 38.9 ± 8.1 cmH₂O, $P = 0.079$), or $P_{ga_{max}}$ (190 ± 44 vs. 202 ± 45 cmH₂O, $P = 0.611$). Similarly, there was no change in expiratory abdominal muscle function from pre- to post-expiratory muscle loading in SHAM-EX. Exercise time to the limit of tolerance was not different in EML-EX vs. SHAM-EX (480 ± 132 vs. 489 ± 120 s, $P = 0.792$). The severity of exercise-induced abdominal muscle fatigue was not different in EML-EX vs. SHAM-EX (potentiated $P_{ga_{tw}} - 25 \pm 12$ vs. $-22 \pm 9\%$, $P = 0.376$). Perceptual ratings of dyspnoea and leg discomfort (Borg CR10) were not different at min 1, min 3, and at end-exercise during EML-EX and during SHAM-EX ($P > 0.05$). **CONCLUSION:** Acute expiratory muscle loading does not improve expiratory abdominal muscle function or subsequent exercise tolerance in healthy humans. **Supported by The Physiological Society.**

132 May 31 11:00 AM - 11:15 AM

Diagnosing Exercise Induced Bronchoconstriction: A Comparison Of Eucapnic Voluntary Hyperpnoea And Exercise In Low Humidity

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(No relationships reported)

Eucapnic Voluntary Hyperpnoea (EVH) is a sensitive indirect airway challenge to assist in the diagnosis of Exercise Induced Bronchoconstriction (EIB). However, it has been previously reported that a positive EVH challenge may not necessarily predictive a positive exercise challenge (EX). EX have previously shown varying sensitivity due to differences in control over the inspired air water content, with studies being conducted in ambient lab conditions or using medical grade dry air.

PURPOSE: To compare the EVH challenge with an EX in a controlled dry air environment, to see if a standardised EX can be used in the diagnosis or EIB. **METHODS:** Thirty-one healthy participants (10 female; 21 males, age 36 ± 10 yrs, exercising 7.7 ± 3.0 hrs per week) gave informed consent. Eight had a history of asthma but were not taking preventative medication. Participants completed an EVH and an EX on a cycle ergometer in a randomised order. The EVH required participants to breathe a gas mixture (5% CO₂, 21% O₂ and 74% N₂, <2%RH) at a rate equivalent to 85% predicted MVV. The EX was conducted in an environmental chamber (16°C, 25%RH). Following a 4-min set warm up participants completed 6-mins of cycling at a work rate associated with 85% HRmax. Tests were deemed positive if there was a fall in FEV₁ of ≥ 10% following the challenge. Results were analysed using paired *t*-tests and Pearson's correlation and are presented as mean ± SD. **RESULTS:** Seven participants were positive to EVH. Of these, only two had a positive response to EX. No differences in baseline FEV₁ between EVH and EX were found (EVH: 4.06 ± 0.79, EX: 4.06 ± 0.77L, $p = 0.746$). There was a strong correlation between the % fall in FEV₁ post EVH and EX ($r = 0.520$, $p = 0.003$). However, the % fall in FEV₁ post EVH was significantly greater than post EX (EVH: -7.5 ± 5.4, EX: -2.0 ± 3.8 %, $p < 0.001$). The total amount of air expired was significantly higher in 6 mins EVH compared to 6 mins EX (EVH: 686.5 ± 141.7, EX: 617.9 ± 83.1 L, $p = 0.002$). **CONCLUSION:** A positive EVH challenge may not be predictive of a positive Exercise Challenge in a dry environment. EVH may have a greater sensitivity due to the lower water content of inspired air and a greater VE. This suggests that a mild positive EVH challenge (a fall in FEV₁ of 10-15%), may not be predictive of EIB.

A-26 Free Communication/Slide - Thermoregulation in Clinical Populations

Wednesday, May 31, 2017, 9:30 AM - 10:45 AM
Room: 103

133 **Chair:** Jody Greaney, Pennsylvania State University, University Park, PA.

(No relationships reported)

134 May 31 9:30 AM - 9:45 AM

Core Temperature Responses To Exercise Using A Simulated Burn Injury Model: Impact Of Body Size

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BACKGROUND: The US Army's Standards of Medical Fitness indicate that a burn injury spanning ≥40% of total body surface area (BSA) "does not meet the standard." While whole-body sweat production and thus evaporation are diminished in burn survivors with extensive skin grafts, the impact of a 40% BSA burn injury on core temperature regulation during exercise is likely dependent on body size, as larger individuals will have a greater absolute skin area that can still participate in heat loss despite the same percentage BSA burn injury.

PURPOSE: Using a simulated burn injury model, we tested the hypothesis that the detrimental effect of a 40% BSA "burn injury" would be exacerbated in individuals of smaller versus larger body size during exercise due to a lower absolute (i.e., in m²) skin area available for heat loss.

METHODS: On separate occasions, healthy non-burned individuals of small (SM: n=8, 62.4 ± 5.8 kg, 1.69 ± 0.11 m²) or large (LG: n=8, 99.1 ± 8.4 kg, 2.25 ± 0.09 m²) body size cycled to elicit ~500 W of metabolic heat production for 1 h in a 39°C and 20% relative humidity environment with and without (0%) a simulated burn injury of 40% BSA. Burn injuries were simulated by affixing a highly absorbent, vapor-impermeable material to the torso (20% BSA), arms (10% BSA), and legs (10% BSA) to prevent sweat evaporation. Core temperature was measured in the gastrointestinal tract (T_{gi}).

RESULTS: Greater increases in T_{gi} were observed in SM at 0% (SM: 1.09 ± 0.33°C; LG: 0.64 ± 0.22°C; $P = 0.03$) and 40% (SM: 1.65 ± 0.32°C; LG: 1.14 ± 0.23°C; $P = 0.01$). However, the exacerbated rise in T_{gi} from 0% to 40% was not different between groups (SM: 0.57 ± 0.28°C; LG: 0.49 ± 0.24°C; $P = 0.60$).

CONCLUSIONS: Preliminary data suggest that the exacerbated rise in core temperature with a simulated burn is not dependent on body size. Nevertheless, SM subjects with a simulated burn exercising at the same rate of metabolic heat production experienced the highest absolute T_{gi} and would therefore be at the greatest risk for a heat-related injury. Funding support: Department of Defense - US Army, W81XWH-15-1-0647.

135 May 31 9:45 AM - 10:00 AM

Does the Exercise-Induced Heat Load Influence Whole-Body Heat Loss in Type 1 Diabetes?Sheila Dervis¹, Martin P. Poirier¹, Pierre Boulay², Ronald J. Sigal³, Janine Malcolm¹, Naoto Fujii¹, Glen P. Kenny¹.¹University of Ottawa, Ottawa, ON, Canada. ²University of Sherbrooke, Sherbrooke, QC, Canada. ³University of Calgary, Calgary, AB, Canada.

(No relationships reported)

To date, only two studies have examined the effects of Type 1 diabetes (T1D) on the body's ability to dissipate heat during exercise in the heat. The first study showed no effect of diabetes on local or whole-body heat loss during moderate intensity exercise. However, a recent study revealed that differences may be heat load dependent as evidenced by the fact that attenuations in sweating only were observed for select skin sites at moderate-to-high exercise intensities. It remains to be determined however if these regional attenuations in sweating may lead to reductions in whole-body heat loss thereby compromising body core temperature regulation. **PURPOSE:** To examine if T1D impairs whole-body heat loss as function of increasing exercise-induced heat loads. **METHODS:** Young (27 ± 6 years) adults with (n=6, hemoglobin A1c: 8.0 ± 1.7%, duration of diabetes: 15 ± 7 years) and without T1D (CON, n=6) were matched for age, physical characteristics and aerobic fitness (VO_{2peak}). Participants performed three 30-min bouts of cycling at fixed incremental rates of metabolic heat production of 200 (Ex1), 250 (Ex2) and 300 W·m⁻² (Ex3) in the heat (35°C), equivalent to 35, 52 and 65% of their VO_{2peak}. Each exercise bout was followed by a 30-min recovery. Whole-body evaporative and dry heat loss and metabolic heat production were measured by direct and indirect calorimetry respectively. The change in body heat storage was calculated from the temporal summation of the rate of heat production and heat loss. **RESULTS:** Evaporative heat loss tended to be lower in the T1D group at the end of the second (T1D: 401 ± 71 W; CON: 424 ± 60 W, p=0.15) and third (T1D: 462 ± 75 W; CON: 479 ± 62 W, p=0.12) bouts of exercise only when compared to their healthy counterparts. No differences in dry heat gain were measured between groups for all exercise bouts (all p>0.05). Accordingly, the individuals with T1D stored more heat relative to healthy counterparts during the second (T1D: 247 ± 48 kJ; CON: 167 ± 48 kJ, p=0.03) and third (T1D: 314 ± 70 kJ; CON: 250 ± 83 kJ, p=0.02) exercise bouts. **CONCLUSION:** Our preliminary findings demonstrate that T1D may impair whole-body heat loss during exercise in the heat. Further, we show that the influence of T1D on heat dissipation is dependent upon the exercise-induced heat load. Support provided by the Canadian Institutes of Health Research.

136 May 31 10:00 AM - 10:15 AM

Are Type 2 Diabetes-Related Impairments in Heat Dissipation Heat Load Dependent?Martin P. Poirier¹, Sheila Dervis¹, Pierre Boulay², Ronald J. Sigal³, Janine Malcolm¹, Glen P. Kenny¹.¹University of Ottawa, Ottawa, ON, Canada. ²Université de Sherbrooke, Sherbrooke, QC, Canada. ³University of Calgary, Calgary, AB, Canada.

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(No relationships reported)

Older adults with type 2 diabetes (T2D) have an attenuated physiological ability to dissipate heat during moderate intensity exercise in the heat. However, it is unclear if T2D-related impairments in heat dissipation only occur above a certain exercise-induced heat load and therefore level of heat stress. **PURPOSE:** To examine whether T2D-related impairments in whole-body heat loss, as assessed by direct calorimetry, occur above a certain heat load threshold. **METHODS:** Twelve older (60 ± 7 years) habitually active males with (n=6, hemoglobin A1c: 6.8 ± 0.6 %, duration of diabetes: 9 ± 5 years) and without (n=6) T2D (CON) matched for age, body surface area, and fitness (VO_{2peak}) completed three successive 30-min bouts of semi-recumbent cycling performed at fixed incremental rates of metabolic heat production of 300 (Ex1), 400 (Ex2) and 500 (Ex3) W in the heat (40°C). This was equivalent to 37, 50 and 62% of their pre-determined VO_{2peak}. A 15-min recovery period followed each exercise bout. Whole-body heat loss (evaporative and dry heat exchange) was measured using direct calorimetry. The simultaneous measurement of metabolic heat production via indirect calorimetry was used to calculate the change in body heat storage. **RESULTS:** Whole-body heat loss was reduced in the T2D group relative to CON at the end of Ex1 (T2D: 235 ± 23 W; CON: 261 ± 34 W, p=0.004), Ex2 (T2D: 294 ± 24 W; CON: 335 ± 44 W, p=0.030), and Ex3 (T2D: 330 ± 59 W; CON: 390 ± 39 W, p=0.02). Given that dry heat gain was similar between groups at the end of all exercise bouts (all p>0.05), differences in whole-body heat loss were only due to differences in evaporative heat loss. The relative difference in the maximal level of whole-body heat loss achieved between groups became greater with increasing exercise-induced heat loads (Differences: Ex1=10.5%, Ex2=14.0% and Ex3=20.5%). As such, the individuals with T2D stored more heat during all exercise bouts (Ex1: 197 ± 39 kJ; Ex2: 236 ± 67 kJ; Ex3: 334 ± 78 kJ, p<0.05) compared to the control group (Ex1: 150 ± 61 kJ; Ex2: 160 ± 74 kJ; Ex3: 248 ± 80 kJ). **CONCLUSION:** Our preliminary findings show that

type 2 diabetes impairs the body's ability to dissipate heat during exercise in the heat and that these differences are first evident at a moderate heat load of 300 W (equivalent to 37% of VO_{2peak}).

Supported by the Canadian Institutes of Health Research

137 May 31 10:15 AM - 10:30 AM

Thermoregulation During Exercise and Passive Recovery in Athletes with a Spinal Cord InjuryPeta Forsyth¹, Joanna Vaile-Miller², Kate Pumpa¹, Kevin G. Thompson, FACSM¹, Christopher McLellan³, Ollie Jay, FACSM⁴. ¹University of Canberra, Canberra, Australia. ²Australian Institute of Sport, Canberra, Australia. ³Bond University, Gold Coast, Australia. ⁴University of Sydney, Sydney, Australia. (Sponsor: Ollie Jay, FACSM)

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(No relationships reported)

PURPOSE: To establish the extent of thermoregulatory impairment in paraplegic and tetraplegic athletes compared to able-bodied controls during exercise and passive recovery in the heat using an experimental method that accounts for differences in biophysical factors. **METHODS:** Thirteen trained males were separated into three groups based on spinal cord injury (SCI) level: tetraplegia (TP; C5-C8, 26.8±5.4 y, 71.2±7.1 kg), paraplegia (PA; T4-T12, 25.6±4.6 y, 74.0±19.7 kg), and able-bodied (AB; 26.2±2.2 y, 78.8±3.9 kg). Participants exercised on an arm ergometer for 30 min at a heat production of 4.0 W/kg (AB vs. TP) or 6.0 W/kg (AB vs. PA) with 3 min rest every 10 min, followed by 45 min of passive recovery in 35°C, 50% RH. Esophageal (T_{es}) and gastrointestinal (T_{gi}) temperature and local sweat rate (LSR) on the forehead and upper back were measured throughout. **RESULTS:** After 30 min exercise, ΔT_{es} was greater in TP (1.13±0.25°C) compared to AB (0.34±0.10°C). Similarly, a greater ΔT_{es} was evident for TP (1.60±0.28°C) compared to AB (0.28±0.15°C). Core temperature peaked at 45 min post-exercise for TP, with ΔT_{es} and ΔT_{gi} reaching 1.94±0.18°C and 1.83±0.13°C, respectively. No sweating was evident in TP however in AB, end-exercise ΔLSR was 0.38±0.26 mg·min⁻¹·cm⁻² on the head and 0.36±0.15 mg·min⁻¹·cm⁻² on the upper back. Differences between PA and AB were evident after 30 min exercise for ΔT_{es} (0.56±0.32°C vs 0.38±0.08°C) and ΔT_{gi} (0.75±0.38°C vs 0.50±0.09°C), which is when core temperature peaked for both groups. At 45 min post-exercise, PA remained greater than AB for ΔT_{es} (0.45±0.16°C vs 0.38±0.15°C) and ΔT_{gi} (0.46±0.22°C vs 0.28±0.18°C). Furthermore, ΔLSR was greater in PA than in AB after 30 min exercise, both at the head (1.03±0.75 mg·min⁻¹·cm⁻² vs 0.87±0.20 mg·min⁻¹·cm⁻²) and the back (1.03±0.30 mg·min⁻¹·cm⁻² vs 0.49±0.18 mg·min⁻¹·cm⁻²). **CONCLUSION:** The increase in post-exercise body temperature in TP demonstrates the inability to dissipate heat in hot conditions, primarily due to the lack of sweating. A greater, but less pronounced increase in body temperature during exercise was also apparent in PA compared to AB, suggesting there is a graded effect of SCI level on thermoregulatory impairment.

Funding: Collaborative Research Network for Advancing Exercise and Sport Science (CRN-AESS) Seed Funding Scheme

138 May 31 10:30 AM - 10:45 AM

Multiple Sclerosis Impairs Sweating but not Skin Blood Flow during a Passive Whole-Body Heat StressDustin R. Allen¹, Mu Huang¹, Iqra M. Parupia¹, Ariana R. Dubelko¹, Elliot M. Frohman², Scott L. Davis¹. ¹Southern Methodist University, Dallas, TX. ²University of Texas Southwestern Medical Center, Dallas, TX.

(No relationships reported)

Multiple sclerosis (MS) is an autoimmune disease that affects the central nervous system (CNS), disrupting autonomic function. **PURPOSE:** The aim of this study was to test the hypothesis that individuals with MS have blunted control of thermoregulatory reflex increases in sweat rate (SR), and cutaneous vasodilation compared to controls during a passive whole-body heat stress (WBH). **METHODS:** 18 individuals with relapsing-remitting MS and 18 healthy controls (CON) participated in the study. Core temperature (T_{core}), skin temperature, heart rate, arterial blood pressure, skin blood flow (laser-Doppler flowmetry: LDF), and SR were continuously measured during normothermic baseline (34 °C water perfusing a tube-lined suit) and WBH (increased core temperature 0.8 °C via 48 °C water perfusing the suit). Following WBH, local heaters were warmed to 42 °C, inducing maximal cutaneous vasodilation at the site of LDF collection. Cutaneous vascular conductance (CVC) was calculated as the ratio of LDF to mean arterial pressure and expressed as a percentage of maximum. **RESULTS:** Individuals with MS had an attenuated SR response to WBH (ASR from baseline: MS: 0.42±0.2 vs CON: 0.60±0.3 mg/cm²/min, p=0.005), while Δ% CVC_{max} was similar between the groups (CON: 41.7±16%; MS: 37.6±12 %, p=0.39). Additional analysis revealed SR responses were blunted as a function of T_{core} in MS (interaction: group*T_{core}, p=0.03), of which differences were evident at ΔT_{core} 0.7 °C and 0.8 °C (p<0.05). Similar analysis for Δ% CVC_{max} revealed no significant

interaction **CONCLUSION:** Taken together, the attenuated sweat responses in MS may be a result of altered neural control of sweat rate, while the control of the cutaneous vasculature is preserved in response to a WBH.

A-27 Clinical Case Slide - Cardiovascular I

Wednesday, May 31, 2017, 9:30 AM - 10:50 AM
Room: 401

139 **Chair:** Aaron L. Baggish, FACSM. *Massachusetts General Hospital, Boston, MA.*
(No relationships reported)

140 **Discussant:** Paul D. Thompson, FACSM. *Hartford Hospital, Hartford, CT.*
(No relationships reported)

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

142 May 31 9:30 AM - 9:50 AM

He's All Heart

Elana Bannerman¹, John H. Stevenson¹, Pierre Rouzier, FACSM², Greg Little². ¹*University of Massachusetts, Worcester, MA.* ²*University of Massachusetts, Amherst, MA.*
(No relationships reported)

HISTORY: An 18 year old male freshman diver at a division 1 university presented to the student health clinic for his pre-participation exam. On discussing his medical history, he reported that at age 8 he syncope while climbing a rope at gymnastics practice. He was taken to the ED for evaluation, and, after a normal glucose and CT scan of the head, the episode was attributed to dehydration. Over the coming weeks the patient syncope twice more at practice. He was then admitted to the hospital for further evaluation.

PHYSICAL EXAMINATION (at PPE): BP 112/76. HR 60. NAD. CV: NRRR, no murmurs, gallops, rubs. PMI is mid-clavicular with a normal impulse. Lungs: CTAB. The patient has a 5cm diagonal well-healed scar at the upper lateral corner of the L chest.

DIFFERENTIAL DIAGNOSIS: Dehydration, orthostasis, neurocardiogenic/vasovagal syncope, hypoglycemia, seizure, aortic stenosis, hypertrophic cardiomyopathy, cardiac ischemia, supraventricular tachycardia, ventricular tachycardia (Long QT, CPVT, Brugada), bradyarrhythmia.

TEST AND RESULTS (during hospital admission): CT head WNL. ECG WNL. EEG WNL. Exercise stress test revealed concomitant increase in PVCs with increase in HR. Genetic testing (+) for RYR2 gene.

FINAL WORKING DIAGNOSIS: Catecholaminergic Polymorphic Ventricular Tachycardia (CPVT)

TREATMENT AND OUTCOMES: Initially placed on nadolol 60mg daily. Significant athletic restrictions imposed. 3 years later restrictions loosened and he began competitive diving and started weightlifting and performing light cardio. 3 months prior to starting college, he sustained an episode of cardiac arrest while walking on the treadmill. Medications changed to nadolol 60mg daily and flecainide 100mg BID. Implantable loop monitor placed. Patient continued to dive and restrictions tightened to decrease the intensity of training. 3 months later the patient sustained a 3 minute episode of PVT while doing burpees at practice. He then underwent a PM/ICD placement and a left cardiac sympathetic denervation. Started diving again 2 months later. Chose not to reveal medical history during college recruitment process due to concern that he would not be recruited. Currently cleared to perform modified practices and compete in 1m and 3m springboard. Restricted from platform diving.

143 May 31 9:50 AM - 10:10 AM

Aortic Root Dilation in Professional SCUBA Diver

Francisco Morales¹, Araceli Boraita², Maria-Eugenia Heras², Manuel Marina-Breyse², Alvaro N. Gurovich, FACSM¹. ¹*Indiana State University, Terre Haute, IN.* ²*Spanish Sports Health Protection Agency, Madrid, Spain.* (Sponsor: Margot Putukian, FACSM)
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(No relationships reported)

HISTORY: A 34 years old asymptomatic male underwent a complete cardiovascular screening as part of his occupational health screening in the Special Police Force,

Diving Section. Physically active (e.g. running, martial arts, strength training, swimming, and diving). He reports no history of chest pain, syncope, dizziness, palpitations, or dyspnea. His past medical history is unremarkable. No family history of sudden death. He has no current or prior history of smoking or drug use.

PHYSICAL EXAMINATION: Anthropometrics: height 179 cm; weight 83 kg; BSA 2.02 m². Vitals: HR 60 bpm; BP 120/70 mmHg. The cardiac exam revealed a protodiastolic murmur that was heard in the inferior left sternal border, intensity 2/6 with no irradiation. Rest of the examination was normal.

DIFFERENTIAL DIAGNOSIS: Physiologic Murmur, Healthy.

TEST AND RESULTS: Electrocardiogram: Normal sinus rhythm, 60 bpm, axis 0°, PR 0.16 s, QTc 0.38 s, early repolarization, IRBBB, U waves V2-V6. Echocardiogram: Aortic root is severely dilated (aortic annulus 30.5 mm, z-score 1.6; sinuses of Valsalva 50.7 mm, z-score 5.5; sinotubular junction 43.5 mm, z score 5.2; proximal ascending aorta 42.0 mm, z-score 4.2). Aortic valve is tricuspid with mild aortic regurgitation. Distal ascending aorta, aortic arch and descending aorta are normal in size. Left ventricular dimensions show mild LV dilation. LV wall thickness is normal with normal contractility, EF 66%. Cardiac MRI: Aortic root aneurism (48 mm diameter) and effacement of the sinotubular junction. Tricuspid aortic valve without significant stenosis or regurgitation. Rest of the thoracic aorta is normal.

FINAL WORKING DIAGNOSIS: Moderate to severe aortic root aneurysm with tricuspid aortic valve and annuloaortic ectasia.

TREATMENT AND OUTCOMES: Valve sparing aortic root replacement (macroscopic hyaline degeneration of the aneurysm). Acetylsalicylic acid 100 mg/day for 3 months. Progressive aerobic exercise training (low to moderate intensity) for 3 months. Strength training (40-50% of body weight) after first 3 months post-surgery. Referred to genetic testing. Control (3 months): Asymptomatic; ECHO: aortic annulus 27.4 mm, sinuses of Valsalva 35.4 mm, sinotubular junction 33.1 mm, proximal ascending aorta 33.1 mm. Is expected the return to diving activities after 1 year without complications.

144 May 31 10:10 AM - 10:30 AM

Transitory Cardiomyopathy In An Elite Swimmer: A Case Study

Demitri Constantinou. *Faculty of Health Sciences, University of the Witwatersrand, Wits, South Africa.* (Sponsor: Yoganathan (Yoga) Coopoo, FACSM)
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(No relationships reported)

HISTORY: A 20-year-old swimmer presented with symptoms of chest pain, dyspnea and two episodes of syncope whilst training for Olympic trials. Symptoms started 4 months before and increasing. He had difficulty training. He reported palpitations at random and not related to syncope or chest pain. His heart rate would exceed 200bpm at times. He was referred to a cardiologist who applied a Holter monitor and inserted an implantable cardiac defibrillator. There was no previous history of any similar problem. History was suggestive of non-specific viremia several weeks prior. The swimmer had no medical or surgical history of note. He was not on any medication and had been using whey protein supplements and creatine, but denied using prohibited performance enhancing substances.

PHYSICAL EXAMINATION: Examination on several occasions did not reveal any abnormalities. Normal pulses and perfusion. Heart rate average 68 bpm, regular, good volume. Blood pressure equal in left and right arms, average 128/68 mmHg. The rest of cardiovascular examination normal.

DIFFERENTIAL DIAGNOSIS:

1. Viral myocarditis arrhythmia
2. Hypertrophic cardiomyopathy
3. Previously unidentified congenital cardiac pathology
4. Non-cardiac cause

TEST AND RESULTS:

Chest radiology normal. Electrocardiography investigations at time symptom onset, several times later from ambulatory readings did not reveal any pathology / arrhythmias. Cardiac enzyme markers initially showed marginal elevated Troponin T. Echocardiography showed dysfunction of left ventricle with wall hypomotility. Ejection fraction 45% using the Simpson method. Cardiac MRI scan reported no signs of severe left or right ventricle dilation or hypertrophy, but concentric hypomotility of whole left ventricle wall. Ejection fraction was 35% Valves were normal as was the rest of the assessment.

FINAL/WORKING DIAGNOSIS:

Transitory cardiomyopathy following possible viremia

TREATMENT AND OUTCOMES:

1. With detraining form not swimming, the athlete slowly recovered.
2. Follow up echocardiography after 6 months showed improvement with no regional wall motion abnormalities with uniform left ventricle contractility. Ejection fraction was 56%.
3. Chest pain symptoms persisted for at least 6 months, but other symptoms subsided.
4. He gradually returned to symptom-guided training

146 May 31 10:30 AM - 10:50 AM

Chest Pain- Volleyball

Samuel T. Dona, Jr.¹, Jeffrey M. Mjaanes, FACSM². ¹Rush University Medical Center, Chicago, IL. ²Northwestern University, Evanston, IL. (Sponsor: Jeffrey M Mjaanes, FACSM)
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(No relationships reported)

HISTORY: A 20-year-old female collegiate volleyball player presented with a 3-month history of chest pain. Pain was non-exertional, localized to the mid-chest and described as constant with rating of 8/10. She initially sought consult 3 months prior in the emergency room with EKG and labs unremarkable. The patient was diagnosed with costochondritis and managed with a steroid dose pack that provided temporary relief. Her pain then progressively increased to inability to tolerate volleyball activity. Of note, she reported mild left hip and lower back pain that started one week prior to consult.

PHYSICAL EXAMINATION: Cardiac exam revealed regular rate and rhythm with no murmurs. Tenderness to palpation was significant over the sternomanubrial junction. Left hip exam revealed positive piriformis test and sacroiliac compression test. Range of motion was full throughout the bilateral upper and lower extremities. Strength, reflexes, sensation, and pulses normal throughout.

DIFFERENTIAL DIAGNOSIS:

1. Costochondritis
2. Osteomyelitis of sternum
3. Seronegative spondyloarthropathy

TEST AND RESULTS:

Anterior-posterior and lateral chest x-rays:

—Normal cardiac silhouette. No bony abnormalities.

Anterior-posterior and lateral pelvis x-rays:

— Normal joint space. No bony deformities.

Nuclear medicine total bone scan:

— Increased uptake at sternomanubrial interval concerning for inflammatory process.

Further evaluation with CT scan suggested.

CT scan of the sternum with IV contrast:

— Increased uptake at the manubriosternal joint demonstrating subchondral sclerosis.

CBC, RF, ESR, CRP, HLA-B27, ANA, Lupus panel and Lyme titers ordered.

— Lab results normal with the exception of slightly elevated ESR.

FINAL/WORKING DIAGNOSIS:

Seronegative spondyloarthropathy

TREATMENT AND OUTCOMES:

1. Patient referred to Rheumatology given concern for inflammatory arthritis.
2. Initiated NSAIDs and physical therapy for suspected piriformis syndrome.
3. MRI of bilateral SI joints performed and suggestive of sacroiliitis.
4. In preparation for TNF agent treatment, patient found to be Hep B core antibody positive and referred to Hepatology.
5. Started entecavir for Hepatitis B treatment and adalimumab.
6. After 2 months, the patient returned to full volleyball participation with complete resolution of her symptoms.

A-28 Clinical Case Slide - Head

Wednesday, May 31, 2017, 9:30 AM - 11:30 AM

Room: 402

147 **Chair:** Christina L. Master. *The Children's Hospital of Philadelphia, Haverford, PA.*

(No relationships reported)

148 **Discussant:** Robert C. Cantu, FACSM. *Emerson Hospital, Concord, MA.*

(No relationships reported)

149 **Discussant:** John Leddy. *University at Buffalo Sports Medicine Institute, Buffalo, NY.*

(No relationships reported)

150 May 31 9:30 AM - 9:50 AM

Dizziness - Runner

Amanda M. Honsvall¹, William O. Roberts, FACSM², Kelly Roberts Lane, FACSM³. ¹University of Minnesota Medical School, Minneapolis, MN. ²University of Minnesota, Minneapolis, MN. ³Fix It Physical Therapy, Mahtomedi, MN.
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(No relationships reported)

HISTORY

A 36 year old previously healthy male presented to the medical tent via wheelchair with acute onset of dizziness and nausea after finishing a marathon. He had met his goal of finishing just under 3 hours. He alternated water and sports drinks for fluid replacement. He described the dizziness as a spinning sensation that began shortly after crossing the finish line associated with emesis. This persisted while lying still with his eyes closed. Symptoms were exacerbated by tilting his head or attempting to look up. No lightheadedness, chest pain, shortness of breath, hearing changes, numbness or altered mental status. No history of vertigo episodes, recent illness or head trauma. In the medical tent, he vomited 3 times. He was laid supine with his legs elevated. Over 45 minutes, he had 5 cups of oral electrolyte replacement, 3 cups of water and a banana without improvement. He was eventually able to walk one lap around the medical tent while keeping his gaze focused downwards.

PHYSICAL EXAMINATION

T 0 min:

BP 120/58, HR 94, RR 19, O2 94%

T 45 min:

Supine BP 116/64, HR 63

Standing BP 105/60, HR 72

Rectal temp 97.9F

He was mildly ill-appearing with clear mental status, alert and oriented x 4. Cranial nerves II-XII were intact and he demonstrated 5/5 strength in b/l upper and lower extremities. Extraocular movements and smooth pursuit were normal. No signs of spontaneous nystagmus. Nystagmus was observed with change in posture from sitting to supine to side lie. Head impulse testing was positive for compensatory saccade response. Dix-Hallpike maneuver to the right was positive for nystagmus and reproduction of symptoms.

DIFFERENTIAL DIAGNOSIS

1. Exercise associated postural hypotension
2. Exertional Heat Stroke
3. Exercise Associated Hyponatremia
4. Vestibular system dysfunction
5. Central nervous system lesion

TESTS AND RESULTS

N/A

FINAL/WORKING DIAGNOSIS

Benign paroxysmal positional vertigo (BPPV)

TREATMENT AND OUTCOMES

1. The Epley maneuver was performed, inducing one episode of emesis followed by gradual improvement of symptoms over the following 10 minutes.
2. Instructed to avoid rapid or frequent head movements for the next few days.
3. Gradual return to running after complete resolution of symptoms.
4. Follow up with primary care for any worsening of symptoms.

151 May 31 9:50 AM - 10:10 AM

Head Injury - Soccer

Christina L. Master¹, Eileen P. Storey¹, Lei Wang², Hasan Ayaz², Olivia Podolak¹, Matthew F. Grady¹. ¹The Children's Hospital of Philadelphia, Philadelphia, PA. ²Drexel University School of Biomedical Engineering, Philadelphia, PA.

(No relationships reported)

HISTORY: A 16-year-old female soccer goalie sustained a head injury during a heading drill. The player reported a few awkward headers, including one that hit her in the back of the head. The player developed a headache and nausea, but had a normal evaluation by an athletic trainer on the sidelines. The trainer still removed the athlete from play due to the mechanism of injury and the player's report of low-grade symptoms.

PHYSICAL EXAMINATION: The player reported only a mild headache at rest the following day when she presented to clinic. On clinical examination, the player had no symptoms or abnormalities with smooth pursuits, saccades, vestibulo-ocular reflex, visual motion sensitivity, convergence and accommodation tests.

DIFFERENTIAL DIAGNOSIS:

1. Concussion
2. Sub-concussive head injury
3. No concussion

TEST AND RESULTS:

- The player performed the physical examination both 1-day and 1-week post-injury while wearing a functional near-infrared spectroscopy (fNIRS) headband that recorded anterior prefrontal cortex oxygenation changes. Compared to her baseline, the player showed significantly different levels of oxygenation changes at 1-day post-injury that approached pre-injury levels but had not fully returned to baseline at 1-week post-injury.

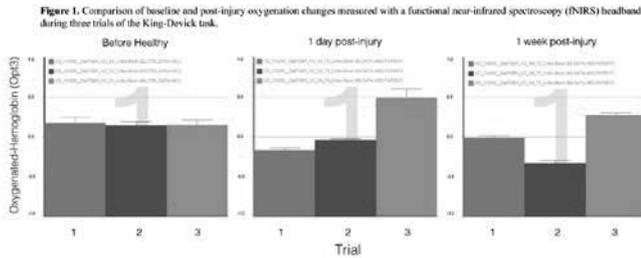
- At clinical evaluation a week after injury, the player reported no symptoms at rest or during the physical examination. The clinician detected no abnormal findings on physical examination.

FINAL WORKING DIAGNOSIS:

Concussion with subclinical deficits

TREATMENT AND OUTCOMES:

1. At 1-day post-injury, the player was permitted to begin a return-to-learn plan as well as a return-to-play protocol.
2. The player was cleared to return to soccer at 1-week post-injury with resolution of symptoms and normal physical examination.



152 May 31 10:10 AM - 10:30 AM

Headache After MVA in Physically Active, Healthcare Professional

Enayet Neak¹, Vanessa Lalley-Demong². ¹St. Joseph's Family Medicine Residency, Syracuse, NY. ²St. Joseph's Family Medicine Faculty, Syracuse, NY.

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(No relationships reported)

HPI: 35 y/o F NP with hx of migraines, presented to the ED 1 day s/p MVA, c/o right-sided headache, nausea, photophobia. The patient went off the road at 30 mph, hitting a snowbank. She had a mild headache after the accident, saying her head whiplashed but denied hitting her head, or LOC. She took an ibuprofen but woke up the following morning with the worst headache of her life, prompting ED visit. Pertinent negatives: No retrograde amnesia, phonophobia, blurred vision, eye pain, hearing loss, tinnitus, neck pain, extremity weakness, paresthesia, dizziness.

In the ED, patient was told her eye dilated funny, but otherwise normal exam. CT head was negative. GCS 15. Symptoms improved with prochlorperazine, diphenhydramine. She followed up in the office 2 days later, with continued symptoms. Office SCAT2 scored 52. She was diagnosed with post-concussion syndrome, and treated supportively. Over the next several months, patient developed diplopia, vertigo, neck pain, fatigue.

EXAM: Vital signs were stable and afebrile, well-developed, AxAxO3, anxious. NCAT. Pupils were equal, round, and L pupil was sluggishly reactive to light. EOMI Visual acuity: OU20/20, OD/OS20/25. AROM/PROM of head and neck were normal. No ptosis, proptosis. CN 2-12 intact. Romberg test negative. Motor strength 5/5 UE & LE. Sensation intact.

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

DDX: Post-concussive syndrome, BPPV, chronic migraine with aura, CN injury, malignancy/tumor

TESTS/RESULTS: CT head (ED) negative. X-ray cervical spine AP/lateral negative. Non-contrast brain MRI negative. She received OMT for neck pain with mild improvement. While working with OT, patient was noted to have horizontal saccades on lateral gaze along L eye, with lateral deviation of L eye. She was referred to neuro-ophthometry. She was diagnosed with CN3 palsy.

DX: Partial oculomotor (CN3) nerve palsy secondary to whiplash from MVA

TX & OUTCOMES: Tx: Optometry rehab with vestibular exercises, prism therapy, OMT, TP injections, PT/OT; Sumatriptan, amitriptyline, melatonin. 17 mo s/p MVA, pt continued to have intermittent headaches, light/noise sensitivity, trouble focusing. Symptoms have improved and pt resumed training for local 5K, which she completed. She is not at baseline.

153 May 31 10:30 AM - 10:50 AM

Partial Abducens Palsy Following Concussion

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(No relationships reported)

HISTORY: 11 year old male presents to the sports medicine office for evaluation of concussion two weeks after he fell off his bike, hitting his head on concrete. He had no loss of consciousness. He was evaluated in the ED for laceration repair. Initial symptoms included headache, vomiting, and sleeping more than usual. Approximately one week into his injury he developed diplopia at which time his parents noticed his eyes were "crossing" more. Headaches and vomiting resolved 10 days post-injury. He endorses a history of color-blindness. He denies history of concussion, mood disorders, strabismus, amblyopia, or eye surgery. There is a strong family history of strabismus and eye surgery.

PHYSICAL EXAM: Neurological exam notable for left CNVI palsy on EOM testing. Normal resting gaze. Testing of smooth pursuits, saccades, and gaze stability did not provoke symptoms. Diplopia and left eye lateral gaze deficit persisted throughout testing, but this was variable. He was able to cross midline intermittently. Near point of convergence was 4cm and accommodation was 7cm bilaterally. Finger to nose testing was fast but inaccurate. Balance testing revealed difficulty with tandem walk backwards with eyes open and closed.

DIFFERENTIAL DIAGNOSIS:

Traumatic abducens palsy

Lateral rectus entrapment

Intracranial mass

Ocular migraine

Malingering

TESTS AND RESULTS:

CT and MRI brain both normal

Ophthalmology: left abducens palsy, bilateral resolving papilledema, recommended patching to alleviate symptoms

Neurology: Traumatic abducens palsy. Resolved papilledema. No other neurological findings.

FINAL WORKING DIAGNOSIS:

Concussion with left abducens palsy

TREATMENT AND OUTCOMES:

4 weeks after his injury he still complained of diplopia, but more intermittently and no longer requiring eye patches. He remained headache free with full academics. He had normal extraocular movements with slow pursuits, but deficit would return with fast eye movements.

He was lost to follow up, but per mother's report, diplopia resolved approximately 7 weeks from injury.

154 May 31 10:50 AM - 11:10 AM

"Post-concussion" Syndrome In A 16-year-old Female Basketball Player

Ryan Woods, Eric Crowley, Edward Laskowski, FACS. Mayo Clinic, Rochester, MN. (Sponsor: Edward R. Laskowski M.D., FACS)

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(No relationships reported)

HISTORY: 16-year-old female presents for evaluation of a possible post-concussion syndrome after being struck in the head by a dodgeball in gym class. Patient was asymptomatic at the time of injury. Two weeks following the injury she awoke feeling "different". Symptoms predominately consisted of headache, head pressure, nausea and photophobia. Her symptoms progressed to the point where she was unable to attend school. She was seen in the sports medicine clinic for presumed post concussive symptoms. Upon presentation she denied upper extremity weakness, radicular pain or sensory symptoms. Her post-concussion symptom score was 56 at the time of her sports medicine visit, with significant headache, light and noise sensitivity, and a continued sensation of feeling "not right." She had a history of concussion sustained two years prior to presentation in which symptoms resolved after two days.

PHYSICAL EXAMINATION: Healthy-appearing individual, sensitive to light. No cognitive deficit. Flat affect. Normal gait. Cranial nerve exam was normal. Full joint range of motion. Normal neurologic exam. Spurling's test was negative for radicular pain. SAC score: 29/30.

DIFFERENTIAL DIAGNOSIS: Brain tumor, Post-concussion syndrome, Migraine headaches, Depression, Anxiety

TEST AND RESULTS: MRI without contrast: No definite evidence of traumatic brain injury. Large cystic-appearing mass in the right lateral ventricle. MRI with contrast: Re-demonstration of mass. Appearance concerning for a neoplasm such as choroid plexus carcinoma metastasis. No evidence of metastatic disease on MRI of cervical, thoracic and lumbar spine. **FINAL WORKING DIAGNOSIS:** Right lateral ventricle brain tumor

TREATMENT AND OUTCOMES: Referrals were made to pediatric neurooncology and pediatric neurosurgery. The patient underwent a right tempoparietal craniotomy with full tumor resection. Surgery was without complications. Biopsy results confirmed a choroid plexus xanthogranuloma. Seven days following surgery she experienced postoperative seizures, and was placed on Kepra. She did not experience recurrent seizures and was able to be titrated down on her Kepra. A six month postoperative MRI scan is pending, with neurology and neurosurgery appointments to follow. She was slowly reintegrated back into school and is currently asymptomatic.

155 May 31 11:10 AM - 11:30 AM

Head- Lacrosse

Amy Valasek. *Nationwide Childrens Hospital, Westerville, OH.*
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(No relationships reported)

HISTORY: A 14-year-old male sustained a closed head injury while playing recreational lacrosse with a friend. During a face off, he tripped over his feet and hit frontal aspect of head on turf. There was no loss of consciousness, hematoma, or bleeding. He was disoriented and taken home due to headache and confusion. He slept for 45 minutes, then, awoke with emesis three times. The family took him to a local pediatric emergency room, a head CT was performed and diagnosed with a concussion. He followed up in concussion clinic 8 days later. He reported symptoms of fatigue, motor slowing, and no headaches. After intake and history, he began computer Cogstate Concussion Test. Within 5 minutes of start, his father called for help due to a first time seizure.

PHYSICAL EXAMINATION: Not alert, sitting in chair with left arm flexed and left leg extended actively having a generalized tonic clonic seizure. He was lifted to the table and head tilt jaw thrust performed due to dusky appearance with improvement, 100% non-rebreather face mask was placed, and seizure self-resolved in 4 minutes. He was slow to arouse and answered questions slowly and appropriately. On examination vital signs were normal for age and no focal deficits elicited with equal strength, sensation, and reflexes bilateral upper & lower extremities. He was transported from concussion clinic to the pediatric emergency room by EMS for further evaluation.

DIFFERENTIAL DIAGNOSIS:

1. Cerebrovascular degenerative disease inflammatory/autoimmune
2. Intracranial lesion
3. Subdural hematoma

TEST AND RESULTS:

Head CT day of injury: No acute intracranial abnormality. Extensive confluent hypodensity in the periventricular cerebral white matter with atrophy.

MRI of brain with contrast 8 days after injury: Extensive, symmetric areas of T2 prolongation within the deep white matter of both cerebral hemispheres, with small cystic changes adjacent to the frontal horns of the lateral ventricles.

EEG: Intermittent slowing on the left is suggestive of underlying cerebral dysfunction.

FINAL/WORKING DIAGNOSIS:

Vanishing White Matter Disease

TREATMENT AND OUTCOMES:

1. Whole Genome Sequencing completed and positive for Vanishing White Matter Disease.
2. Held from all further contact sport participation.
3. Physical therapy and occupational therapy to address progressive weakness.

A-29 Clinical Case Slide - Shoulder I

Wednesday, May 31, 2017, 9:30 AM - 11:30 AM
Room: 504

156 **Chair:** Kyle J. Cassas, FACSM. *Greenville Health System, Greenville, SC.*
(No relationships reported)

157 **Discussant:** Jessie R. Fudge. *Group Health Cooperative, Seattle, WA.*
(No relationships reported)

158 **Discussant:** Dustin Nabhan. *United States Olympic Committee, Colorado Springs, CO.*
(No relationships reported)

159 May 31 9:30 AM - 9:50 AM

Biceps Pain- Rock Climber

Stephanie Kramer¹, Darius Greenbacher², Pierre Rouzier, FACSM³. ¹*Baystate Medical Center, Springfield, MA.* ²*Baystate Medical Practices, Northampton, MA.* ³*University of Massachusetts, Amherst, MA.* (Sponsor: Pierre Rouzier, FACSM)
Email: stephanie.kramerDO@baystatehealth.org
(No relationships reported)

HISTORY: 44 year old right hand dominant rock climber presented with right sided anterior-medial biceps pain without acute injury, although history significant for 500 push ups and 100 pull ups daily, as well as 3-4 hours of rock climbing 3-4 times/week. He does have a history of a 15 foot fall while climbing (in harness and about 7-8 feet from last anchor point) after losing grip with his right hand, but does not associate this with the onset of his pain. He complains of pain with any type of elbow flexion, more with abduction to 90 degrees such as when climbing.

PHYSICAL EXAMINATION: Elbow exam: Inspection: No obvious defects of the biceps/anterior musculature. No overlying ecchymosis. Palpation: Mild tenderness over mid to distal biceps and myotendinous junction, no bony tenderness. ROM: full Strength: 5/5 Special: No Popeye sign. Pain with resisted flexion of the elbow (greater with thumb up) and resisted forearm supination.

Shoulder exam: Inspection: No asymmetry, atrophy or ecchymosis. Palpation: no pain with palpation. ROM: full Strength: 5/5 and symmetric Special: Jobe's test neg. Some mild discomfort with Speed's and Yergason's test at the mid biceps muscle belly but no proximal shoulder/arm pain. No pain with impingement tests. Biceps pain with O'Briens. Neurovascularly intact.

DIFFERENTIAL DIAGNOSIS for biceps pain: 1. Biceps tendon strain vs partial tear- distal vs proximal 2. Overuse injury at biceps myotendinous junction 3. Brachialis strain 4. Acute myositis 5. Sarcoma of the muscle

TEST AND RESULTS: MRI (not arthrogram) showed minimal tendinosis of supraspinatus but no rotator cuff tear. Large type II SLAP tear extending from just posterior to biceps anchor to the upper aspect of posterior labrum. Biceps long head tendon intact and normal position. Normal musculature at marker site placed by pt (approx 16cm from shoulder joint). No evidence of biceps retraction.

FINAL WORKING DIAGNOSIS: Type II SLAP tear

TREATMENT AND OUTCOMES: Minimal relief with rest/PT. Corticosteroid injection provided some relief and pt able to resume activities, however not yet at full volume 1 month after treatment

160 May 31 9:50 AM - 10:10 AM

Shoulder Pain and Weakness in 11 y/o Male after Bike Accident

Everett Hayes. *Evergreen Sports Medicine, Augusta, ME.*
(Sponsor: Peter Sedgwick, FACSM)
(No relationships reported)

History: 11 y/o RHD male with no PMH presented for evaluation of left shoulder injury. He fell off his bike 3 weeks prior while visiting his aunt, landing on his left shoulder onto a sidewalk. There were no other injuries other than an elbow abrasion. He did not complain of any pain, but his mother became concerned when she noticed he wasn't moving his left arm much. When asked, the patient did admit to some pain over the lateral aspect of the shoulder. He could not lift his arm over his head despite lack of significant pain with the motion. He denied neck pain, radicular pain, numbness, tingling or prior shoulder injury. The symptoms had not improved since the time of injury.

Physical Examination:

General: well appearing, no apparent distress
L shoulder:

Inspection: antalgic carriage of shoulder, no deformity, atrophy, swelling
Palpation: tender over humeral head, glenohumeral joint, posterior shoulder
ROM: significantly limited in AROM despite lack of significant pain
Strength: Weak diffusely (3-4/5) out of proportion to minimal level of pain
Neurovascular: distal pulses intact, negative Spurlings, decreased sensation over anterior biceps, otherwise intact

Skin: no breakdown, erythema, ecchymosis

Differential Diagnosis:

Brachial plexus injury
Nerve root avulsion
Suprascapular nerve palsy
Shoulder dislocation
Fracture: humeral head, humeral neck, glenoid, clavicle, cervical
AC separation
Contusion
Non-accidental trauma
Altered pain inhibition

Test and Results: 3-view X-ray of L shoulder: proximal humeral neck fracture, minimally displaced and mildly angulated. There was no apparent involvement of the growth plates.

Diagnosis: Left humeral neck fracture with possible associated neurologic injury
Treatment and Outcomes:

- Placed in a sling for 2 weeks and limited to gentle ROM
- 5 weeks post injury: Repeat x-rays demonstrated appropriate healing. He still demonstrated reduced strength and ROM despite almost no pain so MRI was ordered.
- 8 weeks: MRI obtained and unrevealing for secondary injury that would explain the weakness. He had begun to show improvement with strength and ROM. Started home therapy exercises.
- 11 weeks: No pain, ROM and strength were continuing to improve. Repeat x-ray demonstrated good bone healing. Strengthening exercises increased with plan for resumption of all activities in 2 more weeks.

161 May 31 10:10 AM - 10:30 AM
Right Shoulder Pain

Arie (Eric) Dadush¹, Vincent Morelli¹, James Johnson².
¹Meharry medical college, Nashville, TN. ²Elite Sports Medicine, Nashville, TN.
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 (No relationships reported)

History: A 48 year-old right-handed AAF with no significant PMH presented with right shoulder weakness and pain for 2 weeks. There was no inciting event or recent changes in activity. Her symptoms began 2 weeks after a viral URI. She works as a network manager and started developing acute pain for a few days, which was followed with stiffness, weakness and numbness on the lateral side of her arm. The pain then become constant and the numbness and tingling were intermittent and radiating into her hand. Her symptoms had been worsening over the prior week specifically with overhead activity. She had been using NSAID's, ice/heat and massage with no relief

Physical examination: Winging of the right scapula was noticed as well as tenderness over the deltoid. Passive ROM was normal with decreased active ROM; forward flexion and abduction 0-120 degrees, abduction external rotation 0-60 degrees. Supraspinatus, infraspinatus and triceps strength 3/5 with normal deltoid and trapezius strength. Hawkin's, Neer's, Empty can, and Impingement tests are all positive. O'Brien's, Yergason's and Crossover tests negative. **Differential Diagnosis:** Parsonage-Turner syndrome, Cervical disk disease, Shoulder impingement syndrome, Neoplastic brachial plexopathy, Supraspinatus tendinopathy **Tests and results:** Xray were obtained; no fracture, arthritis or soft tissue abnormalities were seen. Patient was sent for cervical and plexus MRI as well as EMG and nerve conduction studies. MRI results were without infiltrating process or extrinsic compression on the brachial plexus. Cervical spine MRI revealed a small right central disc extrusion without impingement. Nerve conduction studies demonstrated significant differences between the right and left Median and Ulnar nerves. The right Median and Ulnar nerves F-wave latency showed no response compared to 20.3 msc on the left side, which is consistent with a proximal injury as at the level of the plexus. **Final working diagnosis:** Parsonage-Turner syndrome

Outcome: Patient was given Toradol and Depomedrol IM as well as Medrol dose pack and Amitriptyline. She was also referred to PT.

Return to activity and follow up: 7 weeks after the initiation of the treatment patient reported almost complete resolution of her symptoms. She was instructed to follow up as needed if not complete resolution within 8 weeks.

162 May 31 10:30 AM - 10:50 AM
Chronic Axillary Pain and Weakness in a Recreational Weight Lifter

Christopher Chong, 19064, Kevin Duprey. Crozer Keystone, Springfield, PA. (Sponsor: Thomas Kaminski, FACSM)
 (No relationships reported)

HISTORY: A 19 year old college student and recreational weight lifter presents with chronic right axillary pain and mass. His pain started 8 months earlier while doing a human flag pole pose (holding onto a pole and lifting his body parallel to the ground). He felt an acute onset of sharp pain over right axillary region. He self treated with ice and foam roller without any improvement. He saw his primary care doctor who prescribed physical therapy. He attended 10 sessions with no improvement. Pain is currently 5/10, aching, worse after lifting weights and with palpation of the mass.

PHYSICAL EXAMINATION: Exam reveals no ecchymosis on inspection. There is a 2x2 non-mobile soft tissue mass over posterior inferior axillary region that is tender to palpation. Shoulder abduction and flexion on right is limited to 160 degrees with full internal/external rotation. 4+/5 strength with shoulder adduction.

DIFFERENTIAL DIAGNOSIS: Infraspinatus tear, teres major tear, latissimus dorsi tear, lipoma, liposarcoma, neurofibroma, hematoma, asymmetric fat deposition, rhabdomyosarcoma

TEST AND RESULTS: US of right latissimus dorsi: Imaging shows a heterogenous hypo and hyperechoic circular array within the right latissimus dorsi muscle measuring 2cm x3cm.

FINAL WORKING DIAGNOSIS: chronic latissimus dorsi tear.

TREATMENT AND OUTCOMES: Due to chronicity of symptoms and failure of physical therapy, patient elected for dextrose tenotomy. At one month follow up, he reported improvement in his pain from 5/10 to a 2/10, and was advised to slowly increase his activity. Three months after initial treatment, returned for follow up and reported 80% improvement in symptoms and strength. He elected for repeat dextrose tenotomy, and after the procedure was referred to physical therapy. After one month of physical therapy, he was discharged with full strength and complete resolution of pain. He was able to successfully audition for America Ninja Warrior.

163 May 31 10:50 AM - 11:10 AM
Shoulder Injury in a College Football Player

Ward McCracken¹, Justin Byers², Dave Smith¹. ¹University of Minnesota, Minneapolis, MN. ²Bethel University, St Paul, MN.
 (Sponsor: Suzanne Hecht, MD, FACSM)
 (No relationships reported)

HISTORY:

A 21 y/o male, college football running back and basketball player felt his left shoulder pop and shift during a contact play in a football game. He removed himself immediately from play, and on the sideline, he was diagnosed with an anterior glenohumeral dislocation. He had no prior shoulder instability. His shoulder was successfully reduced using a Hennepin-Kocher maneuver on the sideline. Examination immediately following the reduction showed no deficits and he was allowed to return to play wearing a Sully brace. Later in the same game, he was carrying the ball and stiff armed an opponent with the left hand and dislocated his shoulder a second time. Reduction on the sideline was initially unsuccessful the second time and he was taken to the athletic training room and his shoulder was there successfully reduced using a traction/counter-traction technique.

PHYSICAL EXAMINATION:

Left shoulder exam after the second reduction was significantly limited due to continued apprehension but generally showed diffuse weakness without focal deficit, limited AROM in all planes, no bony TTP, and neurovascular exam was intact.

DIFFERENTIAL DIAGNOSIS:

1. Glenohumeral Dislocation
2. Bony Bankart Injury
3. Hill-Sachs Lesion
4. Labral Tear

TESTS AND RESULTS:

XR

- 4V's (AP, Grashey, Axillary, and Scapular Y) negative
 MRI without contrast

- 3x2x1cm Hill-Sachs lesion, soft tissue Bankart injury, no evidence of any rotator cuff muscle tear, residua of moderate medial anterior capsular stripping inferiorly and of medial stripping of the inferior capsular attachment along the undersurface of the glenoid

FINAL DIAGNOSES:

1. Anterior Glenohumeral Dislocation x2
2. Soft Tissue Bankart
3. Hill-Sachs Lesion
4. Capsular Stripping

TREATMENT AND OUTCOMES: He was seen in the college's athletic training room three days following the injury. The medical team presented treatment options to him and surgical consult was obtained. After consideration, he opted for a trial of non-operative treatment. Presently, he continues to make excellent progress with range of motion and strength and has experienced no further instability.

164 May 31 11:10 AM - 11:30 AM
Subacute Presentation of an Elbow Injury-Work Related Delayed by Insurance

Ali Ashraf¹, John Chappa², Melinda Schalow³, Mimi Zumwalt¹.
¹Texas Tech University Health Sciences Center, Lubbock, TX.
²John Chappa, Lubbock, TX. ³Melinda Schalow, Lubbock, TX.
 (Sponsor: Jacalyn J. Robert-McComb, FACSM)
 (No relationships reported)

HISTORY: A 30 year-old, right hand dominant male firefighter sustained a right arm/elbow injury by attempting to catch a heavy garage door from falling during installation at work. He felt a pop with immediate pain. He experienced swelling/bruising in the ensuing couple of days, also difficulty using the affected extremity. Patient was initially seen at an urgent care clinic, then later by his primary care physician. Due to worker's compensation insurance requirements, an MRI was eventually done nearly 3 weeks out from initial injury, before he was referred for orthopedic consultation.

PHYSICAL EXAMINATION: Right upper extremity exam revealed tenderness/ecchymosis in the arm/elbow, weakness with resisted supination and positive hook test. He was still able to flex, extend the elbow plus pronate and supinate his right forearm. He reported no paresthesias or radicular symptoms, with sensation intact to light touch distally. Palpation also showed mild "popeye" deformity proximally at mid anterior arm.

DIFFERENTIAL DIAGNOSIS:

Partial distal biceps tendon rupture
Complete distal biceps tendon rupture
Bony distal biceps avulsion

TEST AND RESULTS: Right elbow anterior-posterior and lateral radiographs: -No fractures or dislocations Right extremity MRI: -Shows complete tear of the distal biceps tendon with retraction

FINAL WORKING DIAGNOSIS: Complete distal biceps tendon rupture - subacute
TREATMENT AND OUTCOMES:

Immediate open reattachment of distal biceps tendon (2 incision technique) to prevent any further retraction.

Arm kept in posterior/U splint with elbow flexed at 90 degrees-NWB R UE.

Follow up visit 10-14 days post-op then right elbow placed in dynamic brace.

Physical therapy protocol two weeks after surgery starting with gravity assisted elbow extension.

Regained full elbow ROM in 3 months (out of brace) with grip strength 90%.

Resolving proximal lateral forearm paresthesias.

Functional test planned at 6 months before returning to previous work/job.



A-39 Basic Science World Congress/Poster - Motor Control and Movement Disorders

Wednesday, May 31, 2017, 7:30 AM - 12:30 PM

Room: Hall F

180 Board #1 May 31 9:30 AM - 11:00 AM

Rock Climbing as a Novel Intervention to Improve Function in Parkinson's Disease: A Case Series

Joshua G. Woolstenhulme, Natalia Agüero, Elizabeth Ruckert, Susan J. Leach. *The George Washington University, Washington, DC.*

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(No relationships reported)

PURPOSE: To preliminarily characterize the feasibility and safety of indoor rock climbing (IRC) as a therapeutic intervention for persons with Parkinson's Disease (PD) and to explore any potential IRC may have for improving physical function.

METHODS: Subjects participated in 8 weeks of thrice weekly IRC. Each climbing session was comprised of 3 climbing sets. Sets gradually progressed from 5 to 8 min as did the degree of technical difficulty (5.5 to 5.7, assessed by the Yosemite Decimal System) over the 8-week intervention. Self-reported difficulty of movement and movement self-confidence were assessed using the Outpatient Physical Therapy Improvement in Movement Assessment Log (OPTIMAL). Dynamic balance was assessed using the Mini Balance Evaluation Systems Test (miniBESTest). Functional leg strength/power was measured using the five times sit-to-stand test (5xSTS).

Aerobic capacity was assessed using the 6-min walk test (6MWT). Grip strength (GS) was assessed using a hand dynamometer. All data were collected at baseline (T0) and after the intervention period (T1). Data for each subject were obtained at the same time of day on T0 and T1.

RESULTS: Three men on stable medication regimes (in order of recruitment: ages 73, 70, 72 yrs; BMI: 24, 24, 25 kg/m²; disease duration: 7, 13, 4 yrs; subjects 1 and 2 had idiopathic PD, subject 3 had familial PD) participated. Most subjects reported improvements in difficulty of movement (change scores [T1-T0] for each subject: -5, +3, -7) and all reported improvements in movement self-confidence (-4, -9, -15) on the OPTIMAL. Minimal dynamic balance improvements (+1, +1, +2) were noted on the total score of the miniBESTest for all subjects. Minimal improvements in functional leg strength/power for 2 subjects (-0.54, +1.27, -0.71 sec) were observed as measured by the 5xSTS. No improvements were observed for 6MWT or GS. No adverse events occurred.

CONCLUSIONS: IRC appears to be a feasible therapeutic activity with minimal safety risks for persons with PD. IRC may play a unique role in decreasing the perceived difficulty of movement and in increasing movement self-confidence for persons with PD. IRC may potentially improve dynamic balance and functional leg strength. This case series provides preliminary evidence for larger studies to examine potential benefits of IRC for persons with PD.

181 Board #2 May 31 9:30 AM - 11:00 AM

Impact of Rock Climbing on Complex Tasks in Persons with Parkinson's Disease: A Case Series

Susan J. Leach, Elizabeth Ruckert, Natalia Agüero, Joshua G. Woolstenhulme. *George Washington University, Washington, DC.*

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(No relationships reported)

PURPOSE: Indoor rock climbing (IRC) incorporates a physical component of climbing a wall with a cognitive component of selecting an appropriate climbing route. A climber is required to divide attention between the physical and cognitive demands of the task, a necessary skill in many daily activities. The purpose was to examine the impact of a novel and challenging IRC intervention on complex tasks such as those requiring divided attention in individuals with Parkinson's Disease (PD).

METHODS: A pretest, posttest pilot intervention study had participants perform IRC 3 x per week for 8 weeks while increasing climbing duration and technical difficulty. Outcome measures included the Trail Making Part B test, the dual task Timed Up & Go (TUG) manual and cognitive tests, the timed Supine to Stand test, and the Four Square Step Test.

RESULTS: Three novice rock climbers with PD took part in this study. Participant 1 (P1) was a 73-year-old male with a 7-year history of idiopathic PD with early stage clinical presentation. Participant 2 (P2) was a 70-year-old male with a 13-year history of idiopathic PD with middle stage clinical presentation. Participant 3 (P3) was a 72-year-old male with a 4-year history of familial PD with early stage clinical presentation and cognitive involvement. The following results represent the change from pretest to posttest in seconds. Climbers P1 and P3 had faster and improved Trail Making Part B times P1: -3.89; P2: +22; P3: -8.57. Climbers P2 and P3 had faster and improved TUG manual times: P1: +0.041; P2: -0.141; P3: -0.976. Climber P3 had faster and improved TUG cognitive times: P1: +0.209; P2: +0.633; P3: -3.791 seconds. All 3 climbers had faster and improved timed Supine to Stand times: P1: -0.442; P2: -0.209; P3: -3.791. Climber P3 had faster and improved 4 Square Step Test times: P1: +0.3; P2: +1.258; P3: -1.458.

CONCLUSIONS: Three novice rock climbers with PD demonstrated improvements in complex tasks following 8 weeks of IRC: P1 and P2 in 2/5 measures; P3 in 5/5 measures. The extent of improvement appeared greatest in P3 who presented with cognitive impairment at baseline. It is possible that IRC prepares learners for task complexities similar to those encountered in the community. This pilot study provides preliminary evidence for larger studies to investigate potential benefits of IRC for persons with PD.

182 Board #3 May 31 9:30 AM - 11:00 AM

Val66met Polymorphism's Influence On Depression Symptoms And Responses To Exercise In Individuals With Parkinson's Disease

Sara A. Harper, 44883¹, Angela L. Ridge². ¹Tiffin University, Tiffin, OH. ²Kent State University, Kent, OH. (Sponsor: Dr. Ellen Glickman, FACSM)

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(No relationships reported)

Individuals with Parkinson's disease (PD) show high inter-individual variability in response to exercise interventions and in the severity of depression symptoms. It may be influenced by a genetic variation called brain derived neurotrophic factor (BDNF) Val66Met polymorphism. **PURPOSE:** To determine if the prevalence of the Val66Met polymorphism influenced incidences of depression symptoms and if

Val66Met polymorphism influenced changes in depression symptoms after dynamic cycling. **METHODS:** Fourteen participants (N=10, 6M/4F Val-allele group, N=4, 2M/2F Met-allele group, 64±9 years old), diagnosed with idiopathic PD were assessed with the Beck Depression Inventory (BDI-II) and provided saliva samples for BDNF Val66Met genotyping. The exercise intervention was three 40 minute dynamic cycling sessions separated by 48 hours. **RESULTS:** There were no differences in the severity or prevalence of depression symptoms at pre-intervention for Val-allele group (N=10, 11.20±12.43) or Met-allele group (N=4, 6.25±5.97) on a 0-63 scale ($P=0.468$). Four of the fourteen participants experienced moderate to severe depression symptoms: one participant - mild depression symptoms (15/63), two participants - moderate depression symptoms (22/63 and 23/63), and one participant - severe depression symptoms (38/63). Participants with moderate or greater depression symptoms had an average BDI-II score that significantly improved ($P=0.017$) from pre-intervention (24.50±9.68) to post-intervention (5.75±6.24). **CONCLUSION:** Val66Met polymorphism did not influence the presence or severity of depression symptoms and did not influence improvements in depression symptoms after dynamic cycling in individuals with mild depression symptoms. However, there was a significant improvement in participants who had moderate to severe depression symptoms regardless of the polymorphism presence. Future research will recruit individuals with PD who have moderate/severe symptoms to determine if these trends hold true in a larger sample. Supported by Kent State University's School of Health Sciences, Midwest American College of Sports Medicine, and Ohio Parkinson Foundation Northeast Region Grant.

183 Board #4 May 31 9:30 AM - 11:00 AM
Dynamic Cycling Improves Motor Symptoms And Mobility In Individuals With PD

Angela L. Ridgel, Dana L. Ault. *Kent State University, Kent, OH.* (Sponsor: Ellen Glickman, FACSM)
Email: aridgel@kent.edu
(No relationships reported)

Parkinson's disease (PD) affects more than one million people in the US and this number is expected to double by 2040. PD is a progressive neurodegenerative disease that leads to difficulties in performing activities of daily living, such as balance and walking. Dynamic high cadence cycling is a unique rehabilitation modality that has been shown to improve motor function in individuals with idiopathic PD after three sessions. **PURPOSE:** To assess if six bouts of dynamic cycling, on a custom motorized recumbent cycle, improves motor function and mobility in individuals with PD. **METHODS:** Individuals were randomized to either a dynamic cycling or a stretching group. Dynamic cycling consisted of a 5 minute warm-up at 50 revolutions per minute (rpm), 30 minutes of dynamic high cadence cycling between 75-85 rpm, and a 5 minute cool down. Motor function, balance and gait were assessed after every cycling bout using the UPDRS Motor III scale, Kinesia One, and Timed up and Go (TUG). **RESULTS:** Six bouts of dynamic cycling significantly improved UPDRS III scores ($p=.001$), hand movement amplitude ($p=.002$) and TUG time ($p=.005$) from baseline testing to end of treatment. There was a 17% improvement in UPDRS scores and a 22% improvement in TUG time from baseline testing to end of treatment. **CONCLUSIONS:** Six bouts of dynamic cycling improves motor symptoms, overall motor function and mobility in individuals with PD. These findings suggest that dynamic cycling could be a valuable rehabilitation modality in this population.

184 Board #5 May 31 9:30 AM - 11:00 AM
Cerebellar Transcranial Direct Current Stimulation For Motor Function In Parkinson's Disease
Lidio Lima de Albuquerque, Katherine Fischer, Song Vo, Merrill Landers, Brach Poston. *University of Nevada, Las Vegas, Las Vegas, NV.* (Sponsor: John C. Young, FACSM)
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INTRODUCTION: Cerebellar transcranial direct current stimulation (c-tDCS) is a non-invasive brain stimulation technique that has been shown to acutely increase motor performance in healthy populations. Since altered cerebellum activity contributes to Parkinson's disease (PD) pathology, anodal c-tDCS may improve motor function in PD. **PURPOSE:** The purpose of this study was to determine the long-term influence of c-tDCS on motor learning and transfer of motor learning in PD. **METHODS:** The study was a sham-controlled, double-blind, between-subjects design. Twelve PD patients were allocated to either a c-tDCS group or a SHAM group. Practice consisted of 9 daily sessions involving performance of a complex, visuomotor precision grip task (PGT) with their most affected hand during either c-tDCS (25 minute duration, 2 mA current strength) or SHAM. The PGT involved matching a target sine wave (target force range: 5-35% of maximum) for 10 trials in each session. PGT performance was quantified as the average force error relative to the target force. Transfer tasks were performed in 2 testing sessions performed before and after the 9 practice days and included the Unified Parkinsons Disease Rating Scale Part III (UPDRS) and the Jebsen Taylor Hand Function Test (JTT).

RESULTS: For the PGT, there was no difference in the percentage decrease in force error between groups from the 1st to the 9th practice sessions ($P=0.64$; c-tDCS 29 ± 13%, SHAM 28 ± 14%). For the JTT, the main effect for Group was not significant ($P=0.37$; c-tDCS 37 ± 8 sec, SHAM 33 ± 5 sec). Furthermore, the main effect for Test was not significant ($P=0.42$; Test 1 35 ± 6 sec, Test 2 35 ± 7 sec). Finally, the Group x Test interaction was not significant ($P=0.58$). For the UPDRS, the main effect for Group was not significant ($P=0.53$; c-tDCS 18 ± 4 pts vs SHAM 18 ± 9 pts). Furthermore, the main effect for Test was not significant ($P=0.38$; Test 1 19 ± 7 pts, Test 2 17 ± 7 pts). Finally, the Group x Test interaction was not significant ($P=0.07$). **CONCLUSION:** These findings indicate that long-term c-tDCS does not seem to elicit improvements in motor learning or transfer of motor learning in PD. Therefore, c-tDCS may not be as effective as tDCS applied to the motor cortex in PD. The first author is a CAPES PhD student grantee (BEX 13509/13-6) This research was supported by a CTR-IN Pilot grant to Brach Poston.

185 Board #6 May 31 9:30 AM - 11:00 AM
The Effects of Water Aerobics Exercise on Cerebral Perfusion in Multiple Sclerosis

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PURPOSE: To determine the effects of a 7-day water aerobics exercise intervention on the cerebral hyperemic response to a cognitive task in individuals with MS. **METHODS:** Thirty-one individuals diagnosed with MS were assigned to either an exercise group (N = 17) or a non-exercise group (N = 14). The non-exercise group maintained normal activity for the 7 days, while the exercise group participated in 1 hour of water aerobic exercise on each of the 7 days. Oxygenated hemoglobin (O₂Hb), deoxygenated hemoglobin (HHb), and total hemoglobin (tHb) were measured using near-infrared spectroscopy at rest and during a cognitive task prior to and after the 7 day period. For both groups, paired samples t-tests were used to compare differences in O₂Hb, HHb, and tHb from rest to cognition before and after the 7 days. **RESULTS:** There was no significant difference between O₂Hb from rest to cognition at pre-testing ($t(16) = -1.91, p = 0.07$), however O₂Hb significantly increased from rest during cognition at post-testing ($t(16) = -2.30, p = 0.04$). For the control group, O₂Hb significantly increased from rest during cognition at pre-testing ($t(13) = -2.51, p = 0.03$), but there was no significant difference between O₂Hb from rest to cognition at post-testing ($t(13) = -1.6, p = 0.13$). **CONCLUSIONS:** Water aerobics exercise could be a useful therapy for improving the cerebral hyperemic response to cognition in individuals with MS, which may help offset the cerebral hypermetabolic effects of the disease.

186 Board #7 May 31 9:30 AM - 11:00 AM
Effect Of Aquatic-treadmill Training On Cerebrovascular Function In Community-dwelling Stroke Survivors: A Pilot Study

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Exercise-induced increases in brain blood flow are a key mechanistic pathway for improved brain function through regular exercise. Water-based exercise augments this response and therefore may represent an optimal exercise strategy to target this mediator of improved brain health, particularly for those with impaired cerebrovascular vascular function such as stroke survivors. While aquatic treadmill exercise has been reported to improve gait re-education in stroke rehabilitation, no research has assessed whether cerebrovascular function in stroke survivors is improved following water-based training. **PURPOSE:** To examine the effect of a 4-wk aquatic treadmill (ATM) training intervention on cerebrovascular responsiveness in community-dwelling stroke survivors. **METHODS:** Six community-dwelling stroke survivors (58 ± 11 yrs), with chronic stroke (>6 months), completed a 4-wk ATM training intervention of 30 min water-based walking, 3 times/wk. Before and following the intervention, resting cerebral blood flow velocity (Transcranial Doppler) of the stroke affected and unaffected cerebral hemispheres was assessed along with cerebrovascular responsiveness, as indexed from the percent change in middle cerebral artery blood velocity (MCAv) to a 4-min hypercapnic stimulus (5% CO₂ in air). ANOVA was used to compare pre and post intervention measures. **RESULTS:** Pre-training resting MCAv was similar between the affected and unaffected side (mean ± SD: 46 ± 12 vs 46 ± 19 cm/s, respectively; $p=0.96$), and the

4-wk intervention did not change this relation ($p=0.42$) nor significantly change the resting MCAv value (post training: 47 ± 11 vs 52 ± 15 cm/s; $p=0.29$). MCAv- CO_2 responsiveness increased by 40% in the affected hemisphere (2.8 ± 1.9 to 4.2 ± 1.8 %MCAv / mm Hg $P_{\text{ET}}\text{CO}_2$) and 65% in the unaffected hemisphere (3.0 ± 1.1 to 4.9 ± 0.9 %MCAv / mm Hg $P_{\text{ET}}\text{CO}_2$) following the 4-wk intervention, although this main effect did not reach statistical significance ($p=0.08$) nor was there statistical support for a differential increase between hemispheres (interaction effect: $p=0.41$).

CONCLUSIONS: This pilot study supports ATM training as a feasible option in stroke rehabilitation, and shows promising potential of enhanced cerebrovascular function for stroke survivors in this chronic phase of the rehabilitation pathway.

187 Board #8 May 31 9:30 AM - 11:00 AM
Effect Of Multidirectional And Unidirectional Exercises On Brain Blood Flow Activation In Chronic Stroke Patients

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PURPOSE: Recent studies reported that repetitive unidirectional exercise therapy (UET) like treadmill-walking stimulates subcortical brain areas and the cerebellum. UET may stimulate plasticity of the central nervous system by increasing blood flow in this area and hence increasing neuronal activity. The aim of this study was to examine the effects of two different types of exercise on brain blood flow activation in chronic stroke patients: multi-directional training using a half-dome ball and an aero-step (MET) versus UET on a treadmill. **METHODS:** Twenty chronic stroke patients were randomly assigned to two 12-week exercise programs, MET ($n=10$, 50.9 ± 15.0 yrs) or UET ($n=10$, 58.3 ± 12.1 yrs). Activation of blood flow in the brain was measured during leg movement using functional magnetic resonance imaging (fMRI) at baseline and after 12 weeks of exercise. The MET consisted of using a half-dome ball and an aero-step at 85% of maximal heart rate for 1h/day, 3days/week. SPM5 (<http://www.fil.ion.ucl.ac.uk/spm/>) was used for preprocessing and statistical analysis of the fMRI data ($p < 0.001$). Paired T-tests were used to analyze differences between pre- and post-exercise results ($p < .001$). **RESULTS:** Both MET and UET groups showed a significant increase in activation of blood flow after exercise training. However, there was no significant difference between MET and UET in the total area of activation of blood flow in the brain. While it was not statistically significant, the fMRI analysis reveals different patterns of activation: in the MET group, the most highly activated areas were motor movement and posture control ($t=10.54$, $t=8.6$, $t=8.12$, $p < .001$), while in the UET group, the highly activated areas were somatosensory functions ($t=13.10$, $t=10.08$, $t=3.95$, $p < .001$). **CONCLUSION:** Our finding suggest that although both MET and UET exercise program enhanced blood flow to the brain in chronic stroke patients, MET exercise promotes more activation in submotor areas responsible for unilateral involuntary motor movement and posture control.

188 Board #9 May 31 9:30 AM - 11:00 AM
Influence of Aerobic Exercise Intensity on Acute Changes in Motor Activation Post-Stroke

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Based on evidence among healthy adults, it has been proposed that aerobic exercise (AEX) could acutely activate the brain in ways that facilitate motor learning post-stroke. However, the acute effects of AEX on cortical motor activation have not been well described, and no previous studies have assessed the influence of aerobic intensity on this response among persons with stroke.

PURPOSE: To investigate the effect of AEX intensity on acute cortical motor activation among persons with chronic hemiparetic stroke.

METHODS: Using a crossover design, 10 subjects (5 male; mean \pm SD age, 60.1 ± 8.1 years; 6.1 ± 4.3 years post stroke; comfortable walking speed, 0.69 m/s [$52 \pm 25\%$ normal]; VO_2peak , 16.6 ± 3.4 mL/kg/min [$67 \pm 14\%$ normal]) performed one 20 minute session of moderate-intensity treadmill AEX (peak speed, 0.69 ± 0.30 m/s; mean VO_2 , $55 \pm 14\%$ VO_2peak ; blood lactate at end of session, 1.5 ± 0.5 mmol/L) and one 20 minute session of high-intensity treadmill AEX (1.29 ± 0.41 m/s; $62 \pm 15\%$ VO_2peak ; 5.7 ± 3.2 mmol/L) in random order, at least one week apart. High-intensity AEX used an interval training strategy involving 30 second bursts at maximum safe treadmill speed alternated with 30-60 second rest periods. Cortical motor activation

threshold of the paretic quadriceps femoris was measured immediately before and after each AEX session using transcranial magnetic stimulation. A fixed effects model to incorporate the crossover design was used to examine between-protocol differences in change.

RESULTS: During moderate-intensity AEX, motor threshold increased from 78.2 ± 2.2 to $81.4 \pm 2.2\%$ maximum stimulator output (MSO), indicating decreased paretic motor activation. During high-intensity AEX, motor threshold decreased from 80.6 ± 2.2 to $77.3 \pm 2.2\%$ MSO, indicating increased paretic motor activation. The between protocol difference was statistically significant ($p=0.037$).

CONCLUSIONS: In chronic stroke, high-intensity AEX (above the lactate threshold) appears to acutely increase paretic motor activation significantly more than moderate-intensity AEX (below the lactate threshold), which may have the opposite effect. Further studies are needed to confirm this finding in a larger sample and to determine whether this acute motor activation from high-intensity AEX can be used to improve motor outcomes following stroke.

189 Board #10 May 31 9:30 AM - 11:00 AM
CN-NINM Intervention For The Neurorehabilitation Of Disordered Speech And Emotion

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 (No relationships reported)

BACKGROUND: CN-NINM intervention combines the use of targeted exercise and non-invasive neurostimulation—delivered transcutaneously to the tongue—to enhance natural recovery mechanisms. In a case of chronic stroke, CN-NINM intervention successfully recovered speech and reversed symptoms of depression. **PURPOSE:** To evaluate the efficiency of CN-NINM intervention, using translingual neurostimulation (TLNS), in stroke patient populations. **METHOD:** The patient completed a thirteen-month intervention that consists of three components: (1) TLNS, (2) physical exercises for balance, posture and gait, and (3) speech training. For the first 6 months of the intervention this individual practiced all three components for one hour, twice daily. After 6 months of intervention, there was a 30-day withdrawal period, followed by an additional 6 months resuming the exercises, training, and device use. Improvements in speech and emotion were measured using the Dysarthria Impact Profile (DIP), the Quick Inventory of Depressive Symptoms (QIDS), and the Stroke Impact Scale (SIS). **RESULTS:** All measures demonstrated substantial improvement from baseline to end of intervention. Speech recovered by 49 percent. Depression score decreased by 10 points—a clinically significant improvement—from moderate depression to complete remission of depression. SIS scores for communication and emotion also improved by 13 and 20 percent, respectively. **CONCLUSION:** CN-NINM intervention can be used to recover and improve disordered emotion and speech in individuals with chronic stroke. These findings present a new non-invasive brain stimulation technique with applications in rehabilitative neurosciences. Additional research is necessary to understand the potential mechanisms of this phenomenon and optimize efficiency of the intervention.

190 Board #11 May 31 9:30 AM - 11:00 AM
Lower Extremity Function in Different Cognition Older Adults

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PURPOSE: Lower extremity function is closely related to cognitive and balance impairments. Evaluate the difference of lower extremity function with different levels of cognitive impairment to find out the cognitive effects of balance functioning in community-dwelling older adults.

METHODS: Fifty-five adults aged over 60 (age: 74.36 ± 7.11 yrs, BMI: 23.43 ± 3.29 kg/m²) were divided into normal cognitive (NC, $n=17$), mild cognitive impairment (MCI, $n=16$), and dementia groups (D, $n=22$), using the SLUMS scale and physician's diagnosis. Lower extremity muscle strength (30-second chair stand test), lower extremity flexibility (chair sit-and-reach), agility/dynamic balance (8-foot up-and-go), stability score and single-leg static balance capacity were evaluated.

RESULTS: In static balance, NC group had better performance in stability score (1.77 ± 0.58 vs. 4.22 ± 2.03 , $p < 0.001$) than D group, especially in anterior-posterior side (1.57 ± 0.77 vs. 1.41 ± 1.02 , $p < 0.001$). In ankle proprioception, NC and MCI groups improved the joint position sense more slightly ($1.46 \pm 0.45/1.48 \pm 0.50$ vs. 2.07 ± 0.45 , $p=0.004$) than D group. Moreover, NC and MCI groups had significantly better performance in lower extremity flexibility ($7.5 \pm 8.56\text{cm}/8.72 \pm 6.69\text{cm}$ vs. $-2.57 \pm 10.89\text{cm}$, $p=0.001$), agility/dynamic balance ($6.08 \pm 1.52\text{sec}/6.65 \pm 1.74\text{sec}$ vs. $9.42 \pm 2.6\text{sec}$, $p=0.007$) than D group.

CONCLUSIONS: The abilities of lower extremity functioning and agility/dynamic balance may be affected by the level of cognitive impairment. We suggest that should

give priority for providing strategies of exercise intervention for balance to improve lower extremity function, especially when agility/dynamic, anterior-posterior control and ankle proprioception are limited because of early cognitive impairment.

Key words: dementia, mild cognitive impairment, muscle strength, balance, ankle proprioception

191 Board #12 May 31 9:30 AM - 11:00 AM
Psychophysiological Responses To Dual-task Postural Control In Older Adults After 3-month Of Cognitive-motor Intervention

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In the aging process, there is a higher competition for attentional resources during challenging/dual-task postural conditions, which consequently increases risk of falls. Fall prevention programs should therefore seek proper interventions to improve dual-task performance of the elderly. **PURPOSE:** To assess psychophysiological responses to dual-task postural control in older adults and the effectiveness of 3-month cognitive-motor intervention. **METHODS:** Thirty healthy older adults (70±6y, 76% women) were randomly divided into either 3-month cognitive-motor or control group. Postural control was monitored using a force plate (AMTI HE600600-2k, MA, USA) during quiet stance and in tandem position, both in normal and in DT conditions (subtracting three). Psychophysiological responses (heart rate and variability, breathing frequency, skin temperature and galvanic skin responses) were assessed with NeXus-10 MKII (Mind Media B.V., The Netherlands). Finally, the subjective ratings of physical and cognitive workload were assessed by Borg scale. The results were addressed by interactions of RM ANOVA at p<0.05. **RESULTS:** Significant interactions in terms of better outcomes for cognitive-motor group were found for heart rate (p=0.044) and breathing frequency (p=0.048) whereas results for postural sway failed to reach statistical significance (non-significant trend p=0.097). Furthermore, subjective ratings were increased in both groups with increased postural difficulty (p<0.05). Finally, the cognitive-motor group revealed higher accuracy of secondary (cognitive) task while balancing at the end of the intervention (p=0.032). **CONCLUSION:** Aging process is associated with structural and functional alterations of autonomic nervous system functions that are responsible for an impaired ability to adapt to environmental challenging tasks. The present cognitive-motor intervention was identified as a potentially promising method to counteract these age-related negative adaptations. Supported by Norway Grants, Project No. 4300-472/2014

A-40 Free Communication/Poster - Activity Interventions and Programming in Adults I

Wednesday, May 31, 2017, 7:30 AM - 12:30 PM
Room: Hall F

192 Board #13 May 31 11:00 AM - 12:30 PM
Evaluation Of A Hospital-based Weight Loss Program Involving Exercise, Nutritional, And Behavior Change Modification.

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Weight loss can reduce health risks associated with obesity. Team-approach interventions that involve exercise, diet, and behavioral modification have been shown to result in successful weight loss. **PURPOSE:** The purpose of this project was to evaluate the effectiveness of a hospital-based team-approach physician-referred program that enrolls community members without use of incentives. **METHODS:** Participants included obese (BMI≥30) members of the community (COM, N=48) compared to employees of the local hospital (EMP, N=88). COM were referred to the program by a Physician while EMP were provided with incentives to participate. All participants were evaluated both pre- and post- a 16-week intervention period which included regular supervised exercise sessions and monthly consults with a Registered Dietitian (RD) and a Behavioral Health Specialist (BHS). Background information collected included, sex, initial weight (kg), BMI (kg/m²), percent fat (%) using Bioelectrical Impedance, and readiness for change (RTC) evaluation (modified Brownell LEARN RTC Questionnaire). Attendance at all sessions (RD, BHS, exercise)

were recorded. If final weight was obtained, then the program was considered completed. Independent samples t-tests (p<0.05) were used to determine differences in physical characteristics between groups as well as in total weight loss. Association between consultation attendance (RD and BHS) and completion was determined by Chi-square test for independence with a Bonferroni adjustment. **RESULTS:** No significant differences were detected between participant initial characteristics. There was no significant difference in weight loss between groups (EMP=-12.29±12.56lbs vs COM=-15.58±8.08lbs, p=0.20). However, overall program completion was lower in the COM compared to EMP (58% vs. 85%, respectively). In the COM program a Chi-square test revealed a significant association only between attending BHS consultations and program completion (X²(1,n=48), X²=6.291, p=0.01, phi=0.41). **CONCLUSION:** A team-approach weight loss program may be an effective intervention if the participants successfully complete the program. However, additional research is warranted to determine if adhering to BHS consultation visits could improve completion rates when other incentives are not offered.

193 Board #14 May 31 11:00 AM - 12:30 PM
Use It And Lose It: Fitbit Use, Daily Steps, And Weight Change Among Overweight Adults

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(No relationships reported)

Despite the increasing proliferation of advanced wearable physical activity tracking devices (e.g., Fitbit Zip), their value as tools for physical activity promotion and weight loss remains unclear.

PURPOSE: As part of a pilot intervention trial that examined the efficacy of a novel social support approach for enhancing weight loss, participants were provided with a Fitbit Zip to monitor their physical activity. The current study examined the relationships between Fitbit use and change in weight and daily steps over 4 months. **METHODS:** Overweight adults (N=36) were randomized to either a standard or social support-enhanced, 16-week behavioral weight loss intervention. In addition to a Fitbit Zip, both groups received weekly, in-person group counseling sessions and digital body weight scales. Participants in the social-support enhanced group received two extra Fitbits and scales to share with up to two persons in their social circle. There were no significant differences between conditions, so analyses collapsed groups and examined the full sample. Paired t-tests were used to evaluate changes in weight and daily steps from baseline to post-treatment. Spearman rank correlation coefficients were calculated to test the associations between the total number of days the Fitbit was used (out of 112 days) and changes in daily steps and weight. Fitbit use was objectively established by weekly monitoring of synced data from the Fitbit website. **RESULTS:** At baseline, participants were obese (M BMI= 36.1 + 7.3 kg/m²) and low active (M=5546 + 2390 steps/d). Weight losses averaged -3.5±4.3 kg (p<.0001) and daily steps increased an average of 1101+2395 (p=.009) over baseline. Participants used the Fitbit an average of 5.9±2.5 days/wk. A significant correlation between total number of days the Fitbit was used and weight loss such that there was greater use of Fitbit was associated with greater weight loss (r_s = -.60, p<.0001). A significant, positive correlation was found between the change in daily steps and the number of days the Fitbit was used (r_s=.43, p=.008). **CONCLUSION:** These preliminary findings suggest that advanced wearable physical activity trackers hold promise as tools for assisting with physical activity promotion and weight loss in adults within the context of a multi-component behavioral weight loss program.

194 Board #15 May 31 11:00 AM - 12:30 PM
Lifestyle Enhancement Program: Evaluation of a Community-based Physical Activity Smoking Cessation Program

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PURPOSE: The purpose of this study was to evaluate the efficacy of the Lifestyle Enhancement Program, a two arm, parallel group, randomized clinical trial comparing community-based physical activity (PA) program to a wellness control program as adjunctive smoking cessation treatment.

METHODS: All participants (n=392) received cessation counseling and the nicotine patch and were randomized to PA (n=199; YMCA membership and personalized exercise programming from a health coach) or an equal contact wellness curriculum (n=193). Primary (CO-verified continuous smoking abstinence) and secondary (PA

levels) outcomes were assessed at baseline, 7-week, 6- and 12-months. Indices of treatment perception, adherence, abstinence rates, and PA levels were compared between groups using chi-square analyses and ANOVA.

RESULTS: Smoking abstinence in the PA and wellness groups were 18.6% and 23.8%, respectively at 7 weeks, 15.1% and 16.1% at 6 months, and 14.1% and 16.6% at 12 months. Between group differences did not significantly differ from each other (all p-values > 0.18). In the PA group, increases from baseline to 7 weeks were observed for total minutes of PA/week (97.8 min to 145.2 min; p<.01) and total minutes of strength training/week (12.8 to 29.7; p < 0.005). For the PA group, total PA and strength training were not different at 6 and 12 months compared to baseline, and no changes at any follow-up were observed in the wellness group. Intervention session attendance over the year averaged 63% for the PA intervention and 72% for the wellness (p < 0.001). Participants in both the PA and wellness conditions found the intervention to be “very helpful” in quitting smoking [85% and 83% respectively (p = 0.20)]. Time commitment to the program was considered to be “not at all a burden” [88% in both conditions (p = 0.84)]. Participants indicated they would “strongly agree” to recommend the program to a friend [95% and 92% respectively (p = 0.06)].

CONCLUSIONS: A combination of individual smoking cessation counseling, nicotine replacement therapy, and a community-based PA or wellness program was acceptable to smokers but did not appear to improve long-term abstinence rates above what has been seen with nicotine replacement therapy in previous studies.

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195 Board #16 May 31 11:00 AM - 12:30 PM

Gesture Analysis for Yoga Alignment in Young Adults

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Introduction: Biomedical research aimed toward a deeper understanding of yoga’s benefits and physiological mechanisms has become an active area of study. To decrease disparity between populations who can readily access yoga classes and therapies, benefits of yoga could be implemented in an exergame format at clinical or home environments. This platform could be installed with low cost hardware using the Cloud for analytics and data collection. **Purpose:** Objective was to analyze yoga posture alignment using a 3D room sensor to produce a physical activity exergame for specific groups, such as young adults. This research utilizes gesture analysis software to provide skill improvement feedback to students in a yoga course setting. **Methods:** We measured yoga posture alignment over the course of a 10-week period using Kinect SDK 2.0. A convenience sample of 12 undergraduate students with minimal yoga experience were recruited under an IRB approved protocol. **Results:** Five yoga postures were captured from seven yoga teachers, as a gold standard for comparison and used for training supervised machine learning algorithms. Default settings in Kinect Visual Gesture Builder produced solutions with high True Positives (99.5%) and low False Positives (0.03%) for most yoga postures sampled. Depth stream and skeleton coordinates for the 12 participants were acquired and analyzed against this trained solution. Analysis showed sensitivity for True Positives was greatest for “Side Bend” (0.496) and “Upward Salute” (0.141) and most postures had specificities for True Negatives near 1.0. Based on these results the higher the gesture score, the closer the postures were to the “gold standard”. **Discussion:** Gesture analysis for yoga alignment training may be a useful tool for the development of home and clinical yoga therapy for hard to reach populations. The exergame developed here provides a tool that scores the performance of yoga postures and improvement. Prior research has shown that even short-term yoga based lifestyle interventions were efficacious in weight loss, inflammation and stress and positively influenced cardiovascular risk factors. **Conclusion:** Our plans are to target special populations, study the potential effects of body mass and age on posture alignment, and assess breathing, heart rate and limb stretch.

196 Board #17 May 31 11:00 AM - 12:30 PM

Effects of a Dog Walking Intervention on a University Campus: A Pilot Study

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(No relationships reported)

A great deal of research has focused on implementing walking interventions with the intent of increasing employee well-being and decreasing organizational healthcare costs. The inclusion of dogs within a walking intervention can not only facilitate walking adherence, but also increase health benefits. **PURPOSE:** To assess the benefits experienced by university staff members after walking local shelter dogs during their lunch breaks. **METHODS:** Staff members at a local university were

recruited through a campus listserv. Seven full-time staff members (100% female, 100% white, 27-66 years of age) completed the study. Shelter dogs were transported to campus weekly for four weeks in the Spring of 2016. One week was canceled due to rain. Participants were paired and instructed to walk their assigned dog for 30 minutes using the sample walking routes provided. Accelerometer data (hip-worn ActiGraph GT3X) were collected during each walk to document intensity levels and post-intervention interviews were conducted upon completion of the study to assess participant’s perceived benefits from the intervention. **RESULTS:** Eighty-six percent of participants completed all walking sessions. Participants averaged 24.9 ± 7.4 minutes of moderate-to-vigorous physical activity (range 12-37 min) during the walk. Interview data revealed that participants sat anywhere from 3-7.5 hours out of their 8-hour workday. Participants self-reported being somewhat physically active outside of the workplace setting, but all wanted to find ways to be more physically active throughout the workday. Thematically, qualitative analysis suggested that participants signed up for the study because of their love of dogs, looked forward to their Friday walks, had fun during the walks, returned to work happy, and wanted the program to continue. **CONCLUSION:** Incorporation of dogs into a university-based walking program can encourage program adherence and promote moderate intensity walking among women staff members.

197 Board #18 May 31 11:00 AM - 12:30 PM

Effects Of Elastic Resistance Band Exercise On Older Women With Nonspecific Chronic Low Back Pain

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(No relationships reported)

Nonspecific chronic low back pain (NCLBP) is a common ailment in older adults. It is possible that simple and inexpensive exercise programs could reduce pain and improve physical function, fitness and body composition in older women with NCLBP. **PURPOSE:** To analyze the effects of a short-term elastic band resistance program (EBRP) on pain, spine function, fitness and body composition in older adults with NCLBP. **METHODS:** 20 sedentary older women (70.9±5.9 yr) with NCLBP for at least of 6 months were randomly divided into two groups: control group (CG) (n=9) that continued normal activities without exercise; and EBRP group (EBRPG) (n=11) that performed an 8-wk EBRP on 2 d/wk with 6 multi-articular standing exercises for upper and lower extremities for 4 sets of 10 repetitions (8-9 perceived effort) with 60 s of recovery between sets. Participants did not consume any nutritional supplements and none had any pathology that was currently being treated. Measures assessed pre- and post-training were: visual analogue scale of pain (VAS); Oswestry disability index (ODI); categorized sciatica pain (CSP); back performance tests: pick and lift repetitions tests (PT and LRT, respectively); Schober flexion’s test (SFT); timed up and go test (TUGT); six-minute walk test (6MWT); isometric strength tests: vertical row (VRT), squat (SQT) and trunk curl (TCT); body fat percentage (BF) and fat-free mass (FFM) (via bioelectric impedance). **RESULTS:** CG did not change from pre- to post-testing while EBRPG significantly (p<0.05) improved all variables analyzed. Percentage differences are provided for CG and EBRPG, respectively: VAS +9.4 vs. -70.3; ODI +6.0 vs. -49.1; CSP +4.2 vs. -100; PT +66.7 vs. -85.7; LRT -4.2 vs. +26.4; SFT -2.6 vs. +4.6; TUGT -2.74 vs. -25.4; 6MWT -1.5 vs. +16.6; VRT -7.2 vs. +14.1; SQT -5.2 vs. +23.5; TCT -14.8 vs. +33.2; BF +1.6 vs. -2.4; FFM -1.1 vs. +2.44. Intergroup post-training significant differences were found on VAS, ODI, CSP, PT, LRT, and TUGT. **CONCLUSION:** An intense EBRP applied in a short time period appears to help reduce pain and improve spine function, physical fitness and body composition in older women with NCLBP. Further research is needed regarding the long-term impact of this program on NCLBP.

198 Board #19 May 31 11:00 AM - 12:30 PM

Effects of Combined Aerobic and Resistance Training: A Randomized Controlled Trial

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Limited data are available on the effect of combined aerobic and resistance training (combined training) in Asian populations.

PURPOSE: To determine the effect of combined training on fatness and fitness outcomes, including body fat mass, waist circumference, muscle strength, and flexibility; and also clinical outcomes, including blood pressure, brachial-ankle pulse wave velocity and fasting blood glucose in Japanese women.

METHODS: Forty-one women were randomized to a training group, n = 23 (age 47.3 ± 6.5 years) or control group, n = 18 (age 46.7 ± 6.5 years). The intervention included participation in a 24-minute circuit training session (combining aerobic and resistance training, each of which lasted 30 seconds) and 6-minute stretching 3 times per week for 16 weeks. The aerobic exercise was stepping on a step board while executing resistance training, using 12 different hydraulic devices developed for females to increase their muscle strength. During this training, the participants measured their heart rates once every 8 minutes based on the instructor's guidance to maintain them at 60 to 80% of their maximal heart rates throughout training by adjusting training intensity levels. All outcomes were measured at baseline and after the intervention.

RESULTS: Although there was no statistically significant change in the control group, there were significant reductions in waist circumference (91.0 ± 6.3 to 89.8 ± 6.5 cm) (p = 0.045), systolic blood pressure (127.5 ± 18.9 to 123.3 ± 19.5 mmHg) (p = 0.038), fasting blood glucose (101.0 ± 19.4 to 95.3 ± 13.2 mg/dL) (p = 0.015), and brachial-ankle pulse wave velocity (1315 ± 181 to 1271 ± 173 cm/s) (p = 0.009) in the combined training group. Also, significant increases in the knee extension strength (858 ± 184 to 1140 ± 216 watts) (p < 0.001) and flexibility (33.7 ± 6.4 to 35.9 ± 6.4 cm) (p < 0.001) only in the training group.

CONCLUSIONS: The results of this randomized controlled trial showed that a 16-week combined training significantly improved the fatness and fitness outcomes and the clinical outcomes in Japanese women.

199 Board #20 May 31 11:00 AM - 12:30 PM
Combination Of Sling Exercise Training And Nutritive Administration Of Carbohydrates And Protein By Food As A Strategy To Increase Strength In Older Men And Women

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PURPOSE: After the age of 60, muscle strength is reduced by 1-1.5% per year increasing to 3% per year. However, strength training can counteract age related loss of strength. Sling training, a specific type of strength training, has positive effects on balance and functional mobility. However, knowledge about its effects on force and strength is limited. Malnutrition may be part of aging; especially the uptake of proteins can be below nutrition recommendations which may result in reduced muscle mass. Therefore we investigated in this study combined effects of protein and carbohydrate intake by food immediately after sling training on the training response in older people.

METHODS: 31 subjects (25 female and 6 males, age: 65.9 ± 4.9) conducted a sling training (three times 30 minutes per week for 12 weeks). Immediately after training the intervention group received a meal consisting of 110 g sour milk cheese with two slices of whole meal toast and 250 ml of buttermilk. The nutritional values of these meal consisting of 38.95 g protein, 23.2 g carbohydrates and 2.9 grams of fat (= 1190 kJ / 278.5 kcal). Prior and after the intervention, maximum strength of trunk and leg muscles was tested.

RESULTS: Sling training resulted in a significant increase of strength in the control group as well as the intervention group. Average strength increased between 20 to 30% for leg and chest strength up to 40% to 130% for trunk strength (ventral, dorsal and lateral). For all kinds of trunk strength nutritive protein carbohydrate uptake resulted in an additive training effect which was significant for the left lateral trunk strength. Interestingly all volunteers like to have a common meal after training.

CONCLUSIONS: Our results indicate that a combination of sling training and nutritive protein and carbohydrate uptake by food may be a suitable strategy to counteract age related loss of strength and muscle mass and improve the quality of life in the elderly.

200 Board #21 May 31 11:00 AM - 12:30 PM
Effect of a Group Exercise Program in Symptoms of Depression and Physical Activity: Pilot Study

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Depression has the highest incidence among mental illnesses. Physical activity (PA) and exercise has been associated with lower symptoms of depression (SD). However evidence of the effectiveness of a group exercise program combining aerobic and resistance exercise in this population is scarce. **PURPOSE:** To evaluate the effect of a 6-weeks group exercise program combining aerobic and resistance exercise in SD and moderate to vigorous physical activity (MVPA). **METHODS:** Seven college students

(5 females and 2 males, 21 (21-23) years of age) with a score ≥ to 17 in the Beck's Depression Inventory-II (BDI-II) volunteered for the study. Participants underwent a 3 day per week combined aerobic and circuit resistance 6 week group exercise program. Before and after the exercise program participants completed the BDI-II and wore an accelerometer for 7 days. Tests to assess health related physical fitness (HRF) were also performed (% body fat, VO₂ max, leg and chest 1RM/lb body weight, isometric relative strength, push-ups and curl-ups) and results converted into a score. Wilcoxon Signed Rank were conducted to determine differences between pre- and post-tests, and Spearman's correlations to determine associations between SD, PA and HRF.

RESULTS: Differences were found between pre- and post BDI scores (pre=26 (23 - 27) vs. post=7 (5 - 9), p = 0.02), MVPA (pre= 275.5 (255.63 - 296.27) min/week vs. post= 250.55 (150.27 - 243.43) min/day, p = 0.04), and HRF scores (pre= 4 (4 - 6) vs. post= 7 (6 - 9), p = 0.02). Differences were also found between pre- and post HRF results: % body fat (pre= 34.4 (25.2 - 48.5) vs. post=28.8 (24.4 - 48.4)%, p = 0.02), VO₂ max (pre=23.5 (21.1 - 27.6) ml/kg*min⁻¹ vs. post= 27.2 (21.2 - 29.9) ml/kg*min⁻¹, p = .03), 1RM bench press (pre=.43 (.41 - .83) lb/bw vs. post=.50 (.48 - .97) lb/bw, p = 0.02), 1RM leg press (pre=1.51 (1.36 - 2.44) lb/bw vs. post= 1.99 (1.84 - 2.68) lb/bw, p = 0.02), and push-ups (pre=5 (3 - 13) vs. post=11 (4-20), p = 0.02). No significant correlations were found between SD, PA and HRF. **CONCLUSION:** A 6-week group exercise program can help achieve a reduction of SD and can improve the HRF components in young adults with SD. Exercise training plays an important role in the reduction of SD in physically active young adults.

201 Board #22 May 31 11:00 AM - 12:30 PM

A 12-week Modified Tabata Exercise Program On Functional Fitness For The Elderly: A Pilot Study

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PURPOSE: This preliminary study sought to examine the impact of a 12-week modified TABATA circulative exercise program on functional fitness in an elderly population. **METHODS:** Subjects were community-dwelling older adults over the age of 60. They were recruited using flyers or telephone calls from a local community facility in New Taipei City. Subjects were consented and evaluated by a set of functional fitness tests at baseline and post intervention. The modified TABATA exercises incorporating squatting, forward lunge, heel raise, and table plank were conducted in a circular fashion with a 110 bpm music in the background. The exercise-to-rest ratio were 30:30, 30:20, and 40:20 seconds during the 1st -6th, 7th -10th, and 11th -12th week respectively using the high-knee stepping and side stepping in the rest sessions alternatively. This modified TABATA was implemented weekly for 12 weeks for an average duration of 50 minutes each time. The non-parametric Wilcoxon signed rank test was conducted to detect the pre-and-post differences in all functional fitness tests. Significant level was at α = .05. **RESULTS:** A total of 14 subjects were recruited. Ten (2 male and 8 female) of the participants aged 69.2 ± 5.7 years old completed both pre and post tests with an average attendance rate of 87.8%. After the once-a-week modified TABATA exercise program for 12 weeks, significant differences were found in % body fat (p=0.03), hand grips (left) (p=0.015), 30-seconds chair rise (p=0.007), chair sit-and-reach (left: p=0.033; right: p=0.028) and 2-minute stepping (p=0.012). **CONCLUSIONS:** With some little modification, TABATA exercise can be safe and feasible for older population. Specifically, it might be even more beneficial in prevention of the general deterioration in lower limb flexibility and muscular strength, and also the cardiorespiratory fitness normally occurred with age.

202 Board #23 May 31 11:00 AM - 12:30 PM

Keep Up The Good Work: Does Enrolling In An Exercise Program Influence Other Behaviors?

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Many agencies promote a healthy "lifestyle" but this comprehensive vision of wellness contrasts with interventions targeting specific health behaviors. However, initiation of a new health behavior could promote, consciously or unconsciously, the modification of a second health behavior.

PURPOSE: To investigate if participation in an exercise program promotes spontaneous dietary modification. **METHODS:** Ninety-eight healthy, sedentary adults (53% female, aged 31.4±6.1 years; baseline BMI 25.0±3.9) were randomized to either 12 weeks of aerobic exercise training (n=44) - 4 days/week for 45 min at an intensity of 80-85% of maximal heart rate followed by 4 week deconditioning - or wait list control (n=54). A Food Frequency Questionnaire was administered at baseline and weeks 12 and 16, to derive caloric intake (Kcal), Alternate Mediterranean Diet Index (aMed), and Macronutrients

(Protein, Fat, Carbohydrate) intake. Repeated measures tested treatment, session, and their interaction as predictors with diet measure (Kcal, aMed, Protein, Fat, or Carbohydrate) at Wk12 and Wk16 as the response variables. All models were adjusted for the baseline value of the response variable and were repeated adjusting for gender. **RESULTS:** Both the exercise (Ex) and the waitlist (WL) groups significantly decreased, from baseline to week 16, mean caloric intake (Ex: $\Delta=-232.43\text{cal}$, $p<.01$; WL: $\Delta=-219.89\text{kCal}$, $p<.01$), mean protein intake (Ex: $\Delta=-11.26\text{g}$, $p<.01$; WL: $\Delta-9.42\text{g}$, $p<.01$), mean fat intake (Ex: $\Delta=-7.42\text{g}$, $p=.04$; WL: $\Delta=-8.29\text{g}$, $p<.01$), and mean carb intake (Ex: $\Delta=-24.00\text{g}$, $p<.01$; WL: $\Delta=-24.28\text{g}$, $p<.01$). No significant change in aMed over time was found for either group (Ex: $\Delta=-.31$, $p=.24$; WL: $\Delta=-.35$, $p=.05$). There were no significant difference between the groups in any of the 5 diet measures ($p>.65$).

CONCLUSIONS: Despite this intervention's singular focus on aerobic training, both groups showed a marked reduction in KCal and Macronutrients. Sedentary participants willing to enroll in an exercise study may already be in the action stage of behavior change and may independently elect to change dietary behavior to improve overall wellness. Future studies should investigate what psychological triggers lead to a behavioral "spillover" and if the degree of engagement in the primary behavior could predict the magnitude of the "spillover".

203 Board #24

Abstract Withdrawn

204 Board #25 May 31 11:00 AM - 12:30 PM

Effects Of Participating In Sports Events Through Exercise Class On The Establishment Of Exercise Habits

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Participating in sports events through exercise class may be able to help goal setting, which may contribute to establishing exercise habits. **PURPOSE:** To examine the effects of participating in sports events through exercise class on the establishment of new exercise habits.

METHODS: The requirement of participants were 20- to 64-yr-old women who have not been having exercise habits and confidence to play sports for a long period of time without orthopedic and cardiovascular disease. Fifteen women participated in an exercise (EX) class (6 months, 90 min/session, twice a week) and 16 women who were recommended to participate in a weight-loss (WL) class (the first 3 months were only dietary guidance and the last 3 months were only exercise. Guidance and exercise were 90 min/session, and once a week). Two months after the EX class started, we set a goal to participate in a sports event (5 km running race or 6 km fun walking). The EX class started from low-intensity exercise (stretching and muscle strength training to load own body weight), and gradually transitioned to moderate- or vigorous-intensity exercise (walking, Nordic-pole walking, jogging or running) depending on the level of physical fitness. Ten participants finished the running race and the remaining 5 participants finished the fun walking. The WL class did not set any exercise goals. The participants' exercise habits were investigated and 3 METs or more physical activity was measured using an accelerometer after 1 year from the end of the classes.

RESULTS: The stability rate of the exercise habits was significantly higher in the EX class than in the WL class (EX, 12 participants, 80.0%; WL, 8 participants, 50.0%; χ^2 test, $p = .038$). However, 4 of the 8 participants in the WL class already had had the exercise habits before the class. In addition, 10 participants from the EX class who finished the running race last year have applied for the next year's race. However, physical activity did not differ significantly between the two classes after 1 year (EX, 4.3 ± 1.9 METs-h/day; WL, 3.8 ± 1.9 METs-h/day; t-test, $p = .466$).

CONCLUSIONS: It is concluded that when establishing exercise habits goals should be sets and making use of sports events through exercise class contribute to set definite goals easily and establish new exercise habits.

205 Board #26 May 31 11:00 AM - 12:30 PM

Quantitative And Qualitative Analysis Of An Individualized Consultation To Change Sedentary Behavior In The Workplace.

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Independent of an individual's physical activity levels, prolonged periods of sedentary behavior are detrimental to health. Office-based workers engage in prolonged periods of sitting and are a target group for intervention. Individualized consultations have

potential to change sedentary behavior and offer a low cost alternative to interventions such as sit-to-stand desks. **PURPOSE:** To report quantitative and qualitative outcomes from a randomized controlled trial exploring the use of an individualized consultation intervention to change sedentary behavior in the workplace. **METHODS:** 48 participants (42F, 6M, mean age 42.9 ± 12.0 yrs, BMI 25.2 ± 3.8 kg/m²) were recruited from a university by workplace email and poster distribution. Participants were > 18yrs with full time desk based occupations. Participants were randomized to a control group (n=23) or an intervention (n=25) group who received a 30-45 minute individual consultation incorporating behavior change strategies to support reducing sedentary behavior. Before and after the intervention participants wore an activPAL monitor for 7 days. A sub-sample of 16 intervention participants took part in semi-structured interviews exploring intervention perceptions. **RESULTS:** No changes were reported in overall, weekday or weekend mean sitting, standing or stepping time; step count; sit-to-stand transitions or % of waking day spent sitting, standing or stepping ($p>.05$). Semi-structured interviews provided insight into participant intervention perceptions. Many participants mentioned increased knowledge and awareness of sedentary behavior and the associated physical and psychological benefits. However, several barriers to behavior change were reported including: social norms within a workplace; perceived negative opinion of colleagues; excessive workloads and deadlines and loss of concentration and productivity. **CONCLUSIONS:** The individualized consultation intervention was not effective in changing sedentary behavior. Multi-level barriers impede sedentary behavior change in the workplace. Further work is required to fully understand these complex influences on this behavior in a workplace setting to allow the development and implementation of effective interventions.

206 Board #27 May 31 11:00 AM - 12:30 PM

The Rehabilitation Effect Of Plank For Patients With Chronic Low Back Pain

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Objective: contrast research plank on the rehabilitation effect of patients with chronic low back pain. **Methods:** choose in college affiliated hospital outpatient clinic hospital diagnosed with non-specific and income of 60 patients with chronic low back pain, single blind, randomized, controlled experiment method to are divided into conventional treatment group (zheng massage, cupping, infrared), additional McCann stomach stretch group (routine treatment added McCann base treatment of stomach stretch training) and the additional plank support training group. Three groups of subjects baseline data and evaluation index of no statistical difference before treatment, before treatment, 4 weeks, 8 weeks after treatment has been accepted Oswestry disability index (ODI) questionnaire scores and core strength tests. Data obtained by the SPSS T test and variance analysis. **Results:** 1. ODI is: before the trial, ODI scores of three groups of subjects had no significant difference, after the trial, ODI scores of three groups of participants is less than before the trial, group A $P < 0.05$, B and C group $P < 0.01$. After the trial, the ODI score of group C compared with group A score decreased, $P < 0.01$; Compared with group B score decreased, $P < 0.05$. 2. Core strength comparison: before the trial, all direction core muscle strength compared in three groups were no significant differences, after the intervention, the core strength of the C groups were all directions are also increase before experiment, $P < 0.01$; After the group B were at the core of the strength increase from before the trial, $P < 0.05$. Group C after the intervention, the direction of the core strength of group A were increased, $P < 0.01$; Is in the direction of B group were increased, among them, in the former flexion, left lateral flexion, left and right rotation strength increased significantly, $P < 0.01$. **Conclusion:** 1. Conventional treatment group, the additional plate support group, additional McCann base stomach stretch group, all three methods to different degrees of ease the pain of patients with chronic low back pain, and the latter two effect is better; 2. Plank and McCann stomach stretch training can both improve and increase the role of the core strength of patients with chronic low back pain, and tablet supported training the McCann, prone to stretch more comprehensive.

207 Board #28 May 31 11:00 AM - 12:30 PM

High Intensity Interval Training Improves Blood Lipid Profiles And Fatigue Resistance

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High intensity interval training (HIIT) has merged as a novel metabolic modulator, mitigating metabolic syndrome (i.e., high blood glucose and LDL) and improving cardiovascular fitness. However, little research has been conducted, and importantly, mode, duration, and frequency of exercise remain unclear. **PURPOSE:** To investigate if HIIT improves health fitness-related biomarkers including: fasting blood glucose (FBG), resting heart rate (RHR), blood lipids, resting blood pressure (BP), and post exercise blood lactate production. **METHODS:** 13 healthy male subjects (age: 18-28 years old) were recruited in this study. Subjects were informed about the project

and allowed to familiarize with laboratory bicycle riding for two days, during which pre-test dependent variables (FBG, RHR, BP, blood lipids, maximal anaerobic power by Wingate Test, and post Wingate blood lactate) were measured. On the third day, the subject performed modified Wingate Tests with 2.5% of their body weight as the resistance (3 sets of 30 seconds with 2 minutes of active resting between sets, 3 times a week for 2 weeks). 24 hours after the last session of HIIT, the same dependent variables were assessed for post-test data collection. Results were expressed as mean ± SEM and analyzed with paired, one tail student t-test. **RESULTS:** The HIIT exercise reduced post-exercise BLA (pre-test: 11± 2.68; post-test: 9 ± 3.19, p<0.05), LDL cholesterol (17 ± 4.5% drop, compared to pre-test levels, p<0.05) and total cholesterol levels (9 ± 3% drop compared to pre-test levels, p<0.05), with no significant differences found in FBG, RHR or BP, and HDL cholesterol. **CONCLUSIONS:** HIIT was effective in lowering LDL and TC levels, and BLA during maximal anaerobic power exercise. Our results suggest that as reflected in long-term endurance exercise, short-term HIIT may also be a sufficient means of ameliorating cardiovascular risk factors, specifically bad cholesterol. Our results also suggest that HIIT would be effective to improve fatigue resistance evidenced by reduced lactate levels during maximal anaerobic power, which typically resulted from long-term endurance exercise. Taken together, our study supports emerging evidence that HIIT may be a potent mode of exercise contributing to preventing cardiovascular diseases.

208 Board #29 May 31 11:00 AM - 12:30 PM
ACSM Recommended Exercise of 30 minutes Per Day Improves Aerobic Capacity Similar to 60 minutes Per Day in Individuals with NAFLD

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The effects of two different exercise doses on improving aerobic capacity (VO_{2peak}) in obese individuals with nonalcoholic fatty liver disease (NAFLD) is unknown. **PURPOSE:** The aim of this study was to evaluate the effect of the American College of Sports Medicine physical activity guidelines for adults (30min/d) on aerobic capacity compared to a high dose (60 min/d) in obese persons with NAFLD. **METHODS:** Eighteen obese people (mean ± SD, Age 46.8±5.2 years, BMI=37.3±4.9 kg/m²) with NAFLD were randomized to 16 weeks of verified exercise training (45-55% VO_{2peak} , 5 days/week) to either a low dose (LD, 30 min; n=9) or high dose (HD, 60min/day, n=9). Aerobic capacity (VO_{2peak}) was measured on a motor-driven treadmill. Participants walked to volitional exhaustion using the Balke treadmill protocol. Dual Energy X-ray Absorptiometry (DXA) was used to measure body weight (BW) and percent body fat. Magnetic resonance spectroscopy was used to evaluate (intrahepatic triglyceride) IHTG content. All measures were performed at baseline and 16 weeks. **RESULTS:** Aerobic capacity significantly (p<0.05) improved in both the LD (9.8 ± 2.8%) and HD (8.6 ± 3.0%) from baseline to 16 weeks with no significant (p>0.05) difference between groups. There were no between group differences for IHTG, BW, or percent body fat so data was combined. Exercise training resulted in a 10.5±4.7% decrease in IHTG content (p<0.05), but did not change total body weight (103.5±4.0 kg and 102.7±3.0 kg) or percent body fat (39.0 ±2.0% and 38.5±2.1%) from baseline to 16 weeks. **CONCLUSION:** Performing verified physical activity as recommended by the ACSM improves aerobic capacity, IHTG, and body composition similarly to a higher exercise dose of 60min/day in obese persons with NAFLD.

209 Board #30 May 31 11:00 AM - 12:30 PM
Types of Social Support and Weight Change among Overweight Adults

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Engaging social support has been found to be an effective strategy to promote weight loss. Yet, little is known about the specific types of social support that may be the most influential. **PURPOSE:** The aim of this study was to examine the association between weight change and the types of social support adults participating in a behavioral weight loss intervention identified as the most helpful for their weight loss efforts. **METHODS:** Overweight adults (N=36) were randomized to one of two, 16-week behavioral weight loss interventions. Both treatments consisted of weekly, in-person group counseling sessions, Fitbit Zips for monitoring physical activity, and scales for monitoring body weight. One group also received two extra Fitbit Zips and scales to share with up to two persons in their social circle. There were no significant differences between conditions, so analyses collapsed groups and examined those who started the intervention (N=35). Participants completed an online survey at the end of each intervention week, which asked them to select the most helpful type of social support they received (informational; tangible; network; emotional; esteem). The support type

identified the most frequently as the most helpful type over time was determined for each participant and used in Fisher's exact tests to measure the frequencies with which each type of support was reported between those who lost > 5% of their initial body weight and those who did not. **RESULTS:** Participants were obese at baseline (M BMI = 36.1 + 7.3 kg/m²), and 43% lost > 5% of their initial weight by 16 weeks. Only emotional, esteem, and tangible support emerged as the most frequently reported most helpful types of support among all participants across the intervention period. A greater proportion of those who lost > 5% of their baseline weight identified esteem support as the most helpful type of support versus those who lost < 5% of their initial weight (47% vs 10%, p = .02). No significant differences between weight change groups were found for other support types (ps > .05). **CONCLUSION:** These findings suggest that esteem support may be especially influential for fostering weight loss. However, future studies should employ designs that allow for the direct comparison and more robust evaluation of the effectiveness of different types of support on weight loss in adults.

210 Board #31 May 31 11:00 AM - 12:30 PM
The Effect Of A Hiit And Resistance Exercise Program On Body Composition In Obese Females

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PURPOSE: High intensity interval training (HIIT) has shown reductions in fat mass in normal weight populations¹ equal to or superior than continuous training. However, limited literature exists on the benefits and feasibility of HIIT training with obese participants. Furthermore, it is not known the additional benefits of incorporating resistance training with HIIT training on body composition for obese participants. The purpose of this study was to examine the effect of a 10-week HIIT and resistance training intervention on body composition in obese females. **METHODS:** 20 women (M Age = 37.1 ± 7.4) participated in a 10-week exercise intervention consisting of a high intensity interval treadmill protocol and resistance training three times a week for a total of 30 sessions. Body composition was assessed with the iDexa. **RESULTS:** Participants significantly (p=.007) increased lean mass from pre (107.5±16.4) to post (110.2±18.2) and significantly decreased fat mass from pre (101.93±33.5) to post (96.7±32.7). Greatest fat loss occurred in android (p=.007) and visceral (p=.006) area. **CONCLUSIONS:** Based on the results of this study, HIIT training is a feasible intervention to reduce fat in obese individuals. Combining HIIT training with a resistance training program resulted in favorable body composition changes in obese females.

211 Board #32 May 31 11:00 AM - 12:30 PM

Beat The Street - Harnessing Gamification For Population Level Changes In Physical Activity
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Purpose
 Intelligent Health delivers 'Beat the Street' with the aim to get a whole community more physically active. Beat the Street turns the town into a real-life game where players register their walking and cycling journeys by tapping a smartcard on RFID readers called 'Beat Boxes' placed on lampposts around the town. Players monitor their progress via a website where they can see their own and their team's progress, and the overall target
Methods
 During registration, participants complete a questionnaire which includes a single item physical activity question¹. follow up surveys take place at the end of the game and up to 8 months later. Pre-intervention/post-intervention comparisons are completed based on survey responses and in-depth analysis is completed based on data from each player's activity by tapping their card on beat boxes.
Summary of Results:
 In 2015, Intelligent Health delivered 11 Beat the Street projects, engaging 170,000 participants and collected baseline survey data from 45,136 adults. In 2016 prior to September, Intelligent Health delivered 15 Beat the Street projects, and reached the milestone of 500,000 people engaged and collected baseline survey data from 53,234 players. In 2015, across all Beat the Street projects the proportion of people reporting 0 or 1 days of physical activity decreased from 14% before Beat the Street to 8% after. The proportion meeting WHO guidelines increased from 43% to 48%, and the proportion of people walking for 15+ minutes on 5-7 days per week increased from 54% to 63%. In 2016, across all Beat the Street projects the proportion of people reporting 0 or 1 days of physical activity decreased from 8% before Beat the Street to

1% after. The proportion meeting WHO guidelines increased from 46% to 57%, and the proportion of people walking for 15+ minutes on 5-7 days per week increased from 47% to 61%.

Conclusion

Intelligent Health's analysis from the 26 completed Beat the Street projects to-date suggests that the concept of turning a whole community into a game leads to immediate changes in population levels of physical activity.

212 Board #33 May 31 11:00 AM - 12:30 PM

A Randomized Trial of Chinese Traditional Health-Promoting Exercises for Ankylosing Spondylitis

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PURPOSE: The purpose of this study was to evaluate the influence of a 12-week traditional Chinese Qigong exercise (TCQG) on physiological and physical functions in patients with Ankylosing Spondylitis (AS).

METHODS: Sixty patients diagnosed with AS according to the modified criteria of New York were randomly assigned into either experimental (n = 30) or control groups (n = 30) using a computer-based random generator. AS patients in the experimental group experienced 60-minute Daoyinshu Qigong session twice per week for 12 weeks, whereas AS patients in the control group stayed with their original lifestyle during the 12-week intervention period. The TCQG exercise consisted of 15 basic movements associated with deep breathing, chest expansion, trunk rotation and bending, hip extension and flexion, flying bird movements, opening and closing the hands, and waving hands in the clouds. Health-related outcome measures included Modified Schober Flexion Test (MSF), Finger-to-floor test (FF), and Chest Expansion Test (CE), administered by two certificated physicians. The intragroup data within both groups were compared with the paired t test. The intergroup comparison of changes between baseline and week 12 was investigated with the unpaired t test.

RESULTS: AS patients in the experimental group showed an improvement from baseline to week 12 in all three outcome measures (p = .000), whereas the control group only showed an improvement in Finger-to-floor test (p = .012). For the intergroup comparison, significant differences were only observed in MSF (p = .001) and CE (p = .041), but FF (p = .483). More specifically, the experimental group showed greater improvement in the two tests than the control group.

CONCLUSIONS: Traditional Chinese Qigong exercise is effective in improving spinal mobility, chest expansion, and flexibility. Clinicians could incorporate the TCQG routine into rehabilitation program for patients suffering from AS.

213 Board #34 May 31 11:00 AM - 12:30 PM

Moderate Versus High Intensity Interval Exercise Training Reduce the Clinical Components of Metabolic Syndrome in Physically Inactive Adults: A Randomized Clinical Trial

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PURPOSE: Metabolic syndrome (MetSyn) increases the risk for morbidity and mortality from cardiovascular disease and exercise training is a fundamental factor in the treatment and prevention the clinical components of MetSyn. We conducted this study to investigate how an exercise program affects the risk components of MetSyn and exercise capacity in physically inactive adults. **METHODS:** Twenty inactive adults were randomly allocated to receive either moderate intensity training (MCT group) or high intensity interval training (HIT group). The MCT group performed aerobic training at an intensity of 55-75% of the walking on a treadmill at 60-80% heart rate max (HRmax) until expenditure of 300 kcal until the end of training. The HIT group performed running on a treadmill during 4 minutes at 85-95% peak HRmax and had a recovery of 4 minutes at 65% peak HRmax until expenditure of 300 kcal until the end of training. A MetSyn z-score was calculated for each subject from triglycerides, HDL-c, fasting glucose, waist circumference, and arterial blood pressure (MAP). Blood lipids and glucose, waist circumference, MAP and exercise capacity were measured at baseline and 12-weeks thereafter.

RESULTS: Z-score MetSyn changes were 1.546 (1.575) in the MCT group, -1.249 (1.629) in the HIT group (difference between groups -2.795 [95% CI, 1.276 to 4.311 (P=0.001)]. Average cardiometabolic risk factors changed -0.133 in the MCT group (p=0.040) and 0.018 (p=0.294) in the HIT group. There was a significant decrease in glucose fasting from 0 to 12 weeks in MCT group (P=0.039) compared to 12 weeks for the HIT group (P=0.001). Waist circumference was significantly reduced at 12 weeks compared to 0 weeks in HIT (P=0.010). Percentage body fat did not change in the MCT group 0.0 (0.8) and decreased in HIT group -1.1 (difference between groups 1.2 [95% CI, 0.1 to 2.4 P=0.04]). Muscle mass significantly increased throughout the 12 weeks of training in high intensity with significant differences between groups 0.8 kg [95% CI, 0.3 to 1.3 P=0.027]. MAP was significantly reduced from 0 weeks at 12 weeks in HIT group (P=0.019).

CONCLUSIONS: In inactive adults, this study showed that a 12-week HIT program can improve the clinical risk factor profile for MetSyn.

214 Board #35

Abstract Withdrawn

215 Board #36

May 31 11:00 AM - 12:30 PM

Self-care Posters Serve As A Low-cost Option For PA Promotion Of Hospital Nurses

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Overweight and obesity prevalence is higher in nursing than other healthcare and non-healthcare occupations in part due to minimal participation in physical activity (PA) not required for work. Nurses cite long shifts as a barrier to PA participation. Additionally, PA promotion efforts rarely target staff in the hospital setting.

PURPOSE: To examine the impact of PA monitoring and a poster campaign on the PA behaviors of hospital nurses. **METHODS:** A total of 26 nurses (control: n=13; experimental: n=13) participated in this study. Instructional exercise posters and lifestyle modification posters specific to the nursing profession were hung in the breakroom of two experimental hospital units. Posters were replaced every two weeks for a total of eight weeks. All subjects completed a PA behavior survey pre (week 1) and post (week 10) intervention. Subject PA was objectively monitored with an Actigraph wGT3X-BT accelerometer for 24 hours on three workdays during weeks 1, 5, and 10. All subjects were provided a pedometer in week 2 and received an activity time and intensity breakdown after each accelerometer wear period. PA changes were analyzed with a repeated measures ANOVA. **RESULTS:** Subjects spent more time sedentary (15.3±0.02 vs. 7.0±0.01%), took fewer steps (522.8±47.1 vs. 659.9±38.8 steps/hr), and engaged in less moderate intensity activity (9.8±0.6 vs. 8.0±0.6%) at home than at work independent of condition and study phase, p<0.05. Both groups increased activity-specific caloric expenditure (36.2±3.7 vs. 42.1±3.8 kcal/hr) and step count at home (472.9 vs. 610.9 steps/hr) from week 1 to week 5 (p<0.05). By week 10, activity levels were no longer statistically different than week 1 for either group (p>0.05). In contrast, subjects who incorporated PA into work breaks continued to increase caloric expenditure (+24.9±15.4%) and MVPA (+30.9±18.2%) from week 5 to week 10, p<0.05. At post-test, six experimental subjects were regularly performing exercises depicted in wall posters at work and/or at home compared to two control subjects who participated in PA breaks throughout the study duration.

CONCLUSION: Instructional and motivational posters promoting self-care are more likely to induce lasting changes on the daily PA behavior of hospital nurses than information provided through PA monitoring devices.

216 Board #37

May 31 11:00 AM - 12:30 PM

Zumba Fitness To Improve Body Composition & Physical Fitness In Inactive Employed Females

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PURPOSE: to investigate the effect of two exercise interventions based on Zumba Fitness and Bodyweight training on body composition and physical fitness in inactive employed females. **METHODS:** A total of 56 inactive employed female participated in this study (38.7±1.00-yr). The sample was randomly divided into two groups: Zumba Fitness (Z, n=28, 1hour/per session) and Zumba Fitness + 20 minutes of Bodyweight training (ZB, n=28, 1.33 hours/per week), including both 3 days per week. Body composition (BMI, Fat mass, muscle mass and 6-skinfold) and Physical Fitness through Alpha Fitness Battery for adults: Motor fitness (one leg stand test), Musculoskeletal fitness (shoulder and neck mobility test, jump and reach test, hand-

grip test and sit up test), and cardiorespiratory fitness (2-km test) was analyzed at baseline and 16-weeks post-interventions. A Factorial Anova was used to analyze the effects and interactions of the type of intervention and the measure moments on body composition and physical fitness variables. **RESULTS:** The type of intervention showed a significant effect only in the case of rest heart rate after 2-km test, which was lower in ZB group compared with Z group ($MD=9.53.45$ bpm, $p=0.011$). However, both interventions showed a significantly effects ($p<0.05$) on the majority of the studied variables compared baseline with post-intervention. BMI, fat mass, muscle mass, 6-skinfold, one leg stand test, hand grip test, and 2-km test, enhanced for both group after interventions, however, Z group reached the higher improvements. Shoulder and neck mobility test, sit up test and the Heart Rate post- 2km test, only improved after ZB intervention. **CONCLUSIONS:** Zumba Fitness intervention could improve the body composition and physical fitness in inactive employed females. Twenty minutes plus of bodyweight training seem not to generate changes in the variables studied.

217 Board #38 May 31 11:00 AM - 12:30 PM

Effects of Momentum-based Dumbbell Training on Quality of Life in Subjects with Mild Cognitive Impairments

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Mild cognitive impairment (MCI) is a transitional state between healthy aging and dementia. Individuals with MCI have been reported to reduce their cognitive and physical function and consequently worsen their quality of life and sleep quality. Given that no effective pharmacological treatment exists for MCI patents to alter the progress of cognitive decline exists, there is much interest in lifestyle approaches, such as exercise. Momentum-based dumbbell training is a self-initiated dumbbell-spinning exercise aimed at challenging, concurrently, physical and cognitive abilities. The health effects of this exercise on quality of life and sleep quality were unclear.

PURPOSE: The purpose of this study was to determine the effect of 12-week momentum-based dumbbell training on quality of life and sleep quality among older adults with MCI.

METHODS: We conducted a 12-week randomized controlled trial of 45 community-dwelling older adults with MCI. Participants were randomly assigned to either a dumbbell training group (DTG; $n=22$) or control group (CG; $n=23$). Participants in the DTG participated in a 3-time weekly exercise session for 12 weeks. The primary outcomes were changes in physical component summary (PCS) and mental component summary (MCS) of Short Form 36 health (SF-36) survey with secondary outcomes being eight subscales of SF-36 survey and the Pittsburgh Sleep Quality of Index (PSQI).

RESULTS: At post intervention, participants in the DTG, compared to those in the CG, had significantly improved SF-36 physical functioning (9.55 points; $F=4.14$, $P=0.048$) and vitality (16.51 points; $F=4.27$, $P=0.04$), PSQI total score (1.43 points; $F=4.08$, $P=0.05$) and sleep efficiency score (0.12 points; $F=7.13$, $P=0.01$). Compared to baseline, there was a significant within-group changes (improvement) in DTG group, including SF-36 MCS ($t=2.16$, $P=0.04$), the subscale of SF-36 ($t_{\text{bedly pain}}=3.56$, $P<0.01$; $t_{\text{vitality}}=4.84$, $P<0.01$; $t_{\text{mental health}}=3.96$, $P<0.01$) and PSQI total score ($t=-2.36$, $P=0.03$).

CONCLUSION: There is preliminary evidence showing the potential benefit of momentum-based dumbbell training to improve quality of life and sleep quality in older adults with mild cognitive impairment.

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218 Board #39 May 31 11:00 AM - 12:30 PM

Momentum-based Dumbbell Training Improved Cognitive Function in Older Adults with Mild Cognitive Impairment

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Mild cognitive impairment (MCI) is a transitional state between healthy aging and dementia, which has higher risk for developing Alzheimer's disease. Older adults with MCI also experience decline of motor control, affecting their health and independence. Studies have demonstrated that combined cognitive and exercise training may well provide greater cognitive and physical benefits. Momentum-based dumbbell training is a self-initiated spinning exercise that uses dumbbells to generate momentum while performing exercise movements with varying configurations aimed at concurrently challenging physical and cognitive abilities.

PURPOSE: The main purpose of our study was to explore the effects of momentum-based dumbbell training on cognitive function in older adults with MCI. A secondary purpose was to examine its effects on physical function.

METHODS: Forty-five community-dwelling older adults with MCI were randomly assigned to either a dumbbell training group (DTG; $n=22$) or control group (CG; $n=23$). Participants in the DTG participated in a 3-time weekly exercise session for 12 weeks. All outcome measures were taken at baseline and post-intervention, including Alzheimer's Disease Assessment Scale-Cognitive subscale (ADAS-Cog), Mini-Mental State Examination (MMSE), Montreal Cognitive Assessment (MoCA), Trail Making Test-A/B (TMT-B), Digit Span Test-Forward/Backward (DST-F), Timed Up & Go (TUG), Timed 10m walking, Functional Reach (FR) and Berg Balance Scale (BBS).

RESULTS: Compared to those in the CG participants in the DTG had significantly improved ADAS-Cog (5.02 points, $F=6.95$, $P=0.012$ and MMSE score (1.23 points; $F=4.84$, $P=0.03$) with moderate and high effect size ($ES=1.28-0.51$). There were significant within-group changes (improvement) in ADAS-Cog ($t=-2.34$, $P=0.03$), MMSE ($t=2.00$, $P=0.06$), MoCA ($t=3.85$, $P<0.01$), TMT-A/B ($t=-2.80$, $P=0.01$; $t=-3.09$, $P=0.01$) and DST-B ($t=2.41$, $P=0.03$). Participants in the DTG improved their functional mobility (TUG= $0.81s$, $F=4.34$, $P=0.043$). There was no between-group difference in other outcomes.

CONCLUSION: A 12-week momentum-based dumbbell training can improve cognition and physical function in older adults with MCI, especially global cognitive function and mobility.

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219 Board #40 May 31 11:00 AM - 12:30 PM

Departmental Variations in Wellness And Fitness Characteristics Of Firefighters

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PURPOSE: Firefighters have a very physically demanding and dangerous occupation, resulting in high rates of cardiovascular and musculoskeletal disorders. Specific guidance on implementing wellness and fitness programs to promote adherence and long-term health improvements in firefighters is largely unavailable. The purpose of this study was to assess departmental variations in key wellness and fitness characteristics of firefighters.

METHODS: A cross-sectional study was conducted in career firefighters ($n = 264$; 32 F, 232 M) from 4 fire departments in the Tampa Bay region of Florida. Baseline data were assessed in participants enrolled in a worksite injury prevention trial, including anthropometric and health variables (e.g. BMI, blood pressure, heart rate), physical fitness (back and core muscular endurance, Functional Movement Screen), and health history (e.g. musculoskeletal injury history, Mediterranean Diet Questionnaire, International Physical Activity Questionnaire). Data were compared across the 4 departments.

RESULTS: Significant differences were noted across the departments in systolic blood pressure ($p = 0.0002$), heart rate ($p = 0.003$), physical activity ($p = 0.04$), and low back pain history ($p < 0.0001$). No significant differences were observed in other assessed variables. Of the total sample, 35.6% had high systolic blood pressure, 83.0% were overweight or obese, 60.6% reported a low or moderate physical activity level, and 66.3% reported a history of low back pain.

CONCLUSIONS: This study indicates departmental variations exist in some wellness and fitness characteristics among firefighters within the same region. These results are consistent with subjective observations from our group and others. For optimizing the implementation of wellness and fitness programming in firefighters, efforts should consider departmental variations by emphasizing standardization of approaches across fire departments, particularly when regional initiatives are implemented.

220 Board #41 May 31 11:00 AM - 12:30 PM

VO₂max and HbA1c 3 Months After Participating In High-intensity Aerobic Interval Training Among Persons With Type 2 Diabetes.

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PURPOSE: It remains to be established how participating in exercise interventions affect long-term effects on VO_{2max} and HbA1c among individuals with type 2 diabetes (T2D). The present study investigated VO_{2max} and HbA1c 3 months after participating in a 12 weeks training intervention consisting of high-intensity aerobic interval training (HAIT) (baseline HbA1c of 7.7%). The results were compared with a moderate-intensity continuous training (MICT) group with HbA1c levels below the recommended HbA1c treatment goal of <7.0% (baseline HbA1c of 6.9%).

METHODS: HAIT consisted of 4x4 minutes of walking or running uphill at 85-95% of maximal heart rate, and MICT consisted of continuous walking at 70-75% of maximal heart rate. After the training intervention, the participants chose themselves how to exercise during the next three months, and all training sessions were registered. **RESULTS:** 19 individuals in each training group completed 12 weeks of supervised training, while 16 in HAIT and 10 in MICT completed the 6 months follow up. 3 months after intervention. HbA1c in HAIT was reduced by 0.7% points to 7.0% (p<0.01), and was thus close to recommended HbA1c treatment goal of <7.0%. The change in HbA1c was found after the intervention (from 7.7 to 7.1%) and was thus unchanged in the last 3 months (7.0%). VO_{2max} increased by 19% during the intervention (from 24.1 to 28.8 ml⁻¹·kg⁻¹·min⁻¹, p<0.01) and was also unchanged in the last 3 months after intervention (28.0 ml⁻¹·kg⁻¹·min⁻¹). No change was found in either VO_{2max} or HbA1c in MICT between the three measurement time points (25.9, 25.4, 26.4 ml⁻¹·kg⁻¹·min⁻¹ and 6.9, 6.8, 6.9%, respectively). The difference between HAIT and MICT after the 12 week intervention was statistical significant for both HbA1c and VO_{2max} (p<0.01). **CONCLUSIONS:** HAIT is an effective exercise strategy to improve aerobic fitness and reduce HbA1c in T2D. The results from HAIT were still kept after 6 months.

221 Board #42 May 31 11:00 AM - 12:30 PM
The Relationship Between Gestational Weight Gain, Physical Activity, And Sleep Quality: A Preliminary Report

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PURPOSE: Excess gestational weight gain (GWG) increases the risk for adverse maternal and fetal outcomes. Recent reports link sleep deficiency to excess GWG; however, evidence in non-pregnant women suggests that physical activity improves sleep duration and sleep efficiency. Our objective is to report preliminary findings from a randomized aerobic exercise intervention throughout pregnancy, on the association between sleep quality, GWG, and the modifying effects of physical activity. **METHODS:** Thirteen mothers provided objective physical activity duration, total sleep time, and sleep efficiency via the SenseWear Armband (BodyMedia Inc.) for 5 consecutive days during the 1st, 2nd, and 3rd trimester. Physical activity level (PAL) was expressed as total energy expenditure divided by resting energy expenditure. GWG was calculated as pre-pregnancy weight (measured at 8-13wks) subtracted from weight at delivery. Appropriate versus excess GWG were categorized using 2009 IOM guidelines. **RESULTS:** Sleep duration significantly decreased from the 1st trimester to the 2nd trimester (Mean ± SEM = 436.1 ± 34.7 vs. 381.1 ± 30.0min, p=0.03) and plateaued in the 3rd trimester (381.1 ± 30.0 vs. 306.6 ± 29.0min, p>0.05). There was no difference in sleep efficiency throughout pregnancy. Compared with mothers with appropriate GWG, mothers with excess GWG acquired less sleep (389.6 ± 21.7 vs. 292.1 ± 36.1min, p=0.035) and slept less efficient (81.0 ± 3.8 vs. 61.6 ± 6.4%, p=0.029). Mothers randomized into the exercise intervention had higher sleep duration (412.8 ± 19.7 vs. 301.8 ± 23.8min, p=0.002) and better sleep efficiency (82.5 ± vs. 64.4 ± 4.7%, p=0.007) compared with controls. Multiple linear regression models assessing the independent effects of GWG and exercise intervention on sleep quality demonstrate that aerobic physical activity explains 39% of the variance in sleep duration and 31% of the variance in sleep quality, with no significant effects from GWG. **CONCLUSION:** Our findings suggest that physical activity may be a potentially effective way of improving sleep quality in pregnant women with or without excess gestational weight gain.

222 Board #43 May 31 11:00 AM - 12:30 PM
Effect of Moderate Versus High Intensity Interval Exercise Training on Vascular Function in Inactive Latin-American Adults: A Randomized Clinical Trial

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PURPOSE: Exercise training is effective for improving cardiometabolic health and physical fitness in inactive adults. However, limited research has been conducted on the optimal exercise training intensity for this population. We investigate the effect

of moderate versus high intensity interval exercise training on vascular function and physical fitness in physically inactive adults. **METHODS:** Twenty inactive adults were randomly allocated to receive either moderate intensity training (MCT group) or high intensity interval training (HIT group). The MCT group performed aerobic training at an intensity of 55-75% of the walking on a treadmill at 60-80% heart rate max (HRmax) until expenditure of 300 kcal until the end of training. The HIT group performed running on a treadmill during 4 minutes at 85-95% peak HRmax and had a recovery of 4 minutes at 65% peak HRmax until expenditure of 300 kcal until the end of training. Vascular function (flow-mediated vasodilation, FMD [%], aortic pulse wave velocity, PWV [m·s⁻¹]), blood lipids [fasting glucose, triacylglycerol, total cholesterol, LDL-cholesterol, HDL-cholesterol], blood pressure, and physical fitness (Muscle strength [handgrip [kg]], exercise capacity [VO_{2peak} and graded exercise test duration [minutes]], were measured at baseline and 12-weeks thereafter. **RESULTS:** FMD changes were 2.2 (4.9) % in the MCT group, 7.7 (5.3) % in the HIT group (difference between groups -5.4 [95% CI, -10.3 to -0.6 (P<0.001)]. PWV changed 0.1 in the MCT group but decreased -0.3 in the HIT group, (not significantly different from the MCT or HIT group, P between groups = 0.91). Percentage body fat did not change in the MCT group 0.0 (0.8) but decreased in HIT group, -1.1 (difference between groups 1.2 [95% CI, 0.1 to 2.4 P between groups = 0.04]). No significant group differences were observed in physical fitness, blood lipids or blood pressure. **CONCLUSIONS:** HIT is more effective in improving endothelial function and reducing body fat than MCT in inactive Latin-American adults. **Trial registration.** ClinicalTrials.gov NCT02738385, registered on 23 March 2016.

223 Board #44 May 31 11:00 AM - 12:30 PM
Changes in Endothelial Function Following Fat Sugar Snacking With and Without Exercise Training

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 (No relationships reported)

PURPOSE: Caloric excess induces endothelial dysfunction. Exercise can improve endothelial function or mitigate the negative effects of excess caloric intake. We hypothesized that exercise training would prevent deterioration in endothelial function associated with 4 weeks of fat-sugar snacking. **METHODS:** 27 overweight/obese (BMI = 30.0±3.7 kg/m²) males (age = 29±7 yr) underwent 4 weeks of added fat-sugar snacking (+14,579 ±413kcal), in the form of donuts (6 days/week) added to their regular diet. Participants were randomized to one of three conditions: 1,000 kcal/week supervised moderate-intensity (MICT; n=8) exercise (50% peak VO₂), 1,000 kcal/week supervised high-intensity interval (HIIT; n=10) exercise (90-95% peak heart rate), or no-exercise control (CON; n=9). All participants were tested in the morning following a >10 h overnight fast at baseline and 4 weeks. Endothelial function was assessed by brachial artery flow-mediated dilation (FMD) and was further normalized for shear rate (FMD/shear rate). Two-way repeated measures ANOVA was used to detect time, condition, or time x condition interaction effects. **RESULTS:** FMD was unchanged in all groups (Control: Pre FMD = 4.6 ± 1.2 %, Post FMD = 3.7 ± 2.1 %, p=0.28; HIIT Pre FMD = 6.0 ± 2.7%, Post FMD = 5.5 ± 2.3%, p=0.56; MICT Pre FMD = 6.2 ± 2.4%, Post FMD = 5.5 ± 2.4%, p=0.43). With all groups combined there was a trend towards a reduction in FMD (p=0.16) and FMD/shear rate (p=0.09). Baseline diameter, peak diameter, blood flow velocity and shear rate were unchanged within all groups (p > 0.05). **CONCLUSIONS:** The addition of ~14,500 kcal of fat-sugar snacks in the form of donuts to the regular diets of overweight/obese men over a 4-week period was insufficient to induce deleterious changes in endothelial function. The consumption of additional energy predominantly as fat and sugar may have prevented improvements in FMD expected with HIIT and MICT.

224 Board #45 May 31 11:00 AM - 12:30 PM
A Feasibility RCT: Understanding Impact of Community Gardening on Physical Activity and Sedentary Behavior

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 (No relationships reported)

PURPOSE: To investigate the feasibility of using accelerometers to objectively measure physical activity (PA) during gardening to provide preliminary evidence for a large scale gardening intervention. **METHODS:** This randomized control trial was conducted in 2016 in a Denver low-income community. Repeated measures of PA and sedentary behavior (SB) were compared at two time points (T1: June and T2: October) between two groups (TG = gardeners and NG = non-gardeners). At both T1 and T2,

12 participants (mean age, 44.09 ± 16.26 years) wore the activPAL accelerometers for a 6-day period (including 2 weekend days). Each day, time spent in sedentary time, standing, walking at cadences above and below 120 steps/min, and number of steps were measured, and energy expenditure (EE) in metabolic equivalent-hour was estimated. The data were analyzed using MatLab and SAS. **RESULTS:** At T1, no significant differences ($p > .05$) for overall (weekday and weekend) sedentary, standing, walking times, and EE were detected between TG and NG. Unexpectedly, the TG had lower step counts (1.25 ± 0.35 vs. 2.05 ± 0.47 hrs, $P < .05$) compared to the NG at the <120 steps/min cadence at T1. From T1 to T2 data, the NG significantly increased time spent sedentary (1.09 ± 0.65 hrs, $p < .05$), significantly decreased time spent standing on weekdays (-0.98 ± 0.33 hrs, $p < .01$), and marginally significantly decreased overall time spent standing (-0.56 ± 0.45 hrs, $p = .09$). No significant changes were found between T1 and T2 in TG, nor did any other variables in either TG or NG change. The increased sedentary time and the decreased standing time in the NG but not TG indicated that gardening may protect against sedentary time and maintain PA. One gardener dropped out at T1 and two NGers started late at T2 (we have to submit the abstract before getting their data). All other participants wore the accelerometers for all six days (24 hrs/day), which indicates a good compliance. **CONCLUSIONS:** The accelerometers successfully tracked subjects' PA and SB for sedentary, standing and walking indicating that activPAL accelerometry is a feasible approach for assessing PA and SB. Although the results should be interpreted cautiously due to the small sample size, which precluded adequate statistical power, the study demonstrated feasibility of testing methods for a large scale gardening study.

225 Board #46 May 31 11:00 AM - 12:30 PM
Compensatory Mechanisms to Exercise Induced Energy Deficit
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(No relationships reported)

In recent years, more emphasis has been put on the importance of the role of exercise and proper diet in successful weight management. Weight loss due to an exercise induced energy deficit without changes in dietary intake is generally less than expected.

PURPOSE: The purpose of this study was to compare 24 hour changes in appetite/satiety and daily physical activity following bouts of either 200 or 400 kcal of aerobic exercise (walking) in sedentary overweight/obese ($BMI \geq 25$) college age females. **METHODS:** Overweight/obese college age girls ($n=19$) were recruited and scheduled for 3 trials. The exercise trials consisted of walking at 70% of their heart rate reserve on a treadmill until they expended either 200 or 400 kcal. Energy expenditure was verified by indirect calorimetry. The third trial was a non-exercise control. The order of the trials was randomized. Changes in physical activity (sit/lie time, sleep time, and standing time) were measured using the ActivPal³ accelerometer during the 24 hours post exercise. Changes in appetite/satiety were measured via Visual Analog Scales immediately before and after the exercise session and at 60, 120, and 180 minutes following each trial.

RESULTS: There were no significant changes in sit/lie time between the 200K (575.7 ± 144.6 minutes), 400K (613.7 ± 90.1 minutes), and control trials (554.0 ± 113.3 minutes). There were no significant changes in sleep time between the 200K (532.6 ± 105.6 minutes), 400K (529.7 ± 91.9 minutes), and control trials (570.9 ± 91.8 minutes). There were no significant changes in stand time between the 200K (223.1 ± 110.1 minutes), 400K (187.5 ± 85.0 minutes), and control trials (216.6 ± 95.0 minutes). There was no difference in the appetite between the 200K (27.4 ± 12.2 cm), 400K (25.4 ± 12.9 cm), and control trials (30.4 ± 12.9 cm). There were no significant changes in satiety between the 200K (30.5 ± 17.5 cm), 400K (33.1 ± 15.0 cm), and the control trials (33.3 ± 14.6 cm).

CONCLUSION: In overweight/obese, college age females an exercise bout of either 200 or 400 kcal does not result in changes in daily physical activity or appetite/satiety in the 24-hour period immediately following the exercise session.

226 Board #47 May 31 11:00 AM - 12:30 PM
Examination Of Cardiovascular Risk Factors Among University Employees Participating In A Workplace Walking Program
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PURPOSE: Worksite sponsored physical activity programs are prevalent at universities in an effort to improve health indicators, including risk factors for cardiovascular disease. The purpose of this project was to compare cardiovascular risk factors of university employees participating in a worksite sponsored walking program versus those who did not participate. **METHODS:** The research was a matched pairs design, with two groups. The study group ($n=31$) participated in the "Workplace

Walkoff Challenge" for six weeks, while the control group ($n=11$) did not participate. All cardiovascular risk factors, as defined by ACSM Guidelines, were assessed two weeks prior to the start of the walking program and then repeated during the last week. Risk factors assessed included family history, age, smoking status, physical activity amount, blood pressure, body composition (waist circumference and BMI), dyslipidemia (total cholesterol, HDL, LDL), and fasting glucose. To assess differences in these variables, dependent t-tests were performed.

RESULTS: Walking program participants significantly improved their physical activity amount ($p=.05$), body mass index ($p=.003$), waist circumference ($p=.03$), diastolic blood pressure ($p=.005$) and fasting glucose ($p<.001$) from baseline to end of program. There were no significant improvements for participants in systolic blood pressure or cholesterol (total and HDL). Despite a trend, there was no significant decrease in total number of risk factors following the walking program. The control group had no significant changes in physical activity, BMI, waist circumference, blood pressure or fasting glucose from baseline to follow up. However, the control group had a significant reduction in total cholesterol ($p=.05$). **CONCLUSIONS:** The participants in the walking program had many health indicators improve following the six week walking program. Therefore, short-term worksite walking programs may be effective in improving cardiovascular risk factors. Future research should focus on programming's effect on long-term adherence to physical activity and improvement of health indicators.

227 Board #48 May 31 11:00 AM - 12:30 PM
Occupational Sitting and Physical Activity among College Employees
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Time spent in sedentary behavior (i.e., < 1.5 METs while reclining), is linked to poor health outcomes. Persons who spend considerable periods of time daily in unbroken sitting are at higher risk of cardiometabolic disease. As sedentary time emerges as an independent health risk factor, the workplace has come under greater scrutiny due to its high percentage of computer-based, sedentary jobs. University employees were recently shown to spend 75% of their workday seated (Fountaine et al. 2014). However, apart from this study, little is known about sedentary behavior among employees at academic institutions.

PURPOSE: We subjectively assessed occupational sitting and physical activity of employees at a 4-year, private college. **METHODS:** At the start of the 2016 fall semester, all members ($N = 697$) of the college community received an online version of the Occupational Sitting and Physical Activity Questionnaire (OSPAQ; Chau et al., 2012). The OSPAQ measures perceived time spent in sitting and physical activity. 343 employees (49%) provided complete responses to the survey. Employees reported working 8.3 ± 1.8 hours per day. **RESULTS:** Data were expressed as raw and percent time spent sitting, standing, walking and heavy lifting. Administrators reported spending more hours (46.2 ± 10.0 hr/wk) and days (5.5 ± 0.8 d/wk) at work than faculty (45.0 ± 13.1 hr/wk and 5.1 ± 0.9 d/wk) and staff (40.4 ± 8.6 hr/wk and 5.2 ± 0.8 d/wk). One-way ANOVAs were computed to examine differences among employee categories (staff, administrator, faculty). For time spent walking (68.4 ± 53.4 min/day; $13.9 \pm 10.3\%$ time) or heavy lifting (11.3 ± 28.3 min/day; $2.3 \pm 5.6\%$ time) no significant differences existed among employment categories. Administrators sat (372.2 ± 112.8 mins/day; $73.2 \pm 17.7\%$) significantly more than faculty (314.5 ± 138.8 mins/day; $58.5 \pm 19.6\%$) and staff (315.1 ± 115.8 mins/day; $68.5 \pm 24.2\%$). Faculty stood (136.4 ± 89.2 mins/day; $25.8 \pm 14.8\%$) significantly more than administrators (62.1 ± 49.6 mins/day; $12.4 \pm 9.7\%$) and staff (67.8 ± 80.9 mins/day; $14.1 \pm 16.5\%$). **CONCLUSIONS:** Based upon our findings, targeted behavioral interventions are needed to help reduce the time that administrators spend sitting during their working day.

228 Board #49 May 31 11:00 AM - 12:30 PM
The Influence Of Physical Activities At The Workplace On Private Medical Center Employees
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(No relationships reported)

Being aware of the increase in obesity and sedentary lifestyle, many organizations develop intervention programs to improve the health of their employees by offering them various physical activities at work. **PURPOSE:** To assess the barriers of engaging in physical activity among medical center employees, and the mental and physical impact of participation in physical activity lessons at work. **METHODS:** 231 private medical center employees including physicians, paramedical and administrative staff participated in this study. 135 participants were not active

in the lessons and 96 (70%) who were active, practiced twice weekly in various activities: Pilates, yoga, running, cycling, and Zumba. **RESULTS:** The physical activity group was found to have a higher workplace satisfaction level ($p < .001$), a decrease in burnout ($p < .01$), better health perceptions ($p < .01$), lower weight ($p < .05$), a reduction in chronic morbidity and drug consumption ($p < .05$), less smoking and liquor consumption ($p < .01$), healthier eating and sleeping habits ($p < .001$) and more physical activity outside of working hours ($p < .01$). Among the main barriers to participate in the activity lessons at work for the non-active group were: unsuitable lesson schedule (62%) lack of desire for sport (61%), lack of time (53%), fatigue (44%), prior family commitments (39%), non-payment of activity time (35%), and unawareness of the physical activity programs (27%). **CONCLUSIONS:** Physical activity programs at medical centers promote employees health thereby neutralizing negative aspects such as worker burnout, mental and physical fatigue and increases employee satisfaction at the workplace. Therefore, more promotion of physical activity at the workplace should be encouraged in order to increase employee participation. However, further research is needed in public medical center to verify these research findings among healthcare employees.

229 Board #50 May 31 11:00 AM - 12:30 PM

Everyday Pedelec Use and its Effect on Meeting Physical Activity Guidelines

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While pedelecs became an important element of active transportation, little is known about the physiological responses during their everyday use so far. **PURPOSE:** To compare the heart rate (HR) response during everyday pedelec use and cycling and to determine if pedelecs are a suitable tool to meet American College of Sports Medicine (ACSM) physical activity guidelines for health benefits of 150 min moderate activity (64-76% of maximum HR (HRmax)) per week. **METHODS:** In a crossover design 101 employees recorded HR, duration and intensity of their rides via smart phone app during two periods, lasting two weeks each: one with a provided pedelec (P) and one with their own bicycle (B), in a randomized order. HRmax was determined in graded exercise tests on a cycle ergometer prior to the observation periods. **RESULTS:** The amount of trips per week was significantly higher during P compared to B (5.3 ± 4.3 vs. 3.2 ± 4.0 trips, $p < .001$). The average duration of trips did not differ significantly between P and B (37.5 ± 23.5 vs. 40.3 ± 27.8 min, $p = 0.45$). Perceived exertion during the trips was significant lower with P (11.7 ± 1.8 vs. 12.8 ± 2.1 , $p < 0.001$). Total ride time per week was significantly longer during P (174 ± 146 vs. 99 ± 109 min, $p < 0.001$). Average HR during P was significantly lower than during B (109 ± 14 vs. 118 ± 17 , $p < 0.001$) averaging 64 ± 8 vs. $67 \pm 9\%$ HRmax, respectively. There was no difference in the percentage of subjects meeting ACSM recommendations for physical activity between P and B (25 vs. 24% of subjects, $p = 0.86$).

CONCLUSIONS: In everyday use, average HR during pedelec trips is only three percent lower than during cycling and sufficient to classify the intensity as moderate. Higher usage rates make pedelecs an equal active transportation alternative for fulfilling ACSM guidelines, especially for people who normally would not use a bicycle.
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230 Board #51 May 31 11:00 AM - 12:30 PM
The Investigation On Health Status And Exercise Habit Of Chengdu Civil Servant

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Health is not only without disease or weakness, but also a good condition in physics, psychology and society. Civil servant is a special group, its health status has been aroused serious concern. **PURPOSE:** To understand the health status and exercise habits of civil servants in Chengdu, and helping to make formulation of the intervention to health status. **METHODS:** Using stratified cluster facilitation sampling method, 500 civil servants were randomly selected from Wuhou, Jinjiang, Qingyang, Jinniu and Chenghua District in Chengdu, conducted questionnaires of Health Rating Scale (SHMS V1.0, 40 questions about physical, psychological and social condition, reliability and validity have been verified) and exercise habit. Statistical analysis, T-test, one-way ANOVA and Pearson correlation analysis were conducted by SPSS19.0, $P < 0.05$ was considered statistically significant. **RESULTS:** ① 500 were sent out, 459 recycled, missing up to 2% were delete, 418 were valid. The healthy is only 6.70% (28/418), psychological unhealthy was the most, accounting for

76.08% (318/418). ② Male civil servants of non-health accounts 77.32%, higher than 68.75% of female ($P < 0.05$). ③ 50 to 59 year-old group was the highest 84.75% ($P < 0.05$), 20-29 was the second. ④ About exercise habits, 70.33% (294/418) are for keep fit. 3/week and 30-60min are the most, 61.72% (258/418) and 53.59% (224/418). Sitting 5-8 h/d and more than 8 h/d are the most, 38.28% (160/418) and 34.45% (144/418). ⑤ Duration time and unhealthy score are significant correlation ($P < 0.05$), while frequency and sitting time are not ($P > 0.05$). ⑥ Less than 30min and 30-60min have great difference in unhealthy score, physical and psychological. Less than 30min and more than 60min shows significant difference in unhealthy score, physical and social ($P < 0.05$). ⑦ 3-5/week and more than 5/week shows significant difference in psychological unhealthy ($P < 0.05$). Less than 3/week shows no significant difference with other group ($P > 0.05$).

CONCLUSIONS: ① The health status of civil servants in Chengdu is not prospective, and their sitting time is a little long. ② Exercising more than 30min can make great difference of health status in physics, psychology and society. Combining with frequency, 3-5/week and more than 30min/time are the best intervention.

231 Board #52 May 31 11:00 AM - 12:30 PM

Feasibility Of A Student-led University Wellness Initiative

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Exercise Science students have a unique opportunity to contribute to the wellness of their university community while also improving their own practical experience. **PURPOSE:** The aim of this study was to assess the feasibility and effectiveness of a low-budget wellness initiative at a small liberal arts university. **METHODS:** Deliberate choices were made throughout the planning phase to reduce cost and improve feasibility, even when it necessitated a less valid approach. Thirty-eight Exercise Science students with varying levels of education volunteered to be research assistants. An entirely online enrollment process was developed using Google Forms that included informed consent, PAR-Q, demographic information, activity history, and wellness. A baseline assessment of physical fitness included height and weight (digital scale with stadiometer), waist and hip circumference, 1-mile walk or 1.5-mile run, and resting and exercise heart rate (assessed via radial pulse). Participants were asked to log their self-reported total minutes of weekly physical activity and average rating of perceived exertion (6-20 scale). The product of activity duration and perceived exertion served as a numerical activity score. The student research assistants then contacted their assigned participants weekly for 10 weeks to record activity and create accountability. **RESULTS:** The feasibility of this study and \$2,000 budget allowed for a maximum of 450 participants. Of the 180 participants who completed the online enrollment process and scheduled their baseline fitness assessment, 117 actually showed up and were tested. While the initiative targeted the entire campus community, our study population included 57 employees (6.3% of all employees) and only 60 students (1.1% of all students). Attrition was greater than expected with 94% of tested participants reporting their activity in week 1, and progressively decreasing to a point where only 47% reported their activity in week 5. **CONCLUSION:** This study was extremely feasible and cost-effective. However, greater care must be taken in marketing the program to students and weekly incentives may need to be offered to improve activity reporting throughout.

232 Board #53 May 31 11:00 AM - 12:30 PM

Testing Intentions: Evaluating The Effectiveness Of Implementation Intentions In A Pedometer-Based Worksite Intervention

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Pedometer-based interventions have been found to be successful in increasing physical activity (PA) during the intervention but adherence is challenging. Implementation intentions (II) are specific plans of action concerning when, how, and where an intended behavior will be enacted. The use of this self-regulatory skill with self-monitoring of the pedometer has the potential to initiate behavior change as well as adherence. **PURPOSE:** To test differences between participants that used both II and a pedometer and those that just used a pedometer. **METHODS:** Employees (N = 51) at a mid-sized public university were recruited via employee email to participate in an 8-week pedometer-based intervention. Only employees currently not meeting minimum PA recommendations (<150 minutes of moderate to vigorous PA/week) could enroll. A 2-arm randomized trial was used to compare the effectiveness of: 1)

only pedometers (PED) (n = 25) and 2) pedometers and II (PED + II) (n = 26) on PA. All participants were asked to track steps daily. Participants in the PED + II group were asked to write three II for each perceived barrier to meeting their step goals in Weeks 1 and 4. Pedometers were reissued for a delayed post assessment 4 weeks after the intervention ended (n = 36). Paired t-tests were used to compare differences between baseline to Week 8 and 12 separately for the 2 groups. **RESULTS:** Significant increase in steps ($p = .004$) were observed from baseline (7100 ± 2452.5) to Week 8 (8542 ± 4244.1) for the both groups combined and for the PED+II group ($p = .004$; mean difference: 1458 ± 1009.2). No difference was observed for the PED group ($p = .112$; mean difference: 1427 ± 2511.1). Average steps significantly decreased ($p < .0005$) from Week 8 (9019.2 ± 4684.3) to Week 12 (6689.3 ± 1983.2) for the both groups combined. There was no between group differences in any comparison ($p = .159 - .854$). **CONCLUSION:** The PED+II group significantly increased steps during the intervention indicating that the behavioral strategy was effective. However, participants in both groups had a significant decrease in steps from the end of the intervention to the delayed-post assessment highlighting the struggle to maintain behavioral changes after the intervention ends. Future interventions should continue to combine behavioral modification strategies to increase adherence.

233 Board #54 May 31 11:00 AM - 12:30 PM
Lifestyle and Health Habits Among Canadian University Community

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PURPOSE: It is estimated that by 2019, 55.4% of the Canadian adult population will be categorized as overweight (34.2%) or obese (21.2%) (Twells et al., 2014). Increase of obesity prevalence, calls for continuous search of effective obesity-prevention and health promotion strategies. Following the work of Perusse-Lachance and colleagues (2010), the present study aimed to further examine the prevalence of obesity and lifestyle habits through environmental factors in a different Canadian university community.

METHODS: A web based-survey assessing lifestyle habits such as physical activity and nutrition was sent by email to all university's students (n=14 500) and employees (n=2000). Students or employees had to be registered as part or full time during the 2016 fall semester to participate in the study. Response rate was 13.3% for students (n=1 989) and 24.3% for employees (n=485). All data were analyzed using SPSS.

PRELIMINARY RESULTS: Results showed that 18.7% of students and 28.5% of staff members were overweight (BMI = 25.0-29.9), 10% of students and 10.7% of staff members were obese (BMI ≥ 30.0) while 40% of students and 37% of the employees were currently trying to lose weight. Results also revealed that 50% of staff members and 57% of students were considered sedentary (<150 minutes of physical activity/week).

Regarding fruits and vegetables intake, only 14% of students consumed four or more servings of fruits per day compared to 15% for staff members. In addition, only 15% of students consumed four or more vegetables servings per day as opposed to 26% for staff members. Finally, 91% of employees, compared to 81% of the students, were having breakfast every day.

CONCLUSION: Healthy environments are crucial in the adoption of healthy behaviors (Booth et al., 2001). In this regard, the herein results suggest that overweight and obesity can be an important concern in a well-educated sample and that this issue is associated with various health-related behaviors. These conclusions highlight the need to develop specific health promotion strategies in this Canadian University community.

234 Board #55 May 31 11:00 AM - 12:30 PM
Fitness Perceptions And Practices Of Medical Students From A Patient-Based Learning Curriculum (PBL)

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Purpose: To determine the knowledge of fitness and the fitness habits of medical students at the University of Missouri School of Medicine (UMSOM). There is currently limited research on the association of a Patient-Based Learning (PBL) curriculum with students' fitness as well as their implementation of patient exercise prescription.

Methods: Anonymous surveys were distributed to 394 medical students. Data were entered into the REDCap electronic survey tool and tabulated with REDCap and Microsoft Excel. In the survey, respondents were asked to state the Centers for Disease Control (CDC) recommendations for physical activity in adults. The survey

also included Likert scale questions concerning exercise, and the Godin leisure time exercise questionnaire. Godin scores were calculated and converted to CDC recommended activity levels.

Results: A total of 145 students responded for a response rate of 37%, with 97% agreeing that it is important for physicians to have and exemplify an active lifestyle. However, only 23% met the aerobic physical activity guidelines set by the CDC for adults. Based on the Fisher Exact Test ($P=1.1 \times 10^{-4}$) respondents who met CDC recommendations for exercise also indicated stronger agreement with the statement "I make physical fitness a priority in my life." Although 41% of respondents agree that the medical school curriculum has educated them on appropriate use of exercise, only 2.8% (4/145) were able to correctly state the CDC recommendations for physical activity in adults.

Conclusion: Most medical students in the UMSOM agree that it is important for physicians to maintain an active lifestyle but most do not achieve the CDC recommended level of exercise. Less than half of respondents agreed that the PBL curriculum educated them on appropriate use of exercise, and most could not state the CDC recommendations for physical activity in adults. Healthcare is evolving towards preventative care, including patient exercise counseling and prescription, which may be a current weakness of PBL. Further research is needed to compare PBL curricula to traditional curricula, as well as seeing the ultimate effect on the students' future medical practices.

235 Board #56 May 31 11:00 AM - 12:30 PM
Incorporating Spirituality and Role Models into Physical Activity Programs for Black Women: A Qualitative Inquiry

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Previous research has shown favorable outcomes for incorporating religion and spirituality into (physical activity) PA programs delivered through faith-based or faith-placed settings. Limited research has examined how these concepts can be incorporated into PA programs delivered outside of religious institutions. Likewise, few studies have explored the individuals that Black women consider to be physically active role models and how these role models can be leveraged in a PA program.

PURPOSE. To qualitatively examine how spirituality, religion, and roles models can be incorporated into a PA program for Black women.

METHODS. Twenty-five Black women (M age = 38.5 years, M BMI = 39.4 kg·m²) were enrolled in the study. Focus group guides were designed to gain information on how religion, spirituality, and roles models can be incorporated into a culturally relevant PA program for Black women. Focus groups were audio recorded and transcribed verbatim. Content analysis was used to analyze focus group data.

RESULTS. Participants reached consensus that incorporating aspects of spirituality (i.e., words of affirmation, meditation, mind-body activities) into a PA program was universally acceptable, regardless of religious affiliation. On the other hand, including concepts of religion (i.e., bible verses and/or quotes from religious leaders) was controversial and not recommended among women who did not identify with a religious faith. In reference to the topic of physically active role models, women identified various individuals they considered as role models, including relatives (i.e., their mother, siblings, and children), friends, community leaders, and celebrities (i.e., Michelle Obama, Oprah Winfrey). Participants endorsed the use of these role models in a PA program designed for Black women.

CONCLUSIONS. Findings suggest that including spirituality, as opposed to religion, is an acceptable and motivational concept to include in a PA program for Black women. Similarly, women reported a diverse group of individuals that could be included as physically active Black role models. Designing PA promotion programs to include aspects of spirituality and roles models can enhance the acceptability and salience of the program, which may ultimately lead to increased PA behaviors.

236 Board #57 May 31 11:00 AM - 12:30 PM
Pilates Exercise Improves Balance in Middle-Aged Chinese Women

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PURPOSE: To investigate if an 8-week Pilates exercise program could improve static balance, dynamic balance and core myodynamia strength in middle-aged Chinese women.

METHODS: Sixty middle-aged Chinese women (52-65 years old) were randomly assigned to experimental group (n=30) and control group (n=30). The Pilates exercise

was performed 90 minutes per time, 3 times per week, for 8 weeks, including core myodynamia training, static standing, muscle strength and endurance training of lower extremities. Static balance and dynamic balance tests were performed, and the strength of core myodynamia was measured using a BIODEX balance test system. The SPSS19.0 statistical software was used for data analysis. Paired tests were used for comparison before and after intervention within each group. Group comparisons in changes over time were performed by independent t-tests.

RESULTS: When comparing with themselves before the 8-week Pilates exercise, the women after the exercise had longer time of standing with one foot and eyes' closed (14.68±5.54s vs. 27.68±4.21s), the Romberg experiment with eyes' closed (40.23±6.47s vs. 66.58±7.43s), marching on the spot with eyes' closed (9.35±3.26s vs. 20.74±10.62s) and 8 degree abdominal bridge test (24.57 ± 8.71s vs. 82.78±21.53s) and shorter time of standing and walking (16.36±2.15s vs. 7.93±1.59s), vestibular step test (8.75±1.78s vs. 3.58±2.37s) and the risk of tumbling test (2.42±1.03s vs. 2.11±0.95s), and the difference was statistically significant (P all <0.05). Compared to control group who did not have the 8-week Pilates exercise, the time of standing with one foot and eyes' closed (15.06±4.98s vs. 27.68±4.21s), the Romberg experiment with eyes' closed (39.87±9.01s vs. 66.58±7.43s), marching on the spot with eyes' closed (9.47±4.03s vs. 20.74±10.62s) and 8 degree abdominal bridge test (25.41 ± 6.22s vs. 82.78±21.53s) were prolonged in the experimental group (P all <0.01), and the time of standing and walking (16.86±1.97s vs. 7.93±1.59s), vestibular step test (9.02±2.51s vs. 3.58±2.37s) and the risk of tumbling test (2.39±1.07s vs. 2.11±0.95s) were shorten (P all <0.01).

CONCLUSIONS: After 8 weeks of Pilates exercise, the experimental group' static balance and dynamic balance, and the strength of core myodynamia were improved; and this may reduce the risk for falls.

237 Board #58 May 31 11:00 AM - 12:30 PM
The Effect of University Worksite Walking Program on Physical Activity and Sedentary Behavior Among Employees

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The Centers for Disease Control report that 79% of Americans are not meeting weekly physical activity requirements, increasing the risk of many lifestyle related disease. Due to the many benefits of regular physical activity, university worksites are increasingly offering physical activity programming to encourage employees to be more active throughout the workday. **Purpose:** The purpose of this study was to evaluate the effects of a university sponsored walking program on physical activity amount and sedentary behavior in employees who participated versus those who did not participate. **Methods:** The research was a matched pair design. The study group (n=33) participated in the Workplace Walkoff Challenge (WWC), a six week walking competition held at a small, California university. The control group (n=17) did not participate in the WWC. The International Physical Activity Questionnaire (IPAQ) was utilized to collect vigorous, moderate, and walking MET-Mins⁻¹ per week, and sitting hours during weekdays. Participants also wore an Omron® brand pedometer and reported weekly steps. To assess these variables, dependent t-tests were performed. **Results:** For the participant group, there were significant increases in vigorous (p=.05), moderate (p=.05), and walking (p=.02) MET-Mins⁻¹ per week. There were significant increases in steps from baseline to the last week of the competition (p.01). There were no significant changes in sitting hours per day (p=.39) for WWC participants. For the control group, There were no significant differences in vigorous (p=.18), moderate (p=.35), walking (p=.46) MET-Mins⁻¹ per week for non-participants. There were also no significant increases in steps from baseline to end of competition (p=.24). There were no significant changes in sitting hours per week day (p=.50) for non-participants. **Conclusion:** A six week worksite walking program may be effective in increasing physical activity amount among employees, despite no change in sit time while at the worksite.

238 Board #59 May 31 11:00 AM - 12:30 PM
Reasons For Participants Joining And Continuing An Outdoor Gym In Rio De Janeiro

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The existence of public parks for the practice of physical exercise is common in several places of the world and the explanation could be linked to a health promotion strategy, which seeks to make free leisure activities accessible to citizens. Since this

is a public policy to promote health in the population, it is important to evaluate strategies that provide feedback on investments already carried out, on which we can base the best application of resources. This effectiveness evaluation is necessary as a form of accountability for citizens, allowing re-planning actions, if necessary.

PURPOSE: The objective of this study was to identify the reasons to join an exercise program offered by an outdoor gym located in the university campus, in the city of Rio de Janeiro, Brazil. **METHODS:** This survey relied on the participation of all users of the program "Rio Ar Livre" (RAL) ("Rio Outdoor"), UERJ unit, totaling 44 individuals (8 men and 36 women), with an average age of 64 years, varying from 23 to 87 years. The data were collected through a questionnaire with both closed and semi-open questions, developed exclusively for this investigation. This study was carried out between August and September 2015.

RESULTS: The main reason users frequented this physical activity program was "Due to the decision to improve fitness/to stay fit (women [W]: 57%; men [M]: 37.5%). The most cited positive points were: the "Participation of the teacher and trainee" (W: 88.6%; M: 75%), "Location of UERJ in relation to the participant's residence" (W: 60%; M: 62.5%) and the "attendance" (W: 62.8%; M: 75%). On the question of negative points: "Cleanliness" received the most votes (W: 57%; M: 37.5%).

CONCLUSION: It was concluded that the gym's structure is one of its negative points. However, aspects such as location, gym access and, especially, the competence of personnel working in the gym (RAL-UERJ) are probably the factors leading the user to join the program and remain enrolled in it. Supported by FAPERJ (E-26/210.231/2014).

239 Board #60 May 31 11:00 AM - 12:30 PM

Effect of an Educational Program Promoting Regular Physical Exercises in Subjects With Knee Osteoarthritis

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PURPOSE: The purpose of this study was to investigate the effects of an educational program emphasizing the regular practice of physical exercise on physical fitness, functional capacity and daily- living physical activity levels in patients with knee osteoarthritis (OA). **METHODS:** Two hundred and thirty-nine (239) patients in the public health system (male and female), with primary or secondary knee OA (degree I to IV in the Kelgreen and Lawrence scale), and with referral for OA clinical treatment were randomly allocated to intervention (IG; n = 112) and control groups (CG; n = 127). All subjects of both groups underwent assessment for physical fitness (six-minute-walking- tests), functional capacity (seat-to-stand, Up-and-Down-stairs and Timed-Up-and-Go tests) and daily-living physical activity (IPAQ short-version), before (pre), during (6-months) and after (12- months) the follow-up. Statistical analysis was performed with ANOVA two-way (group x time) with repeated measurements, Chi-square test and the Bonferroni's t test. **RESULTS:** During six months of follow-up, the IG showed significant improvements ($P < 0,05$) in Up-and-Down-stairs (19%), seat-to-stand (30%) and Timed-Up-and-Go (32,5%) tests, as well as a reduction of Body Mass Index (BMI) ($P < 0,05$), which were maintained during the 12 months. There was also an increase in the percentage of self identified "actives" and "very actives" subjects and reduction in the percentage of sedentary subjects in the IG during follow-up ($P < 0,05$). The CG improved only the Up-and-Down-stairs tests during the 6-months follow-up, but the improvement was not maintained during the 12 months follow-up. There was also an increase in the percentage of very actives subjects in GC, however, this increase was lower than that was observed in the IG. There were no significant improvements on muscular capacity, aerobic capacity and flexibility during the 12-months follow-up in both groups. **CONCLUSIONS:** These results suggest that an educational program promoting the regular practice of physical exercise may be an effective tool for improving functional capacity in patients with knee OA.

A-41 Free Communication/Poster - Aging

Wednesday, May 31, 2017, 7:30 AM - 12:30 PM
Room: Hall F

**240 Board #61 May 31 9:30 AM - 11:00 AM
Using Accelerometers to Quantify Exercise Intensity of Exercise Classes in Older Adults**

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Accelerometers offer detailed minute-by-minute information over extended periods pertaining to physical activity behavior. Furthermore, accelerometers are typically placed on the right hip. However, accelerometers placed on the hip may not determine exercise intensity during an entire workout in older adults.

PURPOSE: The first purpose of this study was to use accelerometers to determine the duration of time spent in certain intensities during exercise classes for older adults. The second purpose of the study was to examine the intensity level during those exercise classes as determined by accelerometers placed on the hip and wrist.

METHODS: A total of sixty seven older adults (age: 73.8 ± 14.5 yrs, weight: 71.0 ± 19.0 kg) were recruited. Twenty-five of them wore an accelerometer placed on the right hip (H) and an accelerometer placed on the right wrist (W). All individuals participated in exercise classes that included periods of cardiovascular, strength, and balance exercises. In order to quantify exercise intensity, cut points (cpm) of sedentary (≤ 100 cpm), light (101-799 cpm), and moderate (800-5722) intensity were used. A two-tailed independent t test was used to examine differences between H and W in the amount of time spent in sedentary, light, and moderate exercise intensity. Statistical significance was set at $p < 0.05$.

RESULTS: Overall, the participants engaged in 17.1 ± 5.8 minutes of light and 12.3 ± 8.8 minutes of moderate intensity activities. Furthermore, the majority of the participants (91%) perceived the intensity as moderate. The average time spent in light exercise intensity was 19.1 ± 4.5 and 7.4 ± 2.1 minutes for the H and W accelerometers, respectively. The average time spent in moderate intensity activity was 11.4 ± 6.1 and 35.0 ± 4.2 minutes for the H and W accelerometers, respectively. There was a significant ($p < 0.01$) difference between the accelerometers for light and moderate exercise intensity.

CONCLUSIONS: The data showed that very little of the activity met the moderate intensity threshold by accelerometer data, but this was dependent on the placement of the accelerometer. Furthermore, the data suggests that in order to fully comprehend the intensity of an exercise class for older adults, accelerometers must be worn on both the hip and the wrist.

**241 Board #62 May 31 9:30 AM - 11:00 AM
A Comparison of Upper Body Strength and Body Composition Between Elderly from Costa Rica and Kansas**

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An increased lifespan and body adiposity as people age are considered risks factors for all-cause mortality. Handgrip strength is a considered a powerful predictor of cause-specific and total mortality in older disabled women and to cardiometabolic risk in aging populations. Ethnic-specific heterogeneity of risk factors calls for comparative studies to better understand competent prevention and management, which might be one of the essential steps toward elimination of ethnic disparities for several diseases.

PURPOSE: To compare the upper body strength and body composition in elderly from Costa Rica (CR) and Kansas (KS). **METHODS:** Older adults from CR (men = 26, women = 52, mean age = 68.91 ± 4.79 yr.) and KS (men = 35, women = 65, mean age = 72.84 ± 5.59 yr.), underwent handgrip strength and body composition measurements (dual-energy X-ray absorptiometry). **RESULTS:** Men (31.24 ± 7.02 %) had lower %BF than women (41.28 ± 5.87 %; $p \leq 0.001$). Women (15.0 ± 1.7 kg/m²) had lower lean tissue mass index than men (18.0 ± 1.7 kg/m²; $p \leq 0.001$). Women (6.2 ± 0.8 kg/m²) had lower appendicular lean soft tissue index than men (8.1 ± 1.0 kg/m²; $p \leq 0.001$). KS participants (1.16 ± 0.11 g/cm²) had higher total bone mineral density than CR participants (1.08 ± 0.11 g/cm²; $p \leq 0.001$), and men (1.21 ± 0.11 g/cm²) had higher total bone mineral density than women (1.08 ± 0.09 g/cm²; $p \leq 0.001$). Significant correlations ($p \leq 0.003$ for all) were obtained between handgrip strength

and body height ($r = 0.72$), body weight ($r = 0.56$), arms bone mineral density ($r = 0.67$), total bone mineral density ($r = 0.56$), lean arms mass ($r = 0.78$), total lean mass ($r = 0.81$), body fat% ($r = -0.48$), body fat mass index ($r = -0.22$), lean tissue mass index ($r = 0.59$), and appendicular lean soft tissue index ($r = 0.69$). **CONCLUSIONS:** Differences in body composition and handgrip strength were found in older adults from CR and KS. Ethnic-specific heterogeneity on biologic factors and physical-related performance allows for culturally diverse prevention programs for the elderly.

**242 Board #63 May 31 9:30 AM - 11:00 AM
Association Of Agility With Muscle Strength, Balance, Mobility And Physical Activity Status Of Older Women**

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It has been reported that body-weight supported stepping training increases the walking speed of healthy older women. This suggests that stepping with body weight unloading improves the walking ability. We hypothesized that stepping in a sitting position is associated with the physical fitness, walking ability and the physical activity status of older people.

PURPOSE: The purpose of this study was to examine the association between the stepping rate (agility) and the muscle strength, balance, mobility and the physical activity status of older women.

METHODS: The participants included 108 healthy older women (age: 74 ± 5 years; range: 65-89). The stepping rate, muscle strength (handgrip strength, knee extension strength), balance (one-leg standing time with eyes open), mobility (timed up-and-go test [TUG], maximum walking speed) and physical activity of the participants were measured. The maximal stepping rate in 10 seconds, as measured using an industrial stepping rate counter (Stepping Counter; Yagami), was used as an index of agility. The participants were instructed to perform alternating steps with each leg as quickly as possible for 10 seconds, while in a sitting position. The total number of step for both legs was used as the participant's score. The physical activity status was measured for two weeks using a uniaxial accelerometer. A multiple regression analysis was used to evaluate the association between the stepping rate and each of the other variables.

RESULTS: The stepping rate was 74.8 ± 14.2 (range 34-108) times/10s and was not correlated with age. A multiple regression analysis adjusted for age revealed that the, stepping rate was associated with handgrip strength ($\beta = 0.345$, $p < 0.00$), knee extension strength ($\beta = 0.218$, $p < 0.05$), one-leg standing time ($\beta = 0.312$, $p < 0.01$), TUG ($\beta = -0.239$, $p < 0.05$), maximum walking speed ($\beta = -0.446$, $p < 0.001$) and the percentage of time engaged in low intensity PA ($\beta = -0.245$, $p < 0.05$).

CONCLUSION: The present study showed the association between agility and muscle strength, balance, walking ability and physical activity of physically independent older women.

**243 Board #64 May 31 9:30 AM - 11:00 AM
Inter-rater And Test-retest Reliability Of The Y-balance Test In Healthy Women 50-80 Years Old**

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The assessment of dynamic balance through the use of standardized objective measures is important to identify impairments which may increase fall risk in older adults. Many of the current clinical balance tests are not challenging enough to assess balance and identify fall risk in healthy older adults. A test which may be appropriate for healthy older adults is the Lower Quarter-Y Balance Test (LQ-YBT). The LQ-YBT is a test of dynamic motor control at the limits of stability in single-leg stance which has typically been researched in younger athletic populations to evaluate dynamic balance and risk for injury. **PURPOSE:** To determine the inter-rater and test-retest reliability of the LQ-YBT in healthy women from 50-80 years old. **METHODS:** Eighty-six potential participants were screened and data collection included 60 healthy women 50-80 years old, with mean age $64.3 (\pm 7.9)$ years. Each participant completed the LQ-YBT in a standardized manner as described in the LQ-YBT manual. The scores for each participant were independently determined and recorded to the nearest centimeter by two examiners. After a 5-minute rest, a subset of eight participants performed the LQ-YBT a second time in the same session for the purpose of test-retest reliability. The maximum distance reached in each direction, normalized for leg length, was used for data analysis. Intraclass Correlation Coefficients [ICC (2,1)] were used to determine the test-retest and interrater reliability of the normalized reaches in each direction and the composite scores. **RESULTS:** The LQ-YBT demonstrated excellent

inter-rater reliability with ICC values of 0.98 to 1.0 for the various directions, and 1.0 for the composite scores, bilaterally. The test-retest ICC values were also excellent ranging from 0.75 to 0.93 for the various reaches and 0.96 and 0.95 for the right and left lower extremity composite scores, respectively. **CONCLUSION:** The LQ-YBT demonstrated excellent inter-rater and test-retest reliability in healthy women 50-80 years old and may be considered for use as a measure of dynamic balance in this population.

244 Board #65 May 31 9:30 AM - 11:00 AM
Purine Metabolites and HGPRT Activity in Male Speed-Power vs Endurance Masters Athletes Aged 20-90 Years

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PURPOSE: According to recent studies, purine metabolism better reflects exercise response and muscle adaptation than widely used indicators. Consequently, we proposed using purine derivatives, especially plasma hypoxanthine (Hx) concentration and erythrocyte HGPRT activity as indicators of training status in highly trained young athletes. The aim of this study was to compare the effects of many years' sprint and endurance training on levels of purine derivatives and HGPRT activity. **METHODS:** Master sprinters (SP, n=52), master endurance runners (ER, n=86) and healthy control participants (CO, n=60), age range 20-90 years, were compared. They underwent a treadmill test until exhaustion. Venous blood samples were drawn at rest and post exercise. Hx, xanthine (X), uric acid (UA) and erythrocyte HGPRT activity were assayed by means of HPLC method. Regression analyses were performed to show the relationships between purine derivatives and HGPRT activity and age. **RESULTS:** Resting and post-exercise Hx were similar in both athletic groups and different from the CO group, in which highest Hx values were observed. Resting and post-exercise X were only different between SP and CO groups. Resting HGPRT and post-exercise UA were different between all three groups. Age explained 87-96%, 69-94%, 17-55% and 41-54% of variance in Hx, X, UA and HGPRT, respectively, except for UA in the CO group (1-5%). The relationships between age and Hx and resting X were nonlinear (polynomial function of degree 2). The age-related changes in UA were only minimal in athletes and virtually nonexistent in the CO group. **CONCLUSION:** The age-related elevation in resting and post-exercise Hx suggests that the exercise-induced energetic stress considerably progresses with ageing. Increased Hx levels, despite increasing HGPRT activity that supports ATP resynthesis through the purine salvage pathway, bring about a delayed restoration of the adenine nucleotide (AdN) pool through the energy-consuming *de novo* synthesis. One can expect that in older subjects, subsequent high-intensity exercise bouts will require longer recovery to restore the AdN pool. In practical terms, older athletes should plan their high-intensity workout having regard to these implication of ageing. Supported by National Science Center Poland Grant 2013/09/B/NZ7/02556

245 Board #66 May 31 9:30 AM - 11:00 AM
Improving Power Output in Older Adults Utilizing Plyometrics in an AlterG Treadmill

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In older adults, muscular strength has been shown to decline by up to 1-2% per year, and muscular power declines at an even higher rate. Plyometric training has shown benefits for increasing muscle force, power, and agility in adolescents and recreational adults; however, data on older adults is lacking. The AlterG treadmill allows for improved mobility, strength, and safety while improving functional capacity related to endurance, strength, and power. **PURPOSE:** To determine the effects of performing plyometrics in an AlterG treadmill on power output and functional strength in older adults when compared to traditional strength training. **METHODS:** Twenty-three subjects were randomized to a strength (SG) (n = 8), plyometric (PG) (n = 8), or control (CG) (n = 7). SG and PG exercised 3x/week for 8 weeks and CG performed no exercise. SG performed sets of 3x10 at 65-80% of one-repetition maximum (1RM) (estimated from 3-5RM) on the leg press (LP), leg extension (LE), and single leg lunge (LL). PG performed 3x10 in the squat jump, single leg bound, and power skipping at an intensity range of 65-80% body mass. Timed sit-to-stand and stair climb, estimated maximal muscular strength, and isokinetic power during leg flexion and extension were compared pre and post intervention. A 2 x 3 repeated measures ANOVA was used to determine differences between groups. Data was reported as percent change from baseline. **RESULTS:** Significant improvements occurred in the PG in the timed sit-to-stand (22.11 ± 8.48%, p = 0.013), timed stair climb (14.68 ± 6.28%, p = 0.002),

and stair climb power (16.59 ± 9.07%, p < 0.001). PG and SG significantly increased their estimated 1RM in the LE and LL (p < 0.05). PG was significantly more powerful at all 3 velocities in both flexion and extension except at 60°/sec extension, ranging from 24.54 ± 19.94% to 85.74 ± 62.23% (p < 0.001). PG increased muscular strength similarly or better than SG without performing resistance training. **CONCLUSIONS:** Eight weeks of plyometrics in an AlterG treadmill improved functional strength and power in older adults, accomplished through performing exercise requiring less total work per exercise session. Results suggest that plyometrics, if modified and performed in a safe environment, can increase muscular strength and power and improve functional abilities in older adults.

246 Board #67 May 31 9:30 AM - 11:00 AM
Strength Decline Of Sedentary Adult Men In Different Age Groups

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The muscle decline and your functional capacity have age association, strength capacity also be relation with life style. For health men, this factor still suffer the effects somatopause, but the data for sedentary men still need scientific attention. **PURPOSE:** The purpose of this study was to compare the muscle strength of sedentary adult men with different age group. **METHODS:** The sample was 331 sedentary men divided in tree groups of according with age 21-29 years (G1), 30-39 years (G2) and 40-49 years (G3). All sample non physically active <150 minutes for week. The subjects were anthropometric measurements, 1 minute of abdominal test (IAT), flexion strength of the elbow (FSE). It was made a descriptive statistic, and ANOVA one way with Tukey's post hoc (p<0.05). **RESULTS:** For men was verify a decline in the IAT of 26.8% (p=0,001) comparing G1 with G3 and 23,1% (p=0,001) when compared G2 with G3. But for FSE non significant results was verify in the different age group. **CONCLUSIONS:** We can conclude for the IAT and body mass was verify a significant reduction as advancing age in sedentary men. however that in the flexion strength elbow not detected a strength decline as advancing age in sedentary men.

247 Board #68 May 31 9:30 AM - 11:00 AM
Comparisons of Fat Free Mass and Fat Mass between Active and Inactive Older Women

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Purpose: To compare the fat free mass and fat mass between active and inactive older women. **Methods:** Participated in this investigation 44 older women, mean aged of 66.0 (±4.5years-old). Sample was classified as inactive (Inactive group - IG, n=18), who was not enrolled in an exercise program in the previous six months, and active (Active group - AG, n=26), who have been participating regularly in the last six months in an exercise program (bench stepping group exercise - BSGE) promoted by the physical education department in the Technological Federal University of Parana. Body composition was analyzed by the Dual Energy X-Ray Absorptiometry (DXA) equipment. Data were described by mean and standard deviation and analyzed by the independent T-test using the SPSS software (p<0.05). **Results:** Comparisons between groups showed that IG had a significantly lower fat free mass for all measurements - right and left upper limb (1665.5±467.4 and 1506.8±443.4grams *VS* 2066.9±328.3 and 1866.9±282.2 gram, respectively), trunk (19961.3±3629.4 *VS* 22380.8±3695.9 gram), and right (5108.4±600.3 *VS* 6083.7±616.5 gram) and left (5112.8±738.6 *VS* 5979±542.0 gram) lower limb (all p<0.05). Also, the IG had a higher %fat mass for right (47.0±6.0) and left (47.4±7.0) lower limb than active group (42.2±4.8 and 42.5±4.8, respectively) (all p<0.05). **Conclusion:** Older women who participated in a bench stepping group exercise program had a better body composition than their inactive peers. This results were more evident for fat free mass which has been positively associated with functional-physical fitness and successful aging. Also, it is consensus that the accumulation of fat mass increases the risk for several metabolic and cardiovascular diseases, then the maintenance of %fat mass is crucial for a preventive health perspective.

248 Board #69 May 31 9:30 AM - 11:00 AM
Dynamic Postural Control by Body Mass Index and Walking Speed in Korean Elderly
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(No relationships reported)

PURPOSE: To investigate the influence of body mass index (BMI) and walking speed on postural control in Korean elderly
METHODS: A total of 127 elderly (76.4±7.0 yrs, 155.5±8.1 cm, 60.8±10.2 kg, 25.2±3.5 kg/m²) walked on a force platform for 4.5 meter distance on their pace and parameters of postural control such as Envelope Area (ENV), Rectangle Area (REC), total length from center of pressure (TLC), and Sway Velocity (SV) were measured. Based on their walking speed, they were divided into three groups; slow (S, n=41, 6.5<sec), average (A, n=47, ≤6.5 sec), and fast (F, n=44, ≤5 sec). In addition, based on their BMI, they were grouped as; normal weight (NW, n=35, 21.3±1.3, range 18.5-22.9), overweight (OW, n=38, 24.2±0.5, range 23.0-24.9), and obese (OB, n=54, 28.5±2.5 kg/m², 25≤). Their physical fitness was also measured by 2-min Step Test, 30-second Chair Stand, 8-Ft Up and Go, and One-leg Standing.
RESULTS: No differences in age and height were noticed when compared by groups of BMI. Body weight, fat content, and waist circumference were greater as BMI was higher (p<0.05). ENV (299±285, 316±286, and 252±253 mm²), REC (699±720, 985±2137, and 619±683 mm²), TLC (333±175, 331±175, and 289±117 mm), and SV (17±9, 17±9, and 14±6 mm/sec in NW, OW, and OB, respectively) were not different between groups of BMI. When compared by walking speed, all postural parameters such as ENV, REC, TLC, and SV were not different among S, A, and F. When physical fitness variables were analyzed, no group differences by walking speed and BMI were noticed.
CONCLUSION: The degree of sway of center of pressure during walking in elderly was not different when it was compared by groups of BMI and walking speed. Capability of maintaining body balance in elderly population during locomotion may not be predicted by their BMI or walking speed.

249 Board #70 May 31 9:30 AM - 11:00 AM
Maximal Velocity Adaptions During Unilateral Resistance Training In Older Adults
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Maximal velocity parameters are negatively affected by aging; however, little is known regarding the short-term effects of resistance training (RT) on maximal velocity variables in older adults. Furthermore, whether or not unilateral RT induces maximal velocity adaptations in the untrained limb has not been determined. **PURPOSE:** To examine the effects of unilateral RT on maximal velocity parameters of the ipsilateral and contralateral leg in older males. **METHODS:** Twenty-one untrained older males were randomly assigned to a training (TG; n = 10, age = 64.70 ± 6.91 yrs.) or control (CG; n = 11, age = 65.56 ± 11.56 yrs.) group. The TG performed 3 sessions per week of unilateral isokinetic RT for 4 weeks. RT sessions consisted of maximal concentric knee extensions at 45°·s⁻¹ for 4 sets of 10 repetitions. Subjects were instructed to “kick out as hard and fast as possible” during each RT session. Maximal concentric isokinetic testing of the knee extensors for the trained (TL) and untrained (UL) leg at 500°·s⁻¹ (ISOK₅₀₀) was performed before (PRE), at week 2 (MID), and after week 4 (POST) of RT. There was no resistance during ISOK₅₀₀, with the exception of the lever arm mass, as the velocity was above all subjects’ maximum velocity. The highest velocity attained (PV; deg·s⁻¹) and the linear slope of the velocity-time curve (RVD; deg·s⁻²) were recorded for analysis. For the TL and UL, one-way repeated measures analyses of variance were used for the TG and CG separately. **RESULTS:** PV and RVD remained unchanged in both legs for the CG (p > 0.05). PV did not change in the TL (p = 0.084), while RVD increased from PRE to POST (+5.8%; p = 0.029) and MID to POST (+4.1%; p = 0.038). PV (p = 0.644) and RVD (p = 0.523) were unaltered in the UL. **CONCLUSION:** RVD appears to be more sensitive to change during the early-phase of RT compared to PV in older males. However, neither PV nor RVD in the UL appear to be affected by short-term unilateral RT. Since many neural adaptations are expressed bilaterally, the improvement in RVD for only the training leg suggests the adaptation is more likely mechanical in origin.

250 Board #71 May 31 9:30 AM - 11:00 AM
The Self-Reported Exercise Habits of Older Adult Women and the Associated Effects on Physical Fitness
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ABSTRACT
 The amount of time that older adults exercise is influenced by their fitness, physical function, and self-efficacy to participate in physical activity. As the population of older adults is continuing to increase and become more diverse, it will be important to recognize and investigate differences among them, including variance in exercise time. The usefulness of self-report instrumentation by older adults to determine the optimal amount of time spent exercising to enhance fitness components and physical function is still largely unknown.
Purpose: To investigate the relationship between self-reported exercise habits, fitness levels, and physical function among healthy older adult women. **Methods.** Two groups of older adult women (M_{age} = 69 years) were instructed to continue their normal routines of attending group exercise classes at the local YWCO for a 10-week period. Group 1 (n=15) self-reported a weekly average that was equal to or lower than 360 minutes of exercise per week. Group 2 (n=15) consisted of those participants who reported averaging more than 360 minutes of exercise per week. The Senior Fitness Test (SFT) was used to assess the overall fitness and physical function of both groups of participants at baseline, after five weeks, and again after 10 weeks of exercising. **Results.** Statistical analysis showed no significant interaction effect for time*group (p<0.05) for chair stands [F(2,52)=2.288, p=.112], arm curls [F(2,52)=2.138, p=.128], 2-min step [F(2,52)=1.048, p=.358], chair sit & reach [F(2,52)=1.290, p=.284], and back scratch tests [F(2,52)=1.102, p=.340]. However, a significant interaction effect existed for time*group for the 8-foot Up & Go test [F(2,52)=4.685, p=.013]. **Conclusion.** Study findings suggest that perhaps 360 minutes of exercise per week in a community-based setting such as the Athens YWCO is the threshold for considerably improving mobility, coordination, and dynamic balance as measured by the 8-foot Up & Go task in older adult women. Also, further consideration should be given to utilizing tests similar to the 8-foot Up & Go that are designed to be more sensitive and complex when assessing the physical fitness of older adults.

251 Board #72 May 31 9:30 AM - 11:00 AM
Preliminary Validation Of The Virtual Short Physical Performance Battery In Older Adults With Multiple Sclerosis
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Abstract
Purpose: There are relatively few measures for studying physical function involving older adults with multiple sclerosis (MS), including non-supervised outcomes administered within a patient’s home. However, such measures are necessary considering the prevalence and associated consequences of MS and aging on physical function. The objective of this study was to perform a preliminary examination of the validity of the virtual Short Physical Performance Battery (vSPPB) and its associations with objectively-measured levels of moderate-to-vigorous physical activity (MVPA) and cognitive function.
Methods: A sample of 30 older adults with MS (≥60 years of age) underwent assessments of cognitive function, completed a battery of lower and upper extremity function assessments, including the vSPPB, and wore an accelerometer for a 7-day period. Spearman correlations (r) were conducted based on an expected differential pattern of associations with measures of upper and lower extremity function and for MVPA and cognitive function.
Results: vSPPB scores demonstrated strong associations with measures of lower extremity function (r=0.55–0.81), and weak associations with a measure of upper extremity function (r=0.16). The total SPPB (9.2 (2.3)) and vSPPB (6.9 (2.4)) scores were similar and moderately correlated (r=0.76) and the component scores of the SPPB and vSPPB were moderately to strongly correlated (r=0.41–0.58). Total vSPPB scores demonstrated moderate associations with minutes of MVPA per day (r=0.46). There were no significant associations between vSPPB scores and any of the cognitive measures.
Conclusion: We provide preliminary evidence that supports the validity of scores from the vSPPB as a measure of perceived lower extremity function that provides unique information for inclusion in clinical research and practice involving older adults with MS.

WEDNESDAY, MAY 31, 2017

252 Board #73 May 31 9:30 AM - 11:00 AM
Beneficial Effects of Senior Functional Fitness to Manage Blood Pressure in Community-dwelling Older Adults
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 (No relationships reported)

Purpose: To investigate the relationships and difference of senior functional fitness between varied levels of blood pressure (BP) and functional fitness assessments with community-dwelling older adults.

Method: 1003 community-dwelling residents aged 65 to 95 (Male, n=384, age =74yrs; female, n=615, age =69yrs) volunteered to participate in the study during 2010-2015. Participants completed 6 functional fitness tests, blood pressure measured and a health-screening questionnaire. The senior functional fitness including flexibility, muscle strength, muscle endurance, aerobic endurance, and body agility/dynamic balance. The **classification of Blood Pressure for Adults**: Normal systolic blood pressure (SBP) <120 and diastolic blood pressure (DBP) <80 mmHg (NOR); Prehypertension SBP 120–139 or DBP 80–89 mmHg (PRE); Stage 1 hypertension SBP 140–159 or DBP 90–99 mmHg (1st); Stage 2 hypertension SBP ≥160 or DBP ≥100 mmHg (2nd). One-way ANOVA and Pearson's product moment correlation were used to determine plasticity of functional fitness of individual BP.

Result: Senior functional fitness had the significant correlations with blood pressure ($p < .05$). In aerobic endurance, NOR is better than 2nd (1.36%) ($p < .005$). Furthermore, significant differences were observed in lower limbs muscle endurance, NOR is higher than 1st and 2nd (8.71%, 1.46%) ($p < .005$). In lower body flexibility, NOR is better than 2nd (98.51%) ($p < .005$). However, in upper body flexibility, NOR and PRE were better than 1st and 2nd ($p < .005$). In body agility/dynamic balance, NOR is faster than 1st and 2nd (9.87%, 16.4%) ($p < .005$).

Conclusion: The participants with better control of the blood pressure have better lower extremity muscle endurance, ability, balance, lower and upper extremity flexibility. The cardiovascular function and upper body flexibility were the most direct influence factors to prevent or manage hypertension.

Keywords: prehypertension, older adults, functional fitness

253 Board #74 May 31 9:30 AM - 11:00 AM
Effects of Resistance Training on Physical Exercise Capacity and Vascular Function Among Elderly Women
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 (No relationships reported)

Aging is associated with a decline in physical exercise capacity and in limb blood flow that could lead to a reduction in overall functional capacity. Exercise training has emerged as an effective therapy to improve the decline in physical and vascular function. **PURPOSE:** The purpose was to examine the effects of whole-body resistance training (RT) on physical exercise capacity and microvascular function among elderly women.

METHODS: Fifteen women (age: 69 ± 7.45 years) were referred by physicians as apparently healthy and signed informed consents prior to testing. These women participated in whole-body RT program performed, 2 days/week for 8 weeks. Before and after training muscle strength [One repetition maximum (1RM) for chest press, biceps curl, leg extension, and leg curl], physical exercise capacity [i.e., six-minute walk test (6MW)], and microvascular function (i.e., vascular reactivity) were measured.

RESULTS: The 1RM for all the muscle strength outcomes increased significantly [chest press: 29.74%, pre = 8.64 ± 2.46 ; post = 11.21 ± 2.91 kg; biceps curl: 37.02%, pre = 9.02 ± 2.45 ; post = 12.36 ± 2.49 kg; leg extension: 19.95%, pre = 34.24 ± 11.76 ; post = 41.07 ± 14.53 kg; leg curl 25.33%; pre = 36.00 ± 8.92 ; post = 45.12 ± 8.52 kg]. The 6MW test increased significantly 15.76% [pre = 564.20 ± 90.83 ; post = 653.10 ± 50.78 m, ($p < 0.05$)]; and the vascular reactivity index [measured by fingertip digital thermal monitoring] also increased significantly 13.36% [pre = 2.17 ± 0.44 vs. post = 2.46 ± 0.36 , ($p < 0.05$)].

CONCLUSIONS: Clearly, these findings demonstrate that whole-body RT is capable of increasing physical exercise capacity and microvascular function among elderly women. This study underlies the importance of whole-body resistance exercise training as part of a healthy and active lifestyle in elderly women.

254 Board #75 May 31 9:30 AM - 11:00 AM
Fitness Correlates Of Golf Performance, Exercise Enjoyment, And Mood In Senior Women Golfers
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 (No relationships reported)

Senior golfers (≥ 50 yrs of age) constitute approximately 5 million of the 20 million "committed" U.S. golfers (National Golf Foundation, 2016). This number emphasizes that golf is a lifelong physical activity. **PURPOSE:** To investigate the relationships among golf-specific fitness measures, golf performance, exercise enjoyment, and mood alteration. **METHODS:** Female senior golfers completed golf histories, 17 golf-specific fitness screening tests (TPI-fit; *Tiltest Performance Institute*®), golf swing analyses, and the Physical Activity Enjoyment Scale (PACES). Heart rate (HR), ratings of perceived exertion (RPE), and Total Mood Disturbance (TMD) scores on the Profile of Mood States were measured before and after a 6-min walk test (6MWT). Pearson correlations were calculated. **RESULTS:** Descriptive characteristics, means \pm SD: Age (yrs) = 64.1 ± 8.0 ; Body weight (kg) = 71.1 ± 14.3 ; TPI-fit and golf swing analyses = 17.3 ± 4.4 , 13.1 ± 7.9 , "lower is better"; 6MWT (ft) = 1906 ± 213 (67th %ile), RPE = 13.1 ± 2.0 "somewhat hard", HR (b/min) = 127 ± 20 , %HRmax = 81 ± 15 "vigorous." Age was not correlated with any variables, except months of playing golf per year ($r = -0.56$, $p = 0.03$) with older golfers playing fewer months than younger golfers. Age when beginning golf participation was positively correlated with handicap, average scores for 9- and 18-holes, and number of golf swing errors ($r_s = 0.71$, 0.68 , 0.65 ; $p_s < 0.03$). Golfers' body weights were correlated with better TPI-fit scores ($r = -0.64$, $p = 0.01$) and average scores for 9- and 18-holes of golf ($r_s = -0.67$, -0.65 ; $p_s \leq 0.02$) representing greater strength or leverage during the golf swing. Golfers with better TPI-fit scores tended to have higher exercise enjoyment ($r = -0.42$, $p = 0.09$). TMD scores on the POMS improved (97.4 ± 13.9 , 89.5 ± 15.2 ; $p = 0.06$) after only 6-min of high intensity walking. Greater 6MWT HRs were correlated with greater TMD improvements ($r = 0.49$, $p = 0.05$). **CONCLUSIONS:** Senior women golfers with more years of golf experience, or who were heavier, performed better on TPI golf-specific fitness and swing tests. The women also reported enjoying exercise and desirable changes in mood after aerobic exercise. Future studies of senior women golfers are needed to continue examining the role of golf participation in seniors' fitness levels and overall subjective well-being.

255 Board #76 May 31 9:30 AM - 11:00 AM
Relationships Among and Differences between Muscle Quality and Functional Performance in Younger and Older Women
 Mitchel A. Magrini, Ryan J. Colquhoun, Alejandra Barrera-Curiel, Ryan M. Thiele, Tyler W.D. Muddle, Jason M. DeFreitas, Doug B. Smith, Nathaniel D.M. Jenkins. *Oklahoma State University, Stillwater, OK.*
 (No relationships reported)

The quality of skeletal muscle has been identified as an important factor that is used to describe intramuscular changes associated with muscle function in aging. Traditionally, muscle quality (MQ) has been calculated as maximal muscle strength expressed per unit of muscle mass. More recently, however, the echo intensity (EI) of skeletal muscle ultrasound images has been used as a surrogate measure of muscle quality. **Purpose:** The purpose of this study was to examine the relationships among and differences between commonly-used measures of MQ and functional performance in younger (YW) and older women (OW). **Methods:** 15 YW (mean \pm SD: 22 ± 2 yrs) and 15 OW (74 ± 5 yrs) completed this study. Muscle cross section area (mCSA) and EI of the rectus femoris were measured from ultrasound scans at the midpoint of the thigh. Each participant completed two maximal voluntary isometric knee extension contractions (MVICs) to determine MVIC strength. Each participant also completed three maximal velocity sit-to-stand movements, during which power and movement velocity were measured. MQ was calculated as MVIC strength \div mCSA. Independent samples t-tests were used to analyze differences between YW and OW and Pearson's correlation coefficients were also used to analyze the relationships among the dependent variables in the YW and OW. **Results:** MVIC strength (166 ± 37 vs 105 ± 28 Nm), mean velocity (0.6 ± 0.1 vs 0.4 ± 0.1 m/s), peak velocity (0.9 ± 0.2 vs 0.7 ± 0.1), mean power (435 ± 81 vs 299 ± 57 W), peak power (1070 ± 265 vs 597 ± 127 W) were greater and EI (39 ± 8 vs 52 ± 10 au) was lower in the YW than OW, respectively. There was no difference in muscle quality ($p = 0.96$). EI and MQ were not significantly related ($r = 0.12$) in the YW, but were significantly related in the OW ($r = 0.54$). EI was inversely related to mCSA in the YW ($r = -0.53$) and OW ($r = -0.54$). In addition, MVIC was significantly related to mCSA ($r = 0.75$) in the OW, and was not significantly related to EI or MQ in either the YW or OW. **Conclusion:** There were age-related differences in muscle strength, muscle size, echo intensity, and functional performance, but no age-related difference in traditionally measured MQ. EI was related to MQ in the OW, but not the YW. Although EI has been used as a surrogate for MQ, these data suggest that MQ and EI may reflect different qualities of skeletal muscle in aging.

A-42 Free Communication/Poster - Blood Flow Restriction

Wednesday, May 31, 2017, 7:30 AM - 12:30 PM
Room: Hall F

**256 Board #77 May 31 9:30 AM - 11:00 AM
Acute Neuromuscular Adaptations In Response To Low-intensity Blood-flow Restricted Exercise And High Intensity Resistance Training**

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(No relationships reported)

Numerous studies have reported similar neuromuscular adaptations between low-intensity (LI) blood-flow restricted exercise (LI BFR) and high-intensity (HI) resistance training. Unfortunately, since none of these experimental designs individualized BFR levels to each participant, their findings are difficult to interpret. **PURPOSE:** To compare the acute effects of LI BFR (80% of absolute vascular occlusion pressure) with LI non-BFR and HI training on muscle torque, activation and neuromuscular fatigue. **METHODS:** Ten men (23.8 ± 5.4 yrs) exercised at 20 (LI) and 75% (HI) of 1 repetition maximum. LI consisted of 4 sets of knee extensions (30+15+15+15 repetitions) with and without BFR. HI included 4 sets of knee extensions (10+10+10+10 repetitions) without BFR. BFR pressure was determined individually using resting blood-flow measurements. Torque was determined during maximal voluntary contractions (MVC) before and after exercise. Surface electromyographic activity (root mean square - RMS and median frequency - MF) was recorded for the rectus femoris (RF) and vastus medialis (VM) muscles, before and after each session of training, during isometric contractions performed at 20% MVC. **RESULTS:** Torque decreased post-HI and LI BFR (-9.5 and -7.8%, respectively; p<.05), but not after LI without BFR. The MF was reduced following HI in the VM and the RF muscles (-5.3 and -12.5%, respectively; p<.05). Conversely, the impact of LI BFR on reducing MF was limited to the RF muscle (-10.7%, p<.05). The RMS values for the VM only increased after LI BFR (+26.3%, p<.05). In contrast, while RMS decreased by 19.0% post-HI (p<.05), this was not seen after LI with or without BFR. **CONCLUSION:** LI BFR is as effective as HI in decreasing post-exercise MVC. However, since our data unequivocally demonstrate that the neuromuscular impact of HI is more profound than that of LI BFR, it should be emphasized that the use of high mechanical loads represents a stronger stimulus for muscular adaptation.

**257 Board #78 May 31 9:30 AM - 11:00 AM
Acute Effects of Blood Flow Restriction Cuffs During Aerobic Exercise on Hemodynamics in Females**

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PURPOSE: The purpose of this study was to investigate the acute effects of a 20-minute walk/run at 40% VO₂ with and without blood flow restriction (BFR) cuffs on pulse rate (PR), stroke volume (SV), cardiac output (CO), cardiac ejection time (CET), systemic vascular resistance (SVR) and total vascular impedance (TVI) when compared to a 60-minute walk/run at 65% VO₂ without BFR in females. **METHODS:** Seventeen female subjects, between the ages of 18 and 40, were familiarized with the study protocol, had thigh circumference (THC) measured, and performed the Bruce protocol on the first day. BFR cuff inflation was based on THC. The three randomized sessions: 1) 40% VO₂ with BFR for 20 minutes (BFR-20min), 2) 40% VO₂ without BFR for 20 minutes (no-BFR-20min), and 3) 65% VO₂ without BFR for 60 minutes (no-BFR-60min). Each session began with the subject reaching a hydration status at or below 1.010. Once the hydration levels were reached, the subject would lie down, in the supine position, and have baseline hemodynamics measured. Following baseline measurements, the subject walked/run at a randomly predetermined intensity and time with or without BFR cuffs. BFR cuffs were taken off immediately after the 20-minute BFR condition. Post measurements of hemodynamics were taken at 10, 20, and 40 minutes following exercise. Conditions were separated by at least 48 hours. **RESULTS:** Significant condition main effects were found in PR (p<.01, BFR-20min vs. no-BFR-60min), SV (p<.01, BFR-20min vs. no-BFR-60min), CET (p<.04 no-BFR-20min vs. no-BFR-60min). Significant time main effects were found in PR (p<.01), SV (p<.01), CO (p<.04), CET (p<.01), SVR (p<.04), and TVI (p<.01). Significant condition*time interactions were found in PR (p<.01), SV (p<.01), CO (p<.02), SVR (p<.04), and TVI (p<.01).

CONCLUSIONS: The BFR-20min condition, at 40% VO₂, elicited higher SV and lower PR responses than the no-BFR-60min condition using 65% VO₂, which might be caused by the use of a lower intensity that produced a lower sympathetic nervous system response. Furthermore, the no-BFR-60min condition produced a lower response in SVR and TVI than the no-BFR-20min condition that may have been caused by a greater release of nitric oxide from the session length that was thrice as long.

**258 Board #79 May 31 9:30 AM - 11:00 AM
Impact of Blood Flow Restricted Cycle Training in College-Aged Triathletes on Performance and Physiological Parameters**

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(No relationships reported)

Aerobic exercise training with blood flow restriction (BFR) has been reported to increase aerobic capacity and muscle strength and volume. However, there is no evidence that such a training strategy increases performance in athletes. **PURPOSE:** To elucidate the effects of a 4 week BFR cycle training protocol on aerobic capacity, muscle function and performance variables in triathletes of a university club. **METHODS:** Eighteen healthy university triathletes were randomly assigned to BFR group (n = 12; 19 ± 1 yrs) or no BFR group serving as the control (CON; n = 6; 20 ± 1 yrs). Both groups trained by cycling for 30 minutes, 3 days/week for 4 weeks. BFR was performed for 15 minutes total during each session as 5 minutes with BFR followed by 5 minutes without BFR, by applying cuffs to the upper thighs. The BFR group was further subdivided into two groups: one group with compression set to 160 mmHg (constant pressure, BFR-CP, n = 6); in the other, the compression was gradually increased from 160 to 190 mmHg over 4 weeks (incremental pressure, BFR-IP, n = 6). All tests were performed before (Pre) and after 4 weeks of training (Post). Triathlon-specific performance tests were used: 5000-m run and 1500-m swim time trials and a 20-min bike distance trial, as well as the evaluation of peak oxygen uptake (VO_{2peak}), one legged knee extensor strength, and thigh muscle cross sectional area (CSA). Two-way repeated ANOVAs were used (BFR vs CON or BFR-CP vs BFR-IP and Pre vs Post) with significance accepted as p<.05. **RESULTS:** VO_{2peak} significantly increased after the training (main effect of time) and significant group-by-time interactions were detected (3198 to 3449 mL/min and 3152 to 3212 mL/min in BFR and CON). However, a post-hoc analysis indicated no significant interaction in VO_{2peak} between BFR-CP (3137 to 3396 mL/min) and BFR-IP (3259 to 3501 mL/min). Although the 5000-m run time was significantly shorter after the training (main effect of time), no significant interaction were detected (20.3 to 19.8 min and 20.1 to 19.8 min in BFR and CON). Lastly, there were no significant effects of training on muscle strength or CSA, 1500-m swim time, or 20-min bike distance. **CONCLUSIONS:** In this group of university triathletes, 4 weeks of BFR cycle training increased aerobic capacity, but had no added effect on muscle strength and volume or performance test outcomes.

**259 Board #80 May 31 9:30 AM - 11:00 AM
Influence Of The Degree Of Blood Flow Restriction On Muscular Activity During Bench Press Exercise**

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Abstract; It has been reported that blood flow restriction (BFR) induced increases in muscle activation are correlated with decreased muscle blood flow resulting from external compression (i.e. higher relative pressures) (Sugaya M, 2011). However it has been reported that higher relative pressures may not be necessary with low-intensity exercise with BFR (Loenneke JP et al. 2015). **PURPOSE:** The purpose of this study was to compare the effects of resistance exercise with different degrees of BFR on muscle activation. **METHODS:** 15 healthy adults performed 3 sets of bench press exercise (30, 15, and 15 reps; load: 30% 1RM) during 4 different BFR conditions: non pressure (N-BFR), low pressure BFR (L-BFR), middle level pressure BFR (M-BFR), and high pressure BFR (H-BFR). Surface EMG was recorded from the pectoralis major muscle (PM), anterior deltoid muscle (AD), and the triceps brachii muscle (TB), EMG amplitude (RMS) normalized as the relative exercise intensity (%) was analyzed (2-way repeated measures analysis of variance, and multiple post hoc test). **RESULT:** During 3 sets of exercise, gradual increases in RMS were observed in all muscles. The RMS of AD were 44.0±9.4-52.4±12.1-54.7±13.2 (mean±SD, %, 1set-2set-3set, N-BFR), 47.4±11.6-57.4±15.9-61.9±17.4 (L-BFR), 42.1±8.0-58.3±12.2-65.4±15.7 (M-BFR), and 47.0±12.3-68.2±25.9-77.3±33.9 (H-BFR). Interactions

between BFR conditions and sets for AD had significant effects ($F=2.53, p<0.05$). The main effect of BFR conditions was significant for PM, average of 3 sets (mean \pm SD, %), N-BFR: 46.8 \pm 7.6; L-BFR: 52.4 \pm 14.3; M-BFR: 52.2 \pm 11.7 < H-BFR: 61.5 \pm 21.1, $F=3.06, p<0.05$, but was not significant for TB (N-BFR: 46.5 \pm 14.7; L-BFR: 55.9 \pm 20.1; M-BFR: 50.5 \pm 10.8; H-BFR: 52.1 \pm 17.4, $F=0.86, p>0.05$). **CONCLUSION:** These findings indicate that muscle activation was affected by relative differences in applied pressure for non-restricted trunk muscles (i.e. PM and AD), but not affected for restricted limb muscle (i.e. TB). Previous studies have focused on restricted limb muscle following single-joint resistance training. Therefore, it is important that the influence of the degree of blood flow restriction on muscle activation is investigated in multi-joint exercise.

260 Board #81 May 31 9:30 AM - 11:00 AM
Can Blood Flow Restriction Augment Post Activation Potentiation in College-Aged?

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 (No relationships reported)

It has been shown that blood flow restriction (BFR) can enhance muscular performance, however, it remains unknown if BFR can augment post activation potentiation (PAP). **PURPOSE:** To determine whether BFR can enhance PAP induced by either whole body vibration (WBV) or isometric maximal contractions (IMVC) as measured by jump performance in college-aged males. **METHODS:** Resistance trained men ($n=20$) ages 18-30 years participated in a randomized, crossover design with repeated measures. Subjects visited the lab on 4 occasions. The first visit was for familiarization, and the second visit was the control condition (CON - 3 vertical jumps (VJ) to calculate jump height and power, followed by 10 min rest, then 3 VJ). For visits 3 and 4, subjects performed 2 different treatment conditions (pre, treatment, post), separated by 30 minutes of rest on each day. The 4 treatment conditions included whole body vibration (WBV), whole body vibration with BFR (WBVK), maximal voluntary contractions (MVC) and maximal voluntary contractions with BFR (MVCK) both via deadlift. Repeated measures ANOVA compared conditions for percent changes in power and jump height as well as for the raw power and height values (time (2) x condition (5)). **RESULTS:** There were significant differences in percent change in jump height for 3 of the 4 interventions compared to CON (-1.5 \pm 1.0): WBV 3.0 \pm 9% ($p=0.02$); WBVK 2.8 \pm 9% ($p=0.02$); and MVCK 3.5 \pm 1.0% ($p=0.06$) but not for the MVC condition 0.8 \pm 1.2% ($p=0.145$). There were no significant differences in percent change in jump power for any condition. For raw jump height (inches), there was a significant condition x time interaction ($p=0.001$) and a significant main effect for time ($p=0.004$) or about a 1 inch increase from pre to post across all conditions) but no significant main effect for condition ($p=0.100$). There were no significant main effects or interaction effect for jump power (W). **CONCLUSION:** The 4 conditions (not including CON) significantly improved jump height (but not power), however, the addition of BFR did not enhance PAP or jump performance. These findings suggest the BFR protocol may not have been a strong enough stimulus to enhance PAP since we used a constant restriction pressure for all subjects (160 mmHg) rather than individualizing the pressures based on total occlusion pressures.

261 Board #82 May 31 9:30 AM - 11:00 AM
Blood Flow Restriction Training Improves Functional Tests Associated with Return to Sport After Injury

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 (No relationships reported)

Introduction:

Traditional strength training with high load resistance is not practical for patients with orthopedic injuries and often not tolerated well by sedentary individuals. Blood flow restricted training (BFRT) is an emerging way to increase muscle strength using low loads and high repetitions. However, whether this strength training method also transfers to functional outcomes used in rehabilitation, such as hop testing, is unknown. We hypothesized that BFRT would significantly improve muscle strength and hop test performance used in making return to sport decisions.

Methods:

4 healthy females and 7 males (24.5 \pm 7.25 years old) who were not currently participating in strength training completed the study. Kaatsu BFRT bands were placed on the subjects' thighs while they performed leg extension, calf raises, and leg press exercises starting at 30% of their 1 RM max, 3 times per week for 6 weeks. Resistance was adjusted every other training session. Isometric quadriceps strength was measured on a Biodex. Single leg hop and triple hop performance were measured before and after the study. Strength and hop distances were compared before and after KAATSU strengthening with a paired t-test.

Results:

Significant improvements were found for peak quadriceps strength (pre: 170.0 \pm 47.98 N, post: 197.1 \pm 57.2 N, $p=0.037$), single leg hop (pre: 128.9 \pm 33.8cm, post: 154.2 \pm 33.4cm, $p=0.007$), and triple hop (pre: 405.5 \pm 106.4cm, post: 428.4 \pm 104.1cm, $p=0.025$).

Conclusions:

BFRT is associated with significant improvements in muscle hypertrophy and functional improvements in healthy subjects. There were significant improvements in hop testing distances, indicating the benefits of BFRT extend beyond improved strength. Subsequent studies should evaluate the possibility of creating BFRT programs that target injury-specific muscle groups when high load resistance training is contraindicated due to surgery or injury.

262 Board #83 May 31 9:30 AM - 11:00 AM

Acute Effects Of Aerobic Exercise With Blood Flow Restriction Cuffs On Arterial Compliance In Males

Magalie Sanchez, Margarita Gonzalez, Brittany Esparza, Patrick Murphy. *University at Texas Rio Grande Valley, Brownsville, TX.*
 Email: magalee717@yahoo.com
 (No relationships reported)

PURPOSE: The purpose of this study was to examine the acute effects a 20-minute run, at 40% VO₂, with and without blood flow restriction (BFR) cuffs has on systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP), and pulse pressure (PP) when compared to a 60-minute run at 65% VO₂ without BFR in males. **METHODS:** On the first session, seventeen male subjects (between the ages of 18 and 50) were familiarized with the study protocol, measured for thigh circumference, and performed the Bruce protocol. Inflation of BFR cuffs was based on thigh circumference. Conditions were randomized into three sessions, 1) a 60-minute walk/run without BFR cuffs at 65% VO₂ intensity, 2) 20-minute walk/run at 40% VO₂ intensity with the BFR cuffs inflated, and 3) 20-minute walk/run at 40% VO₂ intensity without BFR. Participants were required to show up hydrated, reaching a status at or below 1.010, and with at least 8-hour fasted during the three separate randomized sessions. After the subject reached set hydration levels, they would lie down in a supine position and have baseline blood pressure measurements taken. After blood pressure was taken, subject would walk/run for 20 or 60 minutes at a moderate intensity (40% or 65% VO₂) with or without BFR cuffs. BFR cuffs were placed before condition three and were taken off immediately post exercise. Upon completion of the exercise, participants laid back into the supine position and had post measurements, of blood pressure, taken post 10, 20, and 40 minutes. Sessions were separated with at least 48 hours. **RESULTS:** Significant condition main effects were found in SPB ($p<0.05$). Significant time main effects were found in SPB ($p<0.02$) and PP ($p<0.05$). Significant condition time main effects were found in SPB ($p<0.01$) and DBP ($p<0.01$). **CONCLUSION:** The results conclude that the 60-minute condition had lower post SBP measurements than the 20-minute BFR and non-BFR conditions, which can be caused by vasodilation, due to the possible increase in nitric oxide, that created less pressure in the arteries from the large difference in activity length when compared to the 20-minute sessions.

263 Board #84 May 31 9:30 AM - 11:00 AM

Differences in Neuromuscular Adaptations After Two Weeks of Conventional vs Blood Flow Restriction Resistance Training

Danny D. Dominguez, Patrick Gage Murphy, Brittany N. Esparza, Gabriela Soto, Roberto Osornio, IV, Ulku Karabulut, Murat Karabulut. *University of Texas at Rio Grande Valley, Brownsville, TX.*
 (No relationships reported)

PURPOSE: The purpose of the study was to determine the neuromuscular changes in the rectus femoris (RF) muscle as measured by electromyography (EMG) following short-term resistance training with and without blood flow restriction (BFR). **METHODS:** 12 males (age = 27.4 \pm 6.3 years; height = 171 \pm 7 cm; weight = 79.8 \pm 13.2 kg) performed six sessions of lower body unilateral resistance training using a leg extension machine. The leg on which BFR was applied was determined through randomization leg dominance. Each training session consisted of unilateral knee extensions with and without blood flow restriction. Electromyography data was recorded for each participant during two isometric maximum voluntary contractions (MVC) and two isokinetic knee extension tests (180°/s and 60°/s) using a Biodex System 4 Pro™. EMG was recorded from the RF during these tests. Resistance training consisted of six non-consecutive sessions of knee extension exercises performed in a time frame of two weeks. For the BFR group, subjects trained for a total of four sets (30, 15, 15, 15) at an intensity of 20% 1RM. The contralateral limb was trained with two sets of 11 repetitions at an intensity of 70% 1RM without BFR. The volume of exercises was similar for both conditions. **RESULTS:** No condition*time interactions or condition and time main effects were observed for root mean square (RMS), mean RMS (mRMS), yMax (yRMS), and median frequency (MDF) in both MVC and isokinetic 180°/s and 60°/s ($p>0.05$). **CONCLUSIONS:** Both training conditions resulted in insignificant changes and there was no significant difference found between time points. It could be concluded that this was not enough time or stimulus to note major differences across modalities in relation to neuromuscular adaptations of the RF as measured by EMG. Further studies should investigate the effects of higher volume load on neuromuscular adaptations.

A-43 Free Communication/Poster - Cardiovascular Disease

Wednesday, May 31, 2017, 7:30 AM - 12:30 PM
Room: Hall F

264 Board #85 May 31 9:30 AM - 11:00 AM Long-term Changes Following Weight Loss in Older Patients with Heart Failure with Preserved Ejection Fraction

Thomas Becton¹, James Muller², Peter Brubaker, FACSM², Barbara Nicklas¹, Dalane W. Kitzman¹. ¹Wake Forest School of Medicine, Winston-Salem, NC. ²Wake Forest University, Winston-Salem, NC. (Sponsor: Peter Brubaker, FACSM)
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(No relationships reported)

Heart failure with preserved ejection fraction (HFpEF) is the most common form of heart failure among older persons, and >80% of patients are overweight/obese. Increased adiposity is associated with numerous systemic impairments that contribute to HFpEF pathophysiology, and is significantly correlated to severity of exercise intolerance, the primary symptom in HFpEF. Yet only one study has examined the effects of caloric restriction (CR) with or without aerobic training (AT) in older HFpEF patients. The Study of Caloric Restriction and Exercise Training (SECRET) demonstrated that a short-term (20-weeks) CR or AT+CR intervention resulted in significant weight loss and led to significant improvements in peak VO₂ and quality of life. However, whether these changes are sustained over time is not known. **PURPOSE:** To evaluate long-term changes in exercise function and body composition in older HFpEF patients after completion of the SECRET interventions. **METHODS:** Sixteen patients, from CR or AT+CR groups (≥10 kg weight loss), underwent maximal treadmill exercise and DXA body composition assessment 29 ± 11 months (range 10-47 months) after completion of their SECRET trial participation. Paired t-tests were used to compare changes over time. Pearson correlations were used to explore the relationship between body composition measures. **RESULTS:** Compared to status at trial end, at follow-up, mean weight change was +5.2 ± 3.8 kg. There was a significant increase in fat mass (+4.9 kg, p<0.001), but not lean mass (+0.3 kg, p=0.67). There was a significant correlation between change in total mass and fat mass (r = 0.75, p=0.001), but only a trend between change in total mass and lean mass (r = 0.49, p=0.053). There was also a significant decrease in relative peak VO₂ (-2.2 ± 2.1 ml/kg/min, p=0.003) and exercise time (-2.4 ± 2.6 min, p=0.006), with a trend for absolute peak VO₂ (-87 ± 152 ml/min, p=0.062). **CONCLUSIONS:** While CR and AT+CR in older HFpEF patients produces significant improvements in exercise tolerance associated with improved body composition, these positive changes appear to diminish during long-term follow-up, and regained weight appears to be mostly fat. This suggests a need for long-term interventions to prevent weight regain and maintain improvements in physical function and body composition in older HFpEF patients.

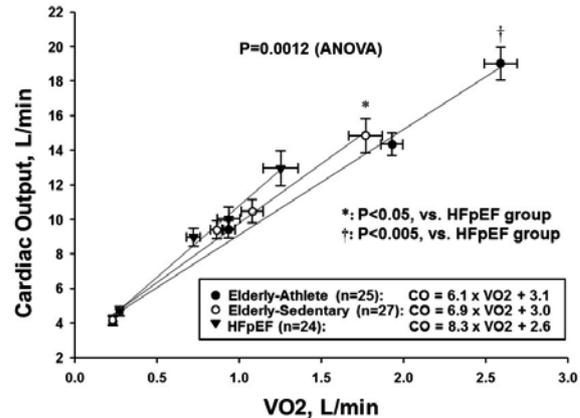
265 Board #86 May 31 9:30 AM - 11:00 AM PeakVO₂-cardiac Output Relationship During Exercise In Seniors Who Are Sedentary, Athletic, And HFpEF Patients

Michinari Hieda, Sarma Satyam, Christopher Hearon Jr., Justin Lawley, Ashley Hardin, Mitchel Samels, Jose Martinez Diaz, Braden Everding, Dean Palmer, Lisa Hicklen, Margot Morris, Sheryl Livingston, Jeungki Yoo, Qi Fu, Rong Zhang, Benjamin D. Levine. *The Institute for Exercise and Environmental Medicine, Texas Health Presbyterian Hospital, Dallas, TX.*
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(No relationships reported)

PURPOSE: The purpose of this study was to evaluate the relationship between O₂ uptake (VO₂) and cardiac output (Qc) during exercise in seniors who were sedentary, athletic, and Patients with HFpEF. **METHODS:** Based on lifestyle physical activity level categorization, elderly-sedentary seniors (n=27, 69±5 yrs) and elderly-athletic seniors (n=25, 68±3 yrs), and patients with heart failure with preserved ejection fraction (HFpEF) (n=24, 71±7 yrs) were selected and underwent cardiopulmonary exercise testing. A modified Astrand-Saltin incremental treadmill protocol was performed to determine VO₂ and ventilatory gas exchange using the Douglas bag technique. Cardiac output (Qc) was measured with the C2H2 rebreathing method. Peak arterial-venous O₂ difference (peak AV-O₂ diff) was calculated by Fick equation (peak VO₂ divided by peak Qc). The slope of the relationship between changes in VO₂ and Qc during exercise was calculated by ΔQc/ΔVO₂. **RESULTS:** Peak VO₂ and peak Qc was lower in HFpEF group than the other groups (peak VO₂: HFpEF: 13.1±3.6; vs. Sedentary: 23.5±4.4; vs. Athlete: 39.5±5.3 ml/kg/

min, P<0.001 (ANOVA) as was peak Qc: HFpEF: 12.7±4.1; vs. Sedentary: 14.8±4.1; vs. Athlete: 19.0±6.0 L/min, P<0.001 (ANOVA). Peak AV-O₂ diff in HFpEF group was the smallest in the 3 groups (HFpEF: 9.7±2.3; vs. Sedentary: 12.2±3.0; vs. Athlete: 14.3±3.6 %, P<0.0001 (ANOVA)), and the Athlete group was greater than the Sedentary group (P=0.04 (Wilcoxon rank-sum)). The relationship between Qc and VO₂ (slope of ΔQc/ΔVO₂) is shown in Figure. **CONCLUSIONS:** Both reduced Qc and AV-O₂ diff contribute significantly to the impairment of exercise capacity in HFpEF through Qc is augmented for a given VO₂. Lifelong exercise training enhances Qc and peak AV-O₂ diff in the elderly population and normalizes Qc/VO₂ relationship.

Relationship between Cardiac Output and VO₂



266 Board #87 May 31 9:30 AM - 11:00 AM Self-Reported Screen Time is Independently Associated with Cardiometabolic Disease Risk Factors in Young Adults

Kathleen R. Connor, 83843¹, Katrina Taylor², Devin Drummer³, Megan C. Nelson¹, Chantal Vella, FACSM¹. ¹University of Idaho, Moscow, ID. ²Eastern Washington University, Cheney, WA. ³Central Washington University, Ellensburg, WA.
(No relationships reported)

Research has shown that self-reported screen time is linked to cardiometabolic disease risk factors in children. Whether this association extends to young adults has not been investigated. **PURPOSE:** To determine the associations between self-reported screen time and individual cardiometabolic disease risk factors in young adults. **METHODS:** Sixty-six young adults volunteered for the study (mean±SD: age 20.6±1.4 y; BMI 24.3±3.6 kg/m²; body fat 22.7±8.8%; peak oxygen consumption [VO₂peak] 45.7±7.7 ml/kg/min). Sedentary behavior and screen time (television viewing, video games and computer games) were self-reported using the Sedentary Behavior Questionnaire. Moderate-to-vigorous physical activity (MVPA) was objectively measured by 7 d of accelerometer wear. Cardiometabolic disease risk factors were measured using standard procedures and included waist circumference, blood pressure, glucose, triglycerides (TG), high-density lipoprotein cholesterol (HDL) and low-density lipoprotein cholesterol (LDL). Body composition was estimated by BOD POD and VO₂peak was measured by indirect calorimetry using an incremental treadmill test to exhaustion. Multiple regression was used to analyze the independent associations between screen time and individual cardiometabolic disease risk factors with sedentary behavior, MVPA, age, and sex used as covariates in the models. **RESULTS:** On average, screen time (14.8±11.6 h/week) accounted for 25% of total sedentary behavior (59.0±25.8 h/week). Screen time was positively associated with BMI (R²=0.19, β=0.35, p=0.02), waist circumference (R²=0.19, β=0.43, p<0.01), fat mass (R²=0.39, β=0.34, p=0.01), and TG (R²=0.24, β=0.43, p<0.01), and negatively associated with VO₂peak (R²=0.66, β=-0.39, p<0.01). These associations were independent of total sedentary behavior, MVPA, age and sex. Screen time was not associated with blood pressure, glucose, HDL or LDL (p>0.05). **CONCLUSIONS:** Our findings suggest that screen time is related to individual cardiometabolic disease risk factors in young adults. Screen time accounted for 25% of sedentary time and may be an important area to target for chronic disease prevention programs in young adults.
Funded by CTR-IN NIH NIGMS #1U54GM104944-01A1

WEDNESDAY, MAY 31, 2017

267 Board #88 May 31 9:30 AM - 11:00 AM
The Relationship Between CAD Risk Factors And Carotid Intima-media Thickness (cimt) In Children
 Daniel J. White. *University of New England, Biddeford, ME.*
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 (No relationships reported)

Increased carotid intima-media thickness (CIMT) is accepted as an early indicator for the development of atherosclerotic coronary artery disease (CAD). The presence of CAD risk factors is shown to have a negative influence on CIMT. As obesity rates increase in children which negatively alters CAD risk factors, it is unclear how this might alter CIMT. **PURPOSE:** The purpose of this study was to determine if there is a relationship between children's CIMT and CAD risk factors as well as number of CAD risk factors combined. **METHODS:** One hundred and nineteen children (age 10.51±0.52, height 147.2±7.05cm, and weight 46.51±12.21kg) took part in the CIMT assessment. Subjects were randomly selected from the Cardiovascular Health Intervention Program. Subjects had previously completed a fasting blood lipid and glucose profile, height, weight, and resting blood pressure to evaluate CAD risk factors. A licensed sonographer completed scans on the right and left common carotid using the ultrasound unit (Terason t3200) with a linear transducer probe. CIMT was measured using the software The Carotid Analyzer for Research Version 6. **RESULTS:** An increase in CIMT was observed in the right ($p<.05$), left ($p<.01$) and combined right and left CIMT ($p<.001$) in children with an elevated BMI ($>85^{th}$ %) Vs those with a healthy BMI. The children with elevated blood pressure ($>95^{th}$ %) had an elevated CIMT in both the left ($p<.001$) and combined left and right CIMT ($p<.05$). In respect to elevated blood glucose ($> 100\text{mg/dl}$), only an elevated CIMT was observed in the right CIMT ($p<.05$). When comparing CIMT to number of CAD risk factors, an increase in CIMT ($p<.05$) was observed in children with 2+ CAD risk factors Vs 0 CAD risk factors. **CONCLUSION:** It appears elevated BP, BMI and glucose have a negative influence on CIMT in children. Changes in CIMT (left VS right) appear to be different based on the CAD risk factor of interest. Children with 2+ CAD risk factors appear to have an adverse effect on CIMT, strongly suggesting the need for early healthy life-style intervention. This research supports previous research looking at CIMT in children with CAD risk factors. Funding provided by Clark Charitable Foundation (Subcontract from Children's National Medical Center, Washington, DC)

268 Board #89 May 31 9:30 AM - 11:00 AM
The Effect of Moderate Resistance Exercise on Arterial Stiffness With and Without the Valsalva Maneuver
 Nicole M. Fortunato, Christa Winter, Elizabeth O'Neill, Samuel A.E. Headley, FACSM. *Springfield College, Springfield, MA.*
 (Sponsor: Samuel Headley, FACSM)
 (No relationships reported)

Resistance exercise has been said to increase arterial stiffness. The Valsalva maneuver can be used while performing resistance exercise, and may also contribute to negatively altering arterial stiffness. **PURPOSE:** The study was designed to determine the effect of moderate intensity resistance exercise on arterial stiffness with and without the Valsalva maneuver. **METHODS:** Subjects ($N = 13$) consisted of males between 18-30 years old who were familiar with resistance training. All subjects completed one session of moderate intensity resistance exercise (60% of 1-RM) with the Valsalva maneuver, and a second session without the Valsalva maneuver in a counterbalanced order. Pulse wave velocity (PWV) was used to measure arterial stiffness before exercise, 10 min post, 30 min post, and 60 min post exercise. **RESULTS:** No significant interaction $F(3,36) = 0.74, p = .54$ was found between the condition of Valsalva maneuver, or no Valsalva maneuver, and the test occasion. No significant main effect $F(1,12) = 0.02, p = .89$ was found for the treatment condition of Valsalva maneuver and no Valsalva maneuver. Also, no significant main effect $F(1.96, 23.57) = 0.18, p = .84$ was found for test occasion (pre-exercise, 10 min post, 30 min post, and 60 min post exercise). **CONCLUSION:** Moderate intensity resistance exercise with and without the Valsalva maneuver did not negatively affect arterial stiffness.

269 Board #90 May 31 9:30 AM - 11:00 AM
Patterning Of Physiological And Perceptual Responses To Exercise: Effect Of Sympathetic Blockade
 Kade Davison, Braden L. Mitchell, Gaynor Parfitt, Simon Spedding, Roger G. Eston. *University of South Australia, Adelaide, Australia.*
 (No relationships reported)

The rating of perceived exertion (RPE), a subjective indicator of exercise intensity, is becoming increasingly popular for monitoring and prescribing exercise intensity in clinical populations. It remains unclear whether the relationship between RPE and oxygen uptake (VO_2) is affected by perturbations to the sympathetic nervous system.

Purpose: To determine whether acute sympathetic blockade alters the relationship between heart rate (HR), RPE and VO_2 during incremental exercise. **Methods:** Eleven healthy adults completed two graded exercise tests (GXT) on a motorized treadmill, under a β_2 receptor antagonist and placebo. Treadmill speed increased by $2 \text{ km} \cdot \text{h}^{-1}$ every 2 min and participants reported their RPE (Borg 6-20 RPE Scale) each min until exhaustion. The VO_2 and HR were measured continuously. Linear regression modelled the growth of individual participant relationships of RPE and HR with VO_2 . To account for differences in peak HR between conditions, values were expressed relative to the peak HR from each GXT. Paired sample t-tests assessed differences in the slope (b) of the individual regression models between conditions. **Results:** The $\text{VO}_{2\text{peak}}$ and HRpeak were lower during β -blockade (51.9 ± 5.3 vs $48.6 \pm 7.5 \text{ mL} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$, $p<0.05$; 192.7 ± 8.2 vs $156.0 \pm 23.1 \text{ b} \cdot \text{min}^{-1}$, $p<0.01$, respectively). As expected, the slope for the relationship between HR and VO_2 was greater during β -blockade ($b 0.37 \pm 0.03$ vs 0.48 ± 0.07 , $p<0.01$), however, there was no significant difference in the slope of the RPE- VO_2 relationship ($b 3.34 \pm 0.71$ vs 3.30 ± 0.77 , respectively $p>0.05$) and no significant difference in b when HR was expressed relative to the peak HR during the GXT ($b 0.71 \pm 0.07$ vs 0.73 ± 0.07 , $p>0.05$). **Conclusion:** Despite a marginally lower $\text{VO}_{2\text{peak}}$, the relationship between RPE and VO_2 remains unchanged by sympathetic blockade, whereas the absolute HR- VO_2 relationship is significantly altered. This means that RPE can be used in place of HR to determine metabolic work or estimate fitness sub-maximally in individuals taking β -blockade.

270 Board #91 May 31 9:30 AM - 11:00 AM
Exercise-induced Change in Metabolites and Associations with Cardiometabolic Risk Factors
 Andrea M. Brennan¹, Mark Benson², Jordan Morningstar³, Robert E. Gerszten⁴, Robert Ross, FACSM¹. ¹Queen's University, Kingston, ON, Canada. ²Brigham and Women's Hospital, Boston, MA. ³Massachusetts General Hospital, Boston, MA. ⁴Beth Israel Deaconess Medical Center, Boston, MA.
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 (No relationships reported)

Exercise-induced improvement in risk for chronic disease is attributed to changes in body composition, cardiorespiratory fitness, blood pressure and glucose metabolism; however, the underlying mechanism is unclear. Metabolomics offers the technology needed to investigate large numbers of metabolites that may participate in biochemical pathways of exercise-induced improvement in cardiometabolic risk. **PURPOSE:** To investigate the impact of an exercise intervention on plasma metabolites and whether changes in metabolite levels are related to changes in cardiometabolic risk factors. **METHODS:** A secondary analysis was performed in 216 middle-aged abdominally obese men and women ([mean (SD)], 52.4 (8.0) years) originally recruited to participate in a 6-month randomized controlled trial examining the effects of exercise amount and intensity on cardiometabolic risk factors. 139 metabolites were profiled by liquid chromatography-mass spectrometry. Cardiorespiratory fitness (CRF) was assessed using standard open-circuit spirometry during a maximal graded exercise test. Waist circumference (WC) was measured at the superior edge of the iliac crest. 2-hour glucose was measured in response to a 2-hour 75-g oral glucose tolerance test. Systolic (SBP) and diastolic blood pressure (DBP) was measured using an automated BP monitor. **RESULTS:** Seven metabolites significantly changed in the exercise compared to control group ($p<0.05$). There were no significant associations at the adjusted p-value ($p<0.0004$) between change in metabolites and change in 2-hour glucose, SBP or DBP. Change in leucine ($B=-0.29$), isoleucine ($B=-0.30$) and UDP-N-acetylglucosamine ($B=-0.40$) were negatively associated and citric acid isocitric acid ($B=0.29$) was positively associated with change in CRF. Change in UDP-N-acetylglucosamine ($B=0.46$) was positively associated with change in WC ($p<0.0004$). **CONCLUSION:** These findings represent a more global effort to uncover the biochemical pathways in which exercise elicits its cardiometabolic effects. These observations implicate several metabolites that may serve as biomarkers or have a direct regulatory role in pathways related to exercise and improved cardiometabolic status.

Supported by Canadian Institute of Health Research Grant

271 Board #92 May 31 9:30 AM - 11:00 AM
Time Course for Blood Pressure Changes with Aerobic Exercise in U.S. Veterans
 Shakeelah Sutton. *Veterans Affairs Medical Center, Washington, DC.* (Sponsor: Peter Kokkinos, FACSM)
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 (No relationships reported)

It is well-established that regular exercise training decreases resting blood pressure (BP). However, the length of exercise training necessary to lower resting BP is not well-defined.

PURPOSE: To assess the time course of exercise-induced BP changes in individuals with resting systolic BP ≥ 130 and/or diastolic BP ≥ 80 mm Hg.

METHODS: Veterans were enrolled in a 12-week hospital-based exercise program that consisted of aerobic exercise two to three times per week. Resting BP was taken manually at the beginning of each session. Exercise intensity was maintained at 60% -80% of heart rate reserve.

We assessed resting BP in 93 patients (61.5 ± 7.8 years) who completed the 12-week intervention. Qualifying resting BP was defined as systolic BP ≥ 130 mmHg and/or diastolic BP ≥ 80 mmHg at baseline. Baseline and post BP was obtained during stress tests administered before and after the intervention. Midpoint BP was comprised of the average BP obtained during week 6 of the intervention. Two sided paired sample t-tests were applied.

RESULTS: There was a significant decrease in mean resting systolic BP after 6 weeks of exercise from baseline (138.7 ± 14.6 vs. 130.3 ± 14.1 mmHg; p < 0.001). A significant decrease was also found in resting diastolic BP between these two time points (79.9 ± 7.3 vs 74.9 ± 9.1 mmHg; p < 0.001). No significant changes in resting BP were observed between midpoint and post-intervention time points. Post-intervention resting systolic BP (129 ± 13.6 mmHg; p < 0.001) yielded a 9.7 mmHg decline from baseline while diastolic BP (73.6 ± 9.8 mmHg; p < 0.001) yielded a 6.3 mmHg decline (Table).

CONCLUSION: Resting systolic and diastolic BP were significantly lowered after 6 weeks of aerobic exercise training. No additional changes were observed in BP at 12 weeks of exercise. Thus, exercise BP is lowered after just six weeks of aerobic exercise training or approximately 12-18 sessions.

Table.

Resting Blood Pressures During 12-Week Exercise Intervention

	Baseline	Midpoint	Post
Systolic BP (mmHg)	138.7 ± 14.6	130.3 ± 14.1	129 ± 13.6
Diastolic BP (mmHg)	79.9 ± 7.3	74.9 ± 9.1	73.6 ± 9.8

272 Board #93 May 31 9:30 AM - 11:00 AM
The Relationship Between Initiation of Cardiac Rehabilitation and Readmission Rates for Patients with Metabolic Syndrome

Lee Anne Siegmund, Mark McClelland, James Bena. *Cleveland Clinic, Cleveland, OH.*
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(No relationships reported)

Phase II cardiac rehabilitation (CR) has been shown to be effective at reducing risk factors associated with cardiovascular disease (CVD). A delay in starting CR has been associated with poorer fitness outcomes. The risk of CVD more than doubles in the presence of metabolic Syndrome (MetS). The association between initiation of CR, and hospital readmissions in patients with MetS was previously unknown.

Purpose: We sought to determine the relationship between the length of time to the start of CR, and hospital readmissions in patients with MetS. Further, we aimed to determine if there was an association between demographic and clinical variables, and hospital readmissions in this patient population.

Methods: We examined the records of 353 CR patients at a quaternary medical center who had MetS. Continuous measures were imputed using predicted mean matching regression, while categorical measures were imputed based on logistic models. Readmissions prior to beginning CR were excluded.

Results: Patient readmissions within 90 days were more likely to be non-white (p=0.026) and have a time to CR initiation of ≤ 30 days (p<0.001). Patients readmitted at ≤ 6 months were more likely to be non-white (p<0.001) and have time to CR ≤ 60 days (p = 0.017). Of 54 patients readmitted within 6 months, 75.9% began CR within 60 days and 56.9% were non-white. In multivariable models for readmission within 6 months, those of white race (OR 0.42 [0.18, 0.97]; p=0.041) were less likely to be readmitted. Patients who began CR early were 2.47 times more likely to be readmitted by 6 months (OR 2.47 [1.22, 5.02]; p=0.012).

Conclusions: Patients with MetS were more likely to be readmitted if they were non-white. Early uptake to CR resulted in higher likelihood of readmission at ≥ 90 days. These results raise questions about the health status and other unique traits of patients with MetS who begin CR early. Future studies should focus on designing CR programs to meet the needs of non-whites and those who may be sicker at the onset of CR.

273 Board #94 May 31 9:30 AM - 11:00 AM

The Immediate Blood Pressure Lowering Effects of Acute Concurrent Exercise: A Meta-Analysis

Alyssa Jones¹, Lauren ML Corso¹, Hayley V. MacDonald², Blair T. Johnson¹, Jill Livingston¹, Linda S. Pescatello, FACSM¹.
¹University of Connecticut, Storrs, CT. ²The University of Alabama, Tuscaloosa, AL. (Sponsor: Dr. Linda S. Pescatello, FACSM)
(No relationships reported)

Our recent meta-analysis on the blood pressure (BP) lowering effects of concurrent exercise training (CET) found systolic BP (SBP) and diastolic BP (DBP) were moderately reduced an average of ~3 mmHg overall. However, large SBP/DBP (~9/8 mmHg) reductions were noted among adults with hypertension, indicating the potential clinical utility of CET as antihypertensive lifestyle therapy. **PURPOSE:** To perform a meta-analysis to determine whether acute concurrent exercise (CE) is also efficacious antihypertensive lifestyle therapy. **METHODS:** Databases were searched for controlled studies that included: adults (≥19 yr), a single bout of CE, and measured BP pre- and post-CE and control. Analyses followed random-effects assumptions. **RESULTS:** 8 studies and 13 interventions (k) qualified. Subjects (N=109) were young to middle-aged (35.9±16.4 yr), overweight (26.7±3.1 kg/m²) men (34.6%) and women (65.4%) with a resting SBP/DBP of 122.3±11.9/76.6±7.2 mmHg. Among the total sample, 38.6% (N=42) had hypertension, 12.4% (N=14) prehypertension, and 49.0% (N=53) normal BP. Acute CE was performed at moderate-to-vigorous intensity (aerobic=65.6±17.5% maximum oxygen uptake, resistance=63.9±16.5% one-repetition maximum) for 55.0±6.1 min, with 53.9% of the interventions performing aerobic first. Aerobic exercise interventions included walking (38.5%, k=5), cycling (38.5%, k=4), running (15.4%, k=2), and step aerobics (7.7%, k=1) for 29.1±3.0 min. Dynamic resistance exercise interventions were performed on machines for 26.1±4.9 min, and consisted of 2.8±1.2 sets of 11.5±5.4 repetitions per set for 5.9±1.2 exercises. BP was measured in the laboratory for 89.2±45.4 min post-CE. Overall, acute CE elicited large reductions in SBP (d₊ [95% CI]= -0.84 [-1.23, -0.44]; -9.2 mmHg), but not DBP (d₊ [95% CI]= -0.08 [-0.27, 0.11]; -0.6 mmHg) compared to control. We observed significant heterogeneity for SBP (I² [95% CI]= 82.7% [71.6%, 89.4%]) and DBP (I² [95% CI]= 49.7% [4.9%, 73.43%]), but no significant moderators emerged. **CONCLUSION:** Similar to CET, acute CE leads to clinically meaningful reductions in SBP (~9 mmHg), but in contrast to CET, not DBP. The BP lowering patterns appear to differ between acute and chronic CE, findings that should be confirmed in future randomized CE trials.

274 Board #95 May 31 9:30 AM - 11:00 AM

Blood Pressure Reductions Following A 12-week Isometric Training Program: Lab-based Vs. Home-based Approach

Ben DH Gordon, Erin Vinoski, Caroline Jones, Jan Warren-Findlow, Reuben Howden. *University of North Carolina at Charlotte, Charlotte, NC.*
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PURPOSE: The American Heart Association (AHA) identified isometric exercise training (IET) as a "potential" supplementary therapy for blood pressure management (Class IIB Level of Evidence C), highlighting a need for further investigation. Importantly, reductions in resting blood pressure (RBP) following IET have been reported in laboratory environments, but data regarding the use of IET in the community are lacking. **METHODS:** Fourteen hypertensive participants (24-60 years) were randomized to one of three conditions; standard laboratory face-to-face delivered IET, home administered IET (with instructional video), and a control condition. IET groups completed handgrip IET at 30% maximal voluntary contraction three days per week for twelve weeks. Changes in resting BP were assessed every six weeks during the training period and six weeks post-training. **RESULTS:** Twelve weeks of IET induced a clinically significant reduction in group mean SBP (class -8.77±6.34; home -8.10±6.13; control -5.77±6.41 mmHg; weeks: p=0.06; treatment p= 0.14). Interestingly, six weeks after training had ended, group mean blood pressure was further reduced in the class condition of IET and SBP was still lower compared to pre-training measures in the home condition, whereas control participants trended towards pre-study measures (class -11.00±7.05; home -6.90±5.68; control -4.55±3.04 mmHg). **CONCLUSIONS:** Twelve weeks of IET produced a clinically relevant reduction in RBP. Similar reductions were observed in both home and class IET conditions with continued reductions taking place post training. These data suggest that self-administered IET in a cohort of hypertensive participants was as effective compared to a laboratory-based setting. Therefore, IET may be an effective and practical intervention for self-management of RBP in the wider community. Additional research is needed, accounting for other factors that affect RBP, to further confirm, IET as an effective intervention for reducing RBP. Supported by a Faculty Research Grant at UNC-Charlotte

WEDNESDAY, MAY 31, 2017

A-44 Free Communication/Poster - Cardiovascular Responses to Exercise

Wednesday, May 31, 2017, 7:30 AM - 12:30 PM
Room: Hall F

275 Board #96 May 31 11:00 AM - 12:30 PM

Acute Electrical Muscle Stimulation Of The Lower Extremities Enhances The Vascular Endothelial Function

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The use of electrical muscle stimulation (EMS) has been shown to potentially improve or compensate for disadvantages in disabled or chronic patients with physical inactivity. However, little is known about the effects of EMS on the arterial function. **PURPOSE:** The aim of this study was to evaluate the effects of EMS to the lower extremities on the vascular endothelial function determined by flow-mediated vasodilation (FMD). **METHODS:** Eight healthy adult men were studied under two experimental trials (EMS and control without any stimulation) in the supine position. In the EMS trial, both lower leg and thigh muscles were sequentially stimulated at 4 Hz for 20 min. Before and after each trial, the brachial systolic and diastolic blood pressure (SBP and DBP) were measured. In order to measure the FMD, a forearm cuff was inflated to 50 mmHg over their SBP for 5 minutes with subsequent deflation. The right brachial artery diameter was measured using a high-resolution ultrasound device. The FMD was then estimated as the percent change in the arterial diameter over the baseline value at maximum dilation during reactive hyperemia. **RESULTS:** In the EMS trial, the FMD was significantly elevated immediately after (12.1±1.1%) and at 30 min after EMS (11.0±0.9%) compared with rest (9.2±0.8%). However, there were no significant changes in the control trial (9.3±0.9% at rest, 9.4±0.8% immediately after C trial, and 9.2±0.9% at 30min after C trial). Immediately after and 30min after each trial, significant differences in the FMD were found between the EMS and control trials ($p < 0.05$). No significant changes were found in the SBP/DBP in either trial. **CONCLUSIONS:** Acute EMS appears to improve the vascular endothelial function. These findings suggest that chronic EMS might be useful for reducing the risk of cardiovascular disease in people suffering from partial paralysis or arthritis as well as in healthy subjects.

276 Board #97 May 31 11:00 AM - 12:30 PM

Prolonged Sitting-Induced Lower Limb Vascular Dysfunction: The Effect of Oxidative Stress

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Prolonged sitting has been reported to result in significant vascular dysfunction due to increases in lower limb pressure and subsequent reductions in shear stress. Oxidative stress, a known modulator of vascular function, has been reported to increase in the vasculature in response to high pressures, but contrary findings exist when attempting to directly link the connection between increased pressure, oxidant production, and resulting vascular dysfunction. Therefore, the direct role of oxidative stress on the observed vascular dysfunction during prolonged sitting is currently unknown. **PURPOSE:** This study sought to examine the impact of oxidative stress on prolonged sitting-induced vascular dysfunction, measured via passive leg movement, by administering an acute oral antioxidant prior to the sitting session. **METHODS:** Seven young (24 ± 1 yrs) healthy males completed two 3-hour sessions of prolonged sitting. Subjects were given either an oral antioxidant (AO) containing 2 grams of vitamin C or a placebo (PL) pill. The supplementation took place following the baseline measures and immediately prior to the sitting session and all supplementation was double-blinded with at least 72 hours separated the two sitting sessions. Leg vascular function was assessed with passive leg movement (PLM) immediately prior to sitting, 1.5 hours, and 3 hours after the onset of the sitting session. **RESULTS:** Leg vascular function (assessed via PLM-induced hyperemia) was revealed to be significantly reduced following the three hours of prolonged sitting in the PL condition when evaluated as both Δ LBF (Baseline: 1214 ± 229; 3 hours: 904 ± 196 ml·min⁻¹; $p < 0.05$) and LBF area under the curve (AUC) (Baseline: 500 ± 158; 3 hours: 293 ± 99 ml·min⁻¹; $p < 0.05$). The AO condition resulted in a significant attenuation in lower limb vascular dysfunction after 3 hours of prolonged sitting expressed as both Δ LBF (Baseline: 1193 ± 330; 3 hours: 1040 ± 242 ml·min⁻¹; $p = 0.3$) and LBF area under the curve (AUC) (Baseline: 500 ± 158; 3 hours: 378 ± 99 ml·min⁻¹; $p = 0.2$). **CONCLUSION:**

Prolonged sitting-induced lower limb vascular dysfunction, assessed by PLM, was attenuated in response to an acute antioxidant supplementation. These findings implicate oxidative stress as a modulator of vascular function during prolonged sitting.

277 Board #98 May 31 11:00 AM - 12:30 PM

Tart Montmorency Cherries (prunus Cerasus L.) Acutely Modulate Vascular Function In The Absence Of Improvements In Cognition.

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Cerebral blood volume and metabolism of oxygen declines as part of human ageing and has been related to cognitive decline. There is some evidence to suggest that polyphenol-rich foods play an important role in delaying the onset or attenuating the progression of age-related health disorders such as cardiovascular and Alzheimer's disease, and to improve cognitive function. **PURPOSE:** The aim of this study was to assess the impact of Montmorency tart cherry juice consumption on pre-frontal cortical haemodynamics, cognitive function and blood pressure in middle-aged adults. **METHODS:** Twenty-seven healthy middle aged adults were recruited to take part in the study; the mean ± SD age, stature, mass and BMI were 50 ± 6 years, 170.7 ± 9.1 cm, 76.0 ± 16.0 kg and 26.1 ± 4.9 kg/m², respectively. Participants received either a 60 mL dose of a Montmorency tart cherry concentrate (MC) or a placebo (PLA) in a randomised, double blind, placebo-controlled, crossover design study with a >14 day wash-out period between conditions. Cerebrovascular responses (cerebral blood flow volume, total-, deoxy-, and oxy-haemoglobin), cognitive performance, mood and blood pressure were assessed at baseline and 1, 2, 3 and 5 h following consumption. Total-, deoxy- and oxy-haemoglobin were also continuously measured during the 60-min resting/absorption period immediately following supplementation. **RESULTS:** There were significant differences in concentrations of total and oxy-haemoglobin during the last three epochs of the resting/absorption period ($p \leq 0.05$) and during the cognitive task period 1 h post consumption ($p \leq 0.05$). Furthermore, MC consumption significantly lowered systole ($p \leq 0.05$) over a period of 3 h, with peak reductions of 6 ± 2 mmHg at 1 h post MC consumption relative to the placebo. Cognitive function and mood were not affected. **CONCLUSIONS:** The findings suggest that MC concentrate can acutely modulate CBF in the prefrontal cortex characterized by increased concentrations of both total- and oxy-haemoglobin. Despite this, the results do not translate to improvements in cognition or mood in the hours following consumption. Importantly, these data support previous findings observations that demonstrate a significant improvement in systole following MC supplementation.

278 Board #99 May 31 11:00 AM - 12:30 PM

Blood Flow in Humans During Low-Load Exercise with and without Blood Flow Restriction

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(No relationships reported)

Blood flow restriction (BFR) in combination with exercise has been well studied, however, little is known about the actual blood flow response to this type of exercise. The range of applied pressures in the research is wide, and previous studies have only examined the blood flow response using the same pressure for every individual independent of limb size, and have only done so at rest, after inflation of the cuff, and following exercise. No investigations have examined this response using relative applied pressures as a percentage of arterial occlusion pressure (AOP) nor have they investigated this within an exercise bout. **PURPOSE:** To measure blood flow before, during, and after low-load elbow flexion exercise combined with no restriction (NOBFR), 40% of AOP (40BFR), and 80% of AOP (80BFR). **METHODS:** 140 participants (women=75, men=65) were randomized into one of three conditions. After AOP and one-repetition maximum (1RM) measurement, ultrasound measures of standing blood flow at rest in the right brachial artery were taken. Participants performed four sets comprising 75 total goal repetitions of elbow flexion at 30% 1RM. Blood flow was measured between sets and at one and five minutes post-exercise. **RESULTS:** Blood flow decreased following inflation, with no difference between BFR conditions (40BFR: 38.1 ml·min⁻¹ vs. 80BFR: 36.3 ml·min⁻¹, $p=0.85$). Men had greater blood flow than women in all conditions at all time points (411.6 vs. 214.0 ml·min⁻¹,

respectively, $p < 0.001$). Maximum blood flow was decreased during exercise with pressure (NOBFR=406.7 ml·min⁻¹, 40BFR=311.1 ml·min⁻¹, 80BFR=188.5 ml·min⁻¹, $p < 0.001$). Blood flow tended to increase across sets regardless of condition. One minute following cuff deflation, blood flow was higher in 80BFR than in 40BFR for women only (372.2 vs. 253.1 ml·min⁻¹, $p = 0.005$). One minute following cuff deflation, there was no group difference in blood flow for men (NOBFR=675.2 ml·min⁻¹, 40BFR=715.4 ml·min⁻¹, 80BFR=666.3 ml·min⁻¹, $p = 0.75$).

CONCLUSIONS: The reduction in exercise-induced blood flow during BFR is pressure-dependent, with higher pressures eliciting a decrease in the magnitude of the hyperemic response. Blood flow increased above baseline during all BFR conditions; the use of relative applied pressures ensures that full occlusion does not occur during exercise.

279 Board #100 May 31 11:00 AM - 12:30 PM

Forearm Blood Flow Regulation Following Maximal Strength Training-induced Improvements in Work Efficiency

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(No relationships reported)

Maximal strength training (MST) improves submaximal work efficiency (WE) in the arms. However, since assessment of muscle oxygen uptake ($\dot{V}O_2$) during exercise is lacking, the behavior of MST-induced adaptations is unknown, and it remains elusive if metabolic and vascular responses in arms may contrast what has been observed in legs. **PURPOSE:** To investigate responses in arm blood flow and arteriovenous oxygen difference (a- vO_{2diff}) during steady state exercise following MST. **METHODS:** Thus, utilizing Doppler-ultrasound and a catheter placed in the subclavian vein for measurements of blood flow and a- vO_{2diff} , we assessed steady state WE and peak responses in seven young males (24±2(SD) years) following a six-week handgrip MST intervention. **RESULTS:** As expected, MST improved maximal strength (49±9 to 62±10kg) and rate of force development (923±224 to 1086±238N·s⁻¹), resulting in a reduced submaximal $\dot{V}O_2$ (31±9 to 25±10mL·min⁻¹) and concomitantly increased WE (8.8±2.3 to 11.7±3.6%) (all $p < 0.05$). In turn, the WE-improvement led to a reduced blood flow (486±102 to 395±114mL·min⁻¹), mediated by a lower heart rate (66±4 to 59±7beats·min⁻¹) and blood velocity (43±8 to 32±6cm·s⁻¹) (all $p < 0.05$). Conduit artery diameter and a- vO_{2diff} remained unaltered. The peak test revealed increased time to exhaustion (948 to 1104seconds; $p < 0.05$), and a tendency towards increased peak work rate ($p = 0.06$), but no change in peak oxygen uptake. **CONCLUSION:** Despite arguments of metabolic and vascular limb-specific differences, these results reveal that the mechanisms responsible for WE adaptations following small muscle mass MST in the upper extremities is a direct reflection of what has been documented for lower extremities. Additionally, our data show that the advantageous reductions in blood flow is regulated through conduit artery blood velocity.

280 Board #101 May 31 11:00 AM - 12:30 PM

Cardiovascular, Perceptual and Metabolic Demands Associated with Low-intensity Blood Flow Restriction Cycling

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The use of blood flow restriction (BFR) during very-low-intensity walking can improve aerobic and anaerobic capacity; however, no research exists which has examined BFR during more ecologically valid aerobic exercise, such as intensities consistent with the American College of Sports Medicine guidelines for low- to moderate-intensity. **PURPOSE:** To examine the acute cardiovascular, metabolic and perceptual responses to aerobic BFR exercise at intensities consistent with the American College of Sports Medicine guidelines. **METHODS:** Eighteen healthy males (23 ± 3 y) completed, in a randomized and counterbalanced order, low-intensity (LI), low-intensity with BFR (LI_{BFR}) and high-intensity (HI) interval cycling sessions. These included a standardized warm-up and three 2-min intervals with 2-min of recovery cycling (10W) between efforts. During HI, LI and LI_{BFR} sessions efforts were set to 85%, 40% and 40% of peak power, respectively. During LI_{BFR}, 80% arterial occlusion was applied to both legs during the efforts and removed during recovery. Continuous measures of heart rate (HR), cardiac output (CO) and oxygen consumption ($\dot{V}O_2$) were recorded. Blood pressure and rating of perceived exertion (RPE) were measured at the end of each interval. Lactate was measured pre- and post-session. **RESULTS:** Blood pressure, HR, CO, $\dot{V}O_2$, lactate and RPE were greatest during HI (range; $p = 0.01$ to $p = 0.04$). During the intervals, blood pressure,

HR and CO were greater during LI_{BFR} compared with LI (range; $p = 0.01$ to $p = 0.04$). $\dot{V}O_2$ measured during the recovery periods were greater in LI_{BFR} compared with LI ($p = 0.01$; for all time points). Post-session lactate was greater ($p = 0.01$) during LI_{BFR} (6.3 ± 0.49 mmol·L⁻¹) compared with LI (2.8 ± 0.29 mmol·L⁻¹). Importantly, mean arterial pressure during the third interval (124.2 ± 2.3 mmHg vs. 113.9 ± 2.5 mmHg) was greater ($p = 0.01$) in LI_{BFR} compared with HI. **CONCLUSION:** LI_{BFR} results in greater cardiovascular and metabolic stress compared with LI alone, and therefore could provide an alternative modality to increase aerobic fitness for individuals not able to perform exercise at high-intensity. However, LI_{BFR} may not be suitable for all populations, specifically those with vascular dysfunction.

281 Board #102 May 31 11:00 AM - 12:30 PM

Prior Aerobic Exercise Attenuates Prolonged Sitting-induced Leg Endothelial Dysfunction

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(No relationships reported)

PURPOSE: Prolonged sitting leads to leg endothelial dysfunction; however, it remains unknown whether this impairment can be prevented with prior exercise. It is also unknown if, in the absence of exercise, standing is an effective alternative strategy to sitting for conserving leg endothelial function. Accordingly, the purpose of this study was two-fold: 1) to test the hypothesis that prior exercise prevents sitting-induced endothelial dysfunction; and 2) to test the hypothesis that standing is an effective substitute to sitting for maintenance of leg endothelial function. **METHODS:** Eleven young healthy subjects (7 men; 4 women) completed three experimental trials: sitting, prior exercise + sitting, and standing. Following baseline popliteal artery flow-mediated dilation (FMD) measurements, subjects maintained a supine position for 45 min in the sitting and standing trials or performed 45 min of self-paced cycling (71.3 ± 3.0% HR_{max}) in the prior exercise + sitting trial. Thereafter, subjects were immediately positioned into a seated or standing position, according to the trial, for 3 hours and then popliteal artery FMD measures were repeated. **RESULTS:** Popliteal artery FMD was impaired after 3 hours of sitting ($3.75 \pm 0.5\%$ vs. $1.57 \pm 0.71\%$, $P < 0.05$) and this impairment was attenuated by prior cycling exercise ($3.95 \pm 0.41\%$ vs. $3.10 \pm 0.83\%$, $P > 0.05$). Furthermore, 3 hours of standing did not have a significant impact on popliteal artery FMD ($4.10 \pm 0.45\%$ vs. $3.97 \pm 0.65\%$, $P > 0.05$). **CONCLUSIONS:** Prolonged sitting-induced leg endothelial dysfunction can be partially prevented by prior aerobic exercise. Moreover, in the absence of exercise, standing represents an effective substitute to sitting for maintaining normal leg vascular function.

282 Board #103 May 31 11:00 AM - 12:30 PM

Normobaric Intermittent Hypoxia Increases Middle Cerebral Arterial Blood Flow Velocity With No Systemic Hypertension

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Purpose: To study vascular responses to intermittent hypoxia (IH) exposures. **Methods:** Six healthy men (26 ± 1 yr) were exposed to 5 IH bouts, each comprising 6-min breathing 10% O₂ interspersed with 4 min breathing room air. During IH, middle cerebral arterial blood flow velocity (V_{MCA} , Ez-Dop), blood pressure (BP, NIBP100D), O₂ saturation (SaO₂, Radiometer), breathing frequency (F_r), tidal volume (V_T, Universal Ventilation Meter), inspired and expired O₂ and CO₂ fractions (1100 Medical Gas Analyzer; Perkin-Elmer) were continuously monitored. **Results:** The SaO₂ was decreased during 6-min IH ($P < 0.001$), which was more significant in the 5th than the 1st bout of IH exposures ($P < 0.001$). The V_{MCA} was significantly increased by IH and its magnitude was greater in the 5th than the 1st bout of IH exposures ($P = 0.002$). IH did not change mean BP (MBP) from the baseline (min 0) during either the 1st or 5th bout (see Table). Minute ventilation (V_E) was stimulated by IH ($P = 0.023$) with no difference between the bouts. The increased V_E was driven by increases in V_I because F_r remained constant throughout IH exposures. There was a decrease ($P < 0.001$) in partial pressure of end-tidal CO₂ (P_{ET}CO₂) during IH, which was not different between the 1st and the 5th bouts of IH exposures.

Time (min)		0	1	2	3	4	5	6
SaO ₂ (%)	1 st bout	97.3±0.3	91.3±0.5	84.4±1.0	81.2±1.1	79.1±1.3	76.9±1.3	74.4±1.5
	5 th bout	94.6±0.5	86.6±0.8	78.9±0.5	74.3±1.2	71.7±1.4	70.2±1.6	69.2±1.7
V _{MCA} (cm/s)	1 st bout	54.4±2.4	55.8±2.4	57.0±2.5	58.5±2.8	60.6±3.6	62.4±3.2	63.3±3.5
	5 th bout	58.6±2.3	59.6±2.3	61.4±2.4	63.6±2.9	68.3±2.8	68.5±3.4	68.5±3.9
MBP (mmHg)	1 st bout	88±3	86±4	85±3	84±4	83±4	83±4	83±4
	5 th bout	86±3	85±3	83±3	83±3	83±4	83±3	83±3
V _T (L)	1 st bout	0.82±.10	1.06±.20	1.33±.36	1.26±.36	1.20±.28	1.11±.23	1.33±.29
	5 th bout	0.77±.13	0.95±.19	0.97±.21	0.99±.16	1.21±.29	0.96±.12	1.27±.18
F _{br} (br/min)	1 st bout	13.3±1.6	12.7±1.7	12.5±1.8	13.1±2.1	13.3±2.0	12.5±2.0	12.5±1.9
	5 th bout	12.6±1.7	12.5±1.9	13.1±2.0	13.1±1.8	13.5±2.3	13.0±2.2	12.9±2.1
P _{ET} CO ₂ (mmHg)	1 st bout	42.4±0.3	41.1±0.6	40.1±0.6	39.4±0.5	38.9±0.6	38.9±0.5	39.2±0.5
	5 th bout	42.6±0.5	40.4±0.7	39.8±0.6	39.4±0.8	38.8±0.7	38.7±0.9	38.4±0.9

Conclusion: Normobaric IH exposures enhance cerebral perfusion, which is mediated by a moderate hypoxemia. There is no hypertensive response during the IH exposures.

283 Board #104 May 31 11:00 AM - 12:30 PM
Skin Perfusion and Vascular Conductance during Steady State Exercise are Unaffected by Aging or Heart Disease

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(No relationships reported)

PURPOSE: To examine the effect of healthy aging and ischemic heart disease on skin perfusion (SkP) and vascular conductance (VC) during relatively short-duration (15 min), steady state, normothermic cycle exercise. **METHODS:** All participants were physically active at least 60 min per week at the time of recruitment. SkP was collected (laser-Doppler flowmetry) in 10 young (24±4 yrs) healthy men (YH), 10 older (58±6 yrs) healthy men (OH), and 9 older (61±8 yrs) men with documented ischemic heart disease (IHD) during seated rest and at 60±5% and 75±5% of peak oxygen uptake (VO_{2peak}). VC was calculated as perfusion units (p.u.)/mean arterial pressure, while maximal dilatory capacity was determined using iontophoresis of 3% sodium nitroprusside. A two-way ANOVA with repeated measures was used to determine aging (YH vs. OH) and IHD (OH vs. IHD) comparisons for SkP and VC across experimental conditions. **RESULTS:** VO_{2peak} was not significantly different between YH and OH (mean±SD, 46±6 vs. 44±6 ml.kg⁻¹.min⁻¹ respectively, p=0.535) but was ~34% lower in IHD (29±6 ml.kg⁻¹.min⁻¹, p<0.001 vs. OH). There were no significant aging or IHD interaction effects for SkP or VC across experimental conditions (all p≥0.153). Maximal dilatory capacity was ~12% lower in OH vs. YH (98±36 vs. 111±53 p.u. respectively, p= 0.558) and ~25% lower in IHD vs. OH (73±28 p.u., p=0.096). SkP at 75% VO_{2peak} as a percentage of maximal dilatory capacity was not significantly affected by either aging (32±17 vs. 40±22% in YH and OH respectively, p=0.343) or IHD (47±39%, p=0.872 vs. OH). **CONCLUSION:** During relatively short-duration exercise at similar relative intensity, SkP and VC do not appear to be adversely affected in aging adults with and without IHD. However, older adults and people with IHD may utilise a higher percentage of their maximal dilatory capacity during exercise.

284 Board #105 May 31 11:00 AM - 12:30 PM
Hemodynamic Changes Following High-Velocity Circuit Resistance or Treadmill Training in Adults with Cardiometabolic Risk Factors

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Cardiometabolic syndrome (CMS) is classified as a combination of maladaptive cardiovascular and metabolic abnormalities that includes hypertension, dyslipidemia, and blood vessel dysfunction. These outcomes can negatively influence hemodynamics (HDYN) via a decrease in myocardial efficiency due to increased afterload and/or decreased vascular elasticity. Studies have reported changes in HDYN during and following acute exercise in clinical populations. However, there is a paucity of information on how high-velocity circuit resistance training (CRT) compared to continuous treadmill exercise (TM) affects these parameters at rest. **PURPOSE:** To compare the effects of CRT, TM and no exercise (CONT) on HDYN variables at rest in older adults with multiple CMS risk factors. **METHODS:** Eleven women (66.4 ± 6.4 years) participated in 12-weeks of CRT or TM. Stroke volume (SV), cardiac index (CI), systemic vascular resistance (SVR), end-diastolic volume (EDV), ejection fraction (EF), and oxygen consumption (rVO₂) were measured by impedance electrocardiography and indirect calorimetry before and after training. **RESULTS:** A within-group analysis revealed significant increases in CI (MD= 0.257, SE= .092, p=.023) and EDV (MD= 31.10, SE= 11.96, p=.032), a trend towards an increase in SV (MD=8.63, SE=4.28 p=.07) and a decrease in SVR (MD=-154.15, SE=71.07, p=.06) for CRT. TM resulted in significant increases in CI (MD=.218, SE=.080, p=.026) and EDV (MD=26.16, SE=10.36, p=.035); however, increases were not comparative to those seen with CRT. The CONT group showed a significant decrease in rVO₂ (MD=-1.60, SE=.64, p=.03). No significant differences were observed for EF. At post-testing CONT resulted in a decrease in rVO₂ approaching significance compared to TM (MD=-3.10, SE=1.12, p=.07). CRT demonstrated more favorable changes in SV, CI, SVR and EDV than TM or CONT. However, these changes did not reach statistical significance. **CONCLUSION:** These preliminary results indicate that CRT and TM lead to significant favorable changes in CI and EDV, however, CRT showed greater improvements in each and a trend towards improvements in HDYN when compared to TM and CONT. It is expected that completion of testing on existing subjects will further strengthen our results.

285 Board #106 May 31 11:00 AM - 12:30 PM
Impact of Short-term Training Camp on Aortic Pressure in Collegiate Endurance Runners

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(No relationships reported)

PURPOSE: Stiffening of the aorta may be a possible cause of increased aortic blood pressure (BP) reflecting increased cardiac workload. We have previously reported that in regularly highly-trained endurance athletes, arterial stiffness increases after a short-term training camp characterized by greater training volume. As a follow-up study, we investigated the effect of such exercise on aortic BP. **METHODS:** In a total of 36 regularly highly-trained collegiate endurance runners, pulse wave analysis was performed before and after a seven-day training camp for evaluating aortic BP and the round-trip travel time (TR) of the pressure wave which is a surrogate index of aortic stiffness. They underwent a group training (three sessions per day mainly consisted of long distance running and sprint training). Variables of interest were compared between two groups based on accomplishment of the task (running at least 26 km per day). **RESULTS:** In the accomplished group, TR significantly shortened after the camp. In addition, aortic systolic BP and pulse pressure slightly but significantly elevated despite no significant changes in brachial BP and pulse pressure. Such significant changes were not observed in the unaccomplished group. Additionally, there was a significant correlation between the training distance during the camp and the change in aortic systolic BP (r=0.490, P<0.001). **CONCLUSION:** These results suggest that, even in regularly highly-trained endurance athletes, aortic BP increases acutely after the short-term vigorous training camp, and it is partly due to stiffening of the aorta. In addition, the greater training volume could be a cause of increased aortic BP but not in brachial BP.

286 Board #107 May 31 11:00 AM - 12:30 PM
Time Course Of Acute Exercise-induced Impairment Of Endothelial Dependent Vasorelaxation

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Regular endurance exercise improves endothelium dependent vasorelaxation. However, the initial stress of acute exercise may impair vascular function prior to the beneficial adaptive response. **PURPOSE:** The purpose of this study is to examine the effects of acute exhaustive exercise on endothelial-dependent vascular function. **METHODS:** 7-9 mo old, male, Wistar rats were divided into four groups (n=6/group): sedentary (SED), 6h post-exercise (6h), 24h post-exercise, and 48h post-exercise. Exercise consisted of one bout of exhaustive treadmill exercise lasting between 30-40 min. Endothelium dependent vasorelaxation was assessed in ring segments of the aorta by constructing an acetylcholine dose response curve (10^{-10} - 10^{-5} M) in a wire myograph. **RESULTS:** Maximal vasorelaxation was impaired in 6h (70.1±5.2%) and 24h (76.2±4.4%) compared to SED (86.9±4.2%) and 48h (83.7±4.4%). EC_{50} for 6h ($3.9e^{-7}$) was significantly ($p<0.05$) greater than SED ($1.3e^{-7}$) and 48h ($1.5e^{-7}$). **CONCLUSIONS:** These data suggest that acute, exhaustive treadmill exercise results in impaired endothelial dependent vasorelaxation up to 24h post-exercise and returns to sedentary levels within 48h.

287 Board #108 May 31 11:00 AM - 12:30 PM
The Effect Of Inorganic Nitrate And Exercise On Blood Pressure In Pre-and Hypertension Subjects.

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Dietary supplementation of inorganic nitrate (NO-3) reduces blood pressure (BP) in normal and hypertensive subjects. An acute bout of exercise also reduces BP in many normotensive and in most hypertensive individuals. The possible additive hypotensive effect of NO-3 plus exercise has not been investigated in pre- and hypertensives. **PURPOSE:** To assess whether intake of NO-3 followed by maximal exercise may potentiate the hypotensive effect of both procedures. **METHODS:** Ten pre- or hypertensive subjects participated in a randomized double-blind study one week apart. (7 men, 3 women) (BP \geq 120/80mmHg) (Systolic Blood Pressure SBP/Diastolic Blood Pressure DBP). Subjects arrived in the fasting condition and without medications and ingested either a fruit and vegetables juice containing 250 g of NO-3 (8 mmol/L of NO-3) (N) or nitrate depleted juice (P). After 90 minutes post supplementation, they performed a MAXCAP-T treadmill test. BP was obtained 10 minutes post arrival (BP1), 90 minutes post dietary supplementation (BP2), immediately Post MAXCAP-T (BP3), 10 minutes after MAXCAP-T (BP4), and 150 minutes post MAXCAP-T (BP5). Statistics anova, paired t test, t test two groups. **RESULTS:** After ingestion of N, SBP and DBP were reduced by 11 and 6 mmHg, respectively. Meanwhile, after P, SBP decreased 3 mmHg while DBP did not change. Following MAXCAP-T, SBP increased less after N than P (26 vs 31 mmHg, $P<0.05$). DBP decreased 2 and increased 5 mmHg with N and P, respectively ($P<0.05$). Ten minutes after MAXCAP-T, SBP was 20 and 11 mmHg lower than BP1 for N and P respectively ($P<0.05$). The difference between N and P was significant ($P<0.05$). DBP was reduced 10 mmHg with N with no changes in P. After 150 minutes of MAXCAP-T, SBP was 24 and 16 mmHg lower than BP1 for N and P, respectively ($p<0.05$). Meanwhile, DBP was 8 mmHg lower than BP1 for N without significant changes for P. **CONCLUSIONS:** Ingestion of inorganic nitrate decreased SBP and DBP before exercise and prevented increases in SBP and DBP immediately after acute maximal exercise. The combination of NO-3 and exercise resulted in greater decreases in BP in pre- and hypertensive patients as compared with P.

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Independent and Combined Effects of Heat Stress and Exercise on Arterial Stiffness

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Several studies have established that arterial stiffness, assessed via pulse wave velocity (PWV), is reduced following passive heat stress or exercise. Yet, no study to date has simultaneously investigated the cumulative effects of exercise and heat stress on measures of PWV. **PURPOSE:** Determine the independent and combined effects of heat and exercise on arterial stiffness. **METHODS:** Nine subjects (n=3 females, 46±11 years old; 24.1±2.8 kg/m²) completed four trials, with different interventions, in a randomized order. In a control trial subjects rested supine (CON). In order to independently test the effect of heat stress, subjects were passively heated (i.e. no exercise) in a hot environment (~40°C) while wearing a water perfusion suit with hot water (PH). In two other trials, subjects cycled at ~50% of VO_{2peak} in a hot (~40°C; HC) or cool (~15°C; CC) environment. Prior to interventions and in the hour following interventions, pulse wave velocity (PWV), via Doppler ultrasound, was assessed at the tibial, radial, femoral and carotid artery sites. Central PWV (C_{PWV}) was assessed using measures between the carotid/femoral artery sites, while peripheral stiffness was assessed using the radial/carotid (U_{PWV}), and tibial/femoral (L_{PWV}) artery sites. Mean body temperature (T_b) was measured with skin and rectal thermistors. **RESULTS:** No significant changes in T_b were observed during the CON and CC trials. However, the PH and HC trials elevated T_b 2.69±0.23°C and 1.67±0.27°C, respectively ($p<0.01$). No changes in any measure of PWV were observed in the CON, CC, or HC trials ($p>0.05$). However, in the PH trial U_{PWV} , but not C_{PWV} or L_{PWV} was reduced immediate post (-107±81 cm/s) and 15 minutes (-93±82 cm/s) post heating ($p<0.05$). **CONCLUSIONS:** Contrary to previous data, we did not observe changes in arterial stiffness following aerobic exercise (i.e., CC). Further, although heat stress alone reduced arterial stiffness (specific to the upper peripheral arteries), when combined with exercise in the heat, there was no change in arterial stiffness (i.e., HC). This suggests that heat stress has an independent effect on arterial stiffness that is obliterated when combined with exercise.

289 Board #110 May 31 11:00 AM - 12:30 PM
Atrial Natriuretic Peptide Augmented Following Aquatic Treadmill Exercise

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Aquatic treadmill (ATM) exercise training has been shown to reduce blood pressure reactivity to exercise to a greater degree than land treadmill (LTM) exercise training. Furthermore, ATM exercise tends to elicit a greater post-exercise hypotensive response and an acute augmentation in flow-mediated dilation (FMD). However, the mechanisms for such changes are unclear, and previous research showed no differences in plasma nitrates or nitrites between modes. **Purpose:** To determine the effects of an acute bout of ATM and LTM exercise on atrial natriuretic peptide (ANP), norepinephrine (NE), and epinephrine (EPI) in pre-hypertensive men. **Methods:** Following BP screening and a maximal exercise test, 13 men (33 ± 11 years, 27.7 ± 10.6% fat, 39.3 ± 7.7 ml·kg⁻¹·min⁻¹ 130 ± 7/77 ± 7 mmHg) completed an acute bout of both ATM and LTM at 60% VO_{2max} for a duration required to expend 300 kcal (~30 minutes). Blood samples were obtained pre-exercise and immediately post-exercise. Blood samples were analyzed for ANP, NE, and EPI. **Results:** All results are displayed in the table. The percent increase in ANP was significantly greater ($p<0.05$) for ATM than LTM exercise. There were no significant differences in the change in NE or EPI between modes. **Conclusion:** ANP is released by the atria in response to increased volume load on the heart, and plays a role in blood pressure regulation through both vasodilatory effects and renal natriuretic/diuretic effects. Water submersion is known to increase venous return and preload on the heart. Increased ANP levels observed following ATM exercise in the present study may explain in part the previous findings of an augmented post-exercise hypotensive response and augmented FMD with ATM exercise.

	ATM				LTM				p-Value
	Pre	IPE	Change	%Change	Pre	IPE	Change	%Change	
ANP (pg/mL)	47.1 ± 43.3	56.1 ± 51.7	9.0 ± 29.2	34.3 ± 47.0*	59.2 ± 67.3	53.4 ± 57.1	-5.7 ± 34.4	-9.0 ± 40.0*	0.04*
NE (pg/mL)	409.1 ± 134.9	582.9 ± 143.8	173.8 ± 89.2	48.4 ± 27.3	371.1 ± 131.1	546.4 ± 140.7	175.3 ± 74.8	52.9 ± 28.1	0.77
EPI (pg/mL)	50.6 ± 46.3	64.5 ± 39.4	13.9 ± 19.2	71.9 ± 78.1	52.6 ± 33.8	60.1 ± 54.8	7.5 ± 26.8	8.0 ± 34.7	0.07

Values represent mean ± SD.
ANP: atrial natriuretic peptide; NE: norepinephrine; EPI: epinephrine.
P-Values represent comparison between modes for %change variable by dependent t-test. *p < 0.05

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Experimental Intermittent Ischemia Augments Exercise-Induced Inflammatory Cytokine Production

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(No relationships reported)

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- α , 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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DISCLOSURES: J.R.M. is Chief Operating Officer and K.K.M. is President of Infrared Rx. The other authors report no conflicts of interest, financial or otherwise.

291 Board #112 May 31 11:00 AM - 12:30 PM

To Discern Differences of Cardiovascular Response Over Four Rounds of a High-Intensity Functional Training (HIFT) Session.

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PURPOSE: To Discern Differences of Cardiovascular Response Over Four Rounds of a High-Intensity Functional Training (HIFT) Session. **METHODS:** Participants with at least four weeks of experience with HIFT were recruited ($n=100$; age=31.25±7.2 years; $\dot{V}O_{2peak}=45.9\pm 6.0$ ml/kg/min). Participants completed a graded exercise test to determine peak oxygen consumption ($\dot{V}O_{2peak}$) and heart rate (HR_{peak}). Participants returned to the laboratory after one week to perform as many rounds (1 round: 250-meter row, 20 kettlebell swings and 15 thrusters) of HIFT in 15 minutes. All repetitions were summed at the end and analyzed as a round. During the graded exercise test and HIFT, oxygen consumption and HR were measured via a Cosmed K4b2 portable metabolic system. Average $\% \dot{V}O_{2peak}$ and average $\%HR_{peak}$ of each

round was determined by taking the average heart rate and oxygen consumption of each round and dividing by HR_{peak} and $\dot{V}O_{2peak}$ of the treadmill test. Two-way (4 x 2) repeated measures analysis of variance was conducted with rounds as the within-subjects and physiological response ($\%HR_{peak}$ and $\% \dot{V}O_{2peak}$) as the between-subjects factor to determine whether $\%HR_{peak}$ and $\% \dot{V}O_{2peak}$ responded the same across rounds 1-4 of the HIFT workout (time x HR and $\dot{V}O_2$ interaction). Independent samples t-tests were used to compare $\% \dot{V}O_{2peak}$ and $\%HR_{peak}$ for each round with an adjusted alpha of 0.0125. **RESULTS:** A significant interaction was found between the measure of cardiovascular response and round [$F(1,176)=31.65, p<0.001$] indicating $\%HR_{avg}$ and $\% \dot{V}O_{2avg}$ responded differently across rounds. A significant difference ($p<0.001$) between $\% \dot{V}O_{2peak}$ and $\%HR_{peak}$ was found for all rounds [Round 1: 76.9±8.9% vs. 83.1±8.4%; Round 2: 80.6±9.3% vs. 86.8±8.7%, Round 3: 79.3±9.9% vs. 89.3±5.8%; Round 4: 78.6±9.6% vs. 91.5±6.5%]. **CONCLUSION:** Our results suggest that HR and $\dot{V}O_2$ did not respond the same over four rounds of HIFT; thus, simply estimating HR response during HIFT would overestimate the metabolic demands of the activity. The progressive increase in $\%HR_{peak}$ may be due to increases in thermoregulatory demands causing an increase in cardiac output, while metabolic demands remain relatively constant. Future investigations should aim to determine the mechanism underlying of the dissociation between HR and $\dot{V}O_2$ during HIFT.

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Bench Press With and Without Blood Flow Restriction on Hemodynamics and Pulse Wave Reflection

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(No relationships reported)

Hemodynamic and pulse wave reflection responses to upper-body resistance exercise (RE) with and without blood flow restriction (BFR) are unclear. **PURPOSE:** To evaluate the differences between bench press with and without BFR on hemodynamics and pulse wave reflection in resistance-trained men. **METHODS:** Sixteen resistance-trained men participated in the study. Hemodynamics and pulse wave reflection were assessed before and after low-intensity bench press with BFR (LI-BFR), traditional high-intensity bench press without BFR (HI), and control (CON). The LI-BFR utilized of 4 sets with repetitions of 30, 15, 15, and 15 at 30% 1-repetition maximum (1RM) and 30 seconds rest between sets. The HI consisted of 4 sets of 8 repetitions at 70% 1RM and 60 seconds rest between sets. The CON consisted of supine rest for 10 minutes. A repeated measures ANOVA was used to evaluate the conditions (LI-BFR, HI, CON) across time (rest, recovery) on hemodynamics and pulse wave reflection. **RESULTS:** There were significant ($p\leq 0.05$) increases in heart rate after LI-BFR (Rest: 57±10bpm; Rec: 62±11bpm) and HI (Rest: 57±14bpm; Rec: 69±13bpm) compared to rest and CON. There were no changes in aortic and brachial systolic blood pressure (BP) after any condition. However, there were significant ($p\leq 0.05$) reductions after HI-BFR in aortic (Rest: 66±9 mmHg; Rec: 61±6 mmHg) and brachial (Rest: 60±5 mmHg; Rec: 65±9 mmHg) diastolic BP compared to rest. There were significant ($p\leq 0.05$) condition by time interactions after LI-BFR and HI for augmentation index (AIx) (LI-BFR: Rest: 10.0±5.6%, Rec: 27.2±12.1%; HI: Rest: 12.2±9.0%, Rec: 22.3±8.1%, AIx at 75bpm (LI-BFR: Rest: 1.1±7.6%, Rec: 21.6±14.5%; HI: Rest: 4.5±12.7%; Rec: 19.5±10.4%), augmentation pressure (LI-BFR: Rest: 3.9±2.2 mmHg, Rec: 13.3±6.9 mmHg; HI: Rest: 5.2±3.9 mmHg, Rec: 9.6±3.7 mmHg) and wasted left ventricular energy (LI-BFR: Rest: 838±513dynes s/cm2, Rec: 2961±1743dynes s/cm2; HI: Rest: 1116±849dynes s/cm2, Rec: 1983±904dynes s/cm2) such that they were augmented compared to rest and CON, with no differences between LI-BFR and HI. **CONCLUSION:** These data suggest that LI-BFR significantly decreases aortic and brachial diastolic BP. In addition, LI-BFR and HI significantly alter pulse wave reflection in a similar fashion.

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Abstract Withdrawn

294 Board #115 May 31 11:00 AM - 12:30 PM

Validity Of Forearm Oxygen Uptake During Handgrip Exercise: Assessment By Ultrasonography And Venous Blood Gas

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ABSTRACT:

Assessment of forearm oxygen uptake ($\dot{V}O_2$) during handgrip exercise is a keenly investigated concept for observing small muscle mass metabolism. Although a combination of Doppler-ultrasound measurements of brachial artery blood flow and blood gas drawn from a deep forearm vein has been utilized to calculate forearm $\dot{V}O_2$

for more than two decades, this experimental design has, somewhat surprisingly, not been validated. **PURPOSE:** To evaluate the reliability and accuracy of this technique following handgrip exercise. **METHODS:** Test-retest measurements were performed with ~0.25 watt (W) steady state increments in ten healthy young (24±3(SD) yrs.) males during handgrip exercise. **RESULTS:** $\dot{V}O_2$ and workload exhibited a linear relationship ($p<0.01$) following all submaximal workloads (0.50W:43.8±10.1 mL·min⁻¹; 0.75W:53.8±14.1 mL·min⁻¹; 1.00W:63.4±16.3 mL·min⁻¹; 1.25W:72.2±17.6 mL·min⁻¹), while the final increment before exhaustion was non-significant, marking a $\dot{V}O_2$ -plateau (1.5W:79.2±18.6 mL·min⁻¹). In turn, blood flow exhibited a concomitant relationship ($p<0.01$) with $\dot{V}O_2$ (0.50W:359±86 mL·min⁻¹; 0.75W:431±112 mL·min⁻¹; 1.00W:490±123 mL·min⁻¹; 1.25W:556±112 mL·min⁻¹; 1.50W:622±131 mL·min⁻¹) while arteriovenous oxygen difference ($a-vO_{2diff}$) remained constant following all workloads (123±11-130±10 mL·L⁻¹). The average $\dot{V}O_2$ test-retest difference was -0.4 mL·min⁻¹ with ±2SD limits of agreement (LOA) of 8.4 and -9.2 mL·min⁻¹, respectively, while coefficients of variation (CV) ranged from 4-7%. Accordingly, test-retest blood flow difference was 11.9 mL·min⁻¹ (LOA: 8.1 mL·min⁻¹; -60.4 mL·min⁻¹) and again CV ranged between 4-7%. Test-retest difference for $a-vO_{2diff}$ was -0.28 mL·dL⁻¹ (LOA: 1.26 mL·dL⁻¹; -1.82 mL·dL⁻¹) with CV ranging from 3-5%. **CONCLUSION:** Our results reveal that forearm $\dot{V}O_2$ -assessment by Doppler-ultrasound and direct venous sampling is a valid experimental design across a range of exercise intensities, and suggest that this method can be applied for assessment of small muscle mass metabolism in occupationally relevant forearm musculature.

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Cognitive Task Impairs Dynamic Cerebral Autoregulation During Normoxia And Hypoxia.

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Hypercapnia-induced cerebral hyper-perfusion or hypoxia attenuates dynamic cerebral autoregulation (CA). On the other hand, performing cognitive task increases both anterior and posterior cerebral blood flow via frontal and occipital lobe activation and this cognitive tasks-induced cerebral hyper-perfusion attenuates dynamic CA. **PURPOSE:** The aim of the present study was to examine whether cognitive task-induced impairment in dynamic CA was enhanced by hypoxia condition. **METHODS:** To test our hypothesis, we identified dynamic CA during the Go/No-Go task under normoxia and hypoxia conditions. This study examined the relationship between mean arterial pressure (MAP) and mean middle cerebral artery blood velocity (MCA V_{mean}) during the Go/No-Go task. Dynamic CA and steady-state changes in MCA V_{mean} in relation to changes in arterial pressure were evaluated using transfer function analysis. **RESULTS:** MCA V_{mean} increased with the Go/No-Go task ($P=0.022$), but the different response of MCA V_{mean} between normoxia and hypoxia conditions was not observed ($P=0.850$). In the transfer function analysis, the low frequency (LF) and very LF (VLF) phase shift decreased during the Go/No-Go task (LF and VLF; $P<0.001$ and $P=0.01$). However, the decreases in LF and VLF phase shift during the Go/No-Go task was not modified by hypoxia condition ($P=0.617$ and $P=0.981$). **CONCLUSIONS:** Similarly with change in MCA V_{mean} , dynamic CA was attenuated during cognitive task. In contrast to our hypothesis, hypoxia did not affect this phenomenon.

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Effects of Blood Flow Restriction Training on Vascular Reactivity & Morphology in Older Subjects. A Randomized Controlled Trial.

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The positive effects of low intensity blood flow restriction (BFR) training on muscle mass and strength are well documented. Less investigated, however, are the effects and safety of this intervention on the vascular health of older adults. **PURPOSE:** to compare the effects of low intensity resistance training (RT) with BFR and high intensity RT without BFR on body composition, muscle strength and vascular function in older adults. **METHODS:** Through a randomized controlled trial, 29 eutrophic, inactive elderly, aged 72±7 years old, weight 63.1±10.7 kg, body mass index 25.2±2.6 kg/m², were divided in three groups as follows: BFR - exercise intensity set at 30% of 1 repetition maximum (RM) with BFR promoted by a pressure cuff inflated throughout the session at 50% of the resting systolic blood pressure; Control (CON) - exercise intensity set at 30% of 1 RM without BFR; HI - exercise intensity set at 70% of 1 RM without BFR. All subjects performed two exercises for lower limbs and two for upper limbs, three days a week during three months. The RT included three sets of 10 RM

with one minute of resting between sets. All the results were presented as mean±SD. A one way ANOVA, followed by the Bonferroni post-hoc test were used to compare the relative gains (%Δ) among groups. **RESULTS:** Differently to HI, BFR significantly increased arm muscle mass ($P=0.03$) assessed by dual energy x-ray absorptiometry when compared to CON. Handgrip strength was higher in both BFR and HI groups ($P<0.001$). Three months of either BFR or HI were not deleterious to vascular reactivity assessed by venous occlusion plethysmography ($P>0.05$ when groups were compared) and microvascular morphology assessed by nailfold videocapillaroscopy ($P>0.05$). **CONCLUSIONS:** BFR training was able to increase mass and strength of small muscles in older adults, with no deleterious effects in vascular function. Future studies should investigate the possible risks and benefits of this intervention in frail elderly with sarcopenia.

Table 1. Body composition, hand grip strength, isometric knee extension test, vasoreactivity and microvascular morphological maliford results among groups.

	Control (n=10)			High Intensity (n=9)			Blood Flow Restriction (n=10)			P Value
	Before	After	% Δ	Before	After	% Δ	Before	After	% Δ	
Bone mineral density (kg)	2.146±0.4	2.146±0.4	-0.140±0.8	1.844±0.2	1.844±0.4	-0.211±0.5	2.266±0.7	2.266±0.7	2.64±0.9	0.31
Arm muscle mass (kg)	4.2±1.3	4.2±1.4	-1.34±0.6	3.7±0.1	3.9±0.1	5.7±2.1	4.1±1.5	4.7±1.1	23.3±2.9*	0.03
Leg muscle mass (kg)	12.4±3.1	12.3±3.1	-0.8±1.0	11.9±2.8	12.0±2.9	1.1±0.8	13.1±3.6	13.5±3.4	3.9±1.9	0.29
Peak torque (Nm)	91.1±33.9	97.2±46.8	4.9±11.7	91.4±22.9	104.1±22.8	12.6±11.7	99.3±23.3	102.3±30.2	3.1±21.1	0.26
Total work (J)	848.0±340.5	879.2±73.9	3.1±8.9	849.6±226.8	925.3±245.4	10.1±14.7	820.6±226.8	862.5±288.0	5.8±20.4	0.43
Hand grip strength (kg)	22.5±7.9	22.7±7.9	1.1±3.6	20.4±5.8	23.8±5.2	13.2±17.1*	26.3±8.4	31.3±8.5	20.6±8.4*	<0.001
%-FBF Hyperemia (%)	751.4±307.2	867.3±330.1	33.5±66.9	465.5±137.1	683.7±280.4	46.6±46.3	774.6±389.1	739.3±381.2	13.3±70.6	0.53
%-FBF Nitroglycerine (%)	171.3±69.9	149.8±59.9	-9.9±55.1	148.2±36.4	172.6±75.4	23.4±46.3	156.6±87.1	109.5±48.9	-18.6±35.9	0.25
FCD (in mm)	26.3±7.9	31.8±18.3	26.46±7.8	24.9±17.9	32.4±17.8	81.4±27.6	25.6±18.1	26.7±5.6	89.1±17.9	0.51

*FBF Hyperemia - Percent of increment of forearm blood flow reactive hyperemia related to baseline; %FBF Nitroglycerine - Percent of increment of forearm blood flow after sublingual spray of nitroglycerine related to baseline; FCD - Functional capillary density. * $P<0.05$ when compared to control group.

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The Effects of Resistance Exercise on Forearm Blood Flow and Vasodilatory Capacity Between Sexes

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An acute bout of resistance exercise (RE) has been suggested to have a negative effect on vascular function. However, no studies have evaluated differences between the sexes after free-weight resistance exercises. **PURPOSE:** To evaluate the effects of free-weight resistance exercises on forearm blood flow (FBF) and vasodilatory capacity between sexes. **METHODS:** Resistance-trained men (n=14) and women (n=13) between the ages of 18-30 yrs volunteered to participate. One-repetition maximum (1RM) was assessed on the squat, bench press and deadlift. FBF and vasodilatory capacity were assessed using venous occlusion plethysmography. FBF, mean arterial pressure (MAP) and forearm vascular conductance (FVC) were assessed at baseline and 15 minutes after each condition. Vasodilatory capacity was assessed at rest and followed by 5 minutes of circulatory occlusion (220 mmHg) to induce reactive hyperemia before and 20 minutes after an acute bout of RE. The RE consisted of 3 sets of 10 repetitions at 75% 1RM on the squat, bench press and deadlift. Two minutes of rest was given between sets and exercises. Each participant also completed a quiet control session of the same duration. Area under the curve (AUC) was also utilized to determine differences in blood flow. Data were analyzed by an ANOVA to examine the effects of gender by time by condition. Tukey HSD was used as a post-hoc test if the interaction was deemed significant. **RESULTS:** There were no significant sex differences at rest for any of the variables. Furthermore, there were no significant sex by time by condition interactions for any variable. There were significant increases in FBF (Rest: 8.4±6.0 ml/100ml tissue/min; Recovery: 21.0±12.9 ml/100ml tissue/min, $p=0.0001$), and FVC (Rest: 0.101±0.676 ml/min/100ml/mmHg; Recovery: 0.273±0.180 ml/min/100ml/mmHg, $p=0.0001$) after the RE, but not the Control. A significant time by condition interaction was noted for MAP (Rest: 82±7 mmHg; Recovery: 76±4 mmHg, $p=0.003$) such that it was reduced after RE. While there was no increase in vasodilatory capacity, there was a significant increase in AUC (Rest: 149.0±81.0 units; Recovery: 286.4±145.1 units, $p=0.0001$) **CONCLUSION:** These data demonstrate that microvascular function is increased similarly between resistance-trained men and women after an acute bout of RE.

298 Board #119 May 31 11:00 AM - 12:30 PM

Calf Venous Compliance Differences in Male and Female Adults

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Similar to changes in arterial compliance with fitness and aging, venous compliance in the lower extremities of adults improves with higher fitness and declines with increasing age. In young adults, males have a higher venous compliance than females, a difference that does not appear related to hormonal fluctuations. Most previous studies have used small groups to make these comparisons. **PURPOSE:** To determine the calf venous compliance differences in males and females in a larger group of adults. **METHODS:** 71 females and 102 males volunteered for this

project. Participants underwent anthropometric assessment, a submaximal graded exercise test, and assessment of calf venous compliance. Utilizing venous occlusion plethysmography, calf pressure-volume relations were determined using the quadratic regression equation $[(\Delta\text{limb volume}) = \beta_0 + \beta_1 * (\text{cuff pressure}) + \beta_2 * (\text{cuff pressure})^2]$. Calf venous compliance was calculated as the first derivative of the pressure-volume relation during cuff pressure reduction. Sex differences in anthropometric variables, fitness, and compliance (β_1 , β_2 , and the slope of the pressure compliance relationship) were analyzed with a simple ANOVA. **RESULTS:** The males and females were of similar age [102 males (26±12 yrs), 71 females (28±17 yrs)] and fitness level (males 50.24±19.55 ml*kg⁻¹*min⁻¹ vs. females 47.84±16.03 ml*kg⁻¹*min⁻¹). The males were larger in size (BMI: 25.07±3.81 kg/m²; calf volume: 585.79±116.70 cm) than the females (BMI: 23.78±4.3 kg/m²; calf volume: 497.52±132.31 cm). Females had significantly larger β_0 values than males, but males had significantly higher β_2 values than females indicating higher calf venous compliance [males; $\Delta\text{limb Volume} = 0.6665 \pm 1.89051 + 0.0939 \pm 0.1119 (\text{Cuff Pressure}) - 0.0212 \pm 0.20587 (\text{Cuff Pressure})^2$ vs. females; $\Delta\text{limb Volume} = 1.8384 \pm 5.28027 + 0.1083 \pm 0.12568 (\text{Cuff Pressure}) - 0.0009 \pm 0.00107$]. Compliance @ 20mmHg was significantly higher in males than females (0.28 ± 0.83mmHg vs. 0.06 ± 0.02 mmHg respectively). **CONCLUSION:** Consistent with previous research, this large data set found males to have higher calf venous compliance than females and females to have higher net capillary filtration than males.

299 Board #120 May 31 11:00 AM - 12:30 PM

Exaggerated Cardiovascular Response to Muscle Mechanoreflex Activation in Type 2 Diabetic Rats

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Evidence suggests that the cardiovascular response to physical activity is excessively heightened in patients with type 2 diabetes mellitus (T2DM). However, the mechanisms underlying this exaggerated circulatory responsiveness remain to be fully elucidated. The exercise pressor reflex (EPR) is a primary contributor to autonomic cardiovascular regulation during physical exercise. Mechanically (mechanoreflex) and metabolically (metaboreflex) sensitive components mediate EPR function. We have shown previously that the metaboreflex is overactive in T2DM whereas the function of the mechanoreflex remains undetermined in this disease. **PURPOSE:** To assess mechanoreflex activity in T2DM rats. It was hypothesized that the heightened cardiovascular response to exercise in T2DM is induced, in part, by functional alterations in the muscle mechanoreflex. **METHODS:** T2DM was induced in Sprague-Dawley rats by a combination of both a low-dose streptozotocin injection (30-35 mg/kg, ip) and a 14-16 wk high-fat diet. In control rats (normal diet; no streptozotocin; n=34) and T2DM (n=10) rats, the EPR was activated by electrically-inducing hindlimb muscle contraction via stimulation of spinal ventral roots. The mechanically-sensitive component of the EPR was selectively activated by passively stretching hindlimb muscle. **RESULTS:** Compared to control animals, sympathetic and pressor responses to EPR activation were significantly greater in T2DM rats (RSNA: $\Delta = 122 \pm 20$ vs. 61±8 %, P<0.05; MAP: $\Delta = 49 \pm 5$ vs. 20±2 mmHg, P<0.05). Passive stretch likewise evoked greater increases in RSNA ($\Delta = 81 \pm 16$ vs. 31±5 %, P<0.05) and MAP ($\Delta = 38 \pm 7$ vs. 13±2 mmHg, P<0.05) in T2DM rats compared to healthy controls. **CONCLUSIONS:** These data demonstrate the skeletal muscle mechanoreflex is overactive in T2DM. This is an important finding as it suggests that both the metaboreflex (as previously reported) and mechanoreflex contribute significantly to the generation of EPR overactivity in T2DM possibly accounting for the abnormally large cardiovascular response to exercise in this disease. *Supported by the Lawson & Rogers Lacy Research Fund in Cardiovascular Disease*

300 Board #121 May 31 11:00 AM - 12:30 PM

Peripheral and Central Blood Pressure Response to Handgrip Exercise Coupled with Blood Flow Restriction

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Low intensity exercise coupled with blood flow restriction (BFR) produces comparable strength gains and skeletal muscle hypertrophy, compared to non-BFR training at higher intensities. However, the cardiovascular response (e.g., blood pressure-BP) to this type of exercise remains controversial. **PURPOSE:** To examine peripheral and central BP responses to low and high-intensity, unilateral handgrip exercise performed with and without BFR. **METHODS:** Eight college-aged males (Age=24±5 yrs; BMI=30±7 kg/m², handgrip max voluntary contraction-MVC=52±8 kg) underwent three 5-minute bouts (counter-balanced, 10 mins rest) of rhythmic handgrip (1-2 sec duty cycle, 20 squeezes/min) performed at a low (40% MVC) and high-intensity (60%

MVC) with and without proximal occlusion (80-100mmHg, 50-80% arterial occlusion assessed via radial artery Doppler-ultrasound). Peripheral BP's (brachial artery) were obtained using the oscillometric method, and a proprietary transfer function was applied to the pulse waveform to estimate central aortic BP's [systolic, diastolic, mean arterial pressure (MAP) and rate-pressure product (RPP=heart rate x systolic BP)]. **RESULTS:** Peripheral systolic and diastolic BP, MAP and RPP were greater than central pressures at BL (e.g., peripheral systolic BP=130±6 vs. central systolic BP=113±5 mmHg; P<0.001), and across each handgrip bout (P<0.05). Compared to BL, both peripheral and central MAP increased, with the greatest change occurring during high-intensity handgrip with BFR (+17±4, P<0.001). Similar findings were observed for peripheral and central systolic and diastolic BP, and RPP (e.g., central RPP at BL=7296±621, vs. 40% BFR=8217±612, vs. 60% with BFR=9441±686, vs. 60% without BFR=9237±629; P<0.001). **CONCLUSION:** These preliminary findings indicate that low intensity, unilateral handgrip exercise performed with BFR produces a comparable BP response (i.e., magnitude increase for MAP) as high intensity handgrip without BFR; however, RPP was greater during high intensity handgrip both with and without BFR, compared to low intensity with BFR.

301 Board #122 May 31 11:00 AM - 12:30 PM
Post-Exercise Blood Pressure and Autonomic Balance Following Continuous and Intermittent Exercise Bouts

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PURPOSE: To examine the post-exercise response of blood pressure and cardiac autonomic balance following a continuous bout of exercise (CONT) compared to multiple intermittent bouts (INT) resulting in the same volume of exercise.

METHODS: Participants (n=18; age: 23.8±3 yr; 12 females, 6 males) completed both 30 minutes of CONT and 30 min of INT cycling exercise (3, 10-min bouts) at 60% VO_{2max} on 2 separate days. The order of the conditions was randomized and the INT bouts were separated by ~4 hours. Systolic (SBP) and diastolic blood pressure (DBP) were assessed with a continuous noninvasive BP monitor before exercise (PRE) and at 5, 30, 60, and 120 min of seated recovery following CONT and the final INT bout. Spectral measures of heart rate variability, reported as high- (HF) and low-frequency (LF) power, were also obtained from an electrocardiogram at the same time points. LF/HF was reported as a measure of autonomic balance. A 2-way ANOVA was used to compare BP and measures of autonomic control between conditions and over time. A significance level of 0.05 was used for all tests. **RESULTS:** Table 1 shows the values for BP during the conditions. There was a main effect of time on SBP such that it was significantly lower at all post-exercise time points compared to PRE. There were no significant changes in DBP between conditions or over time. Furthermore, there was a main effect of time on LF/HF such that it was higher at 5 minutes post-exercise (CONT: 1.23±0.04; INT: 1.17±0.03) compared to PRE (CONT: 1.10±0.02; INT: 1.06±0.02) and 60 (CONT: 1.11±0.03; INT: 1.10±0.03) and 120 min (CONT: 1.10±0.02; INT: 1.07±0.02) post-exercise. **CONCLUSION:** Both CONT and INT resulted in similar post-exercise reductions in SBP and alterations in autonomic balance. Accumulating exercise in multiple bouts appears to result in a similar post-exercise BP response as the same volume of exercise done continuously.

Table 1.

		PRE	5 min	30 min	60 min	120 min
SBP (mmHg)	CONT	120.3 ± 2	111.0 ± 3*	108.0 ± 3*	105.4 ± 3*	108.5 ± 3*
	INT	121.2 ± 2	111.8 ± 3*	108.6 ± 3*	108.5 ± 4*	105.9 ± 3*
DBP (mmHg)	CONT	65.8 ± 2	65.9 ± 2	67.3 ± 2	65.7 ± 2	66.4 ± 2
	INT	67.0 ± 2	67.9 ± 2	65.1 ± 2	64.0 ± 2	65.9 ± 2

* P<0.05 vs. PRE; Data are mean ± SE

302 Board #123 May 31 11:00 AM - 12:30 PM

Acute Hypotension After High-intensity Interval Exercise in Metabolic Syndrome Patients

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PURPOSE: The purpose of this study was to compare the magnitude of post-exercise hypotension (PEH) after a bout of high intensity interval training (HIIT) in comparison to an isocaloric bout of traditional moderate intensity continuous exercise (CE).

METHODS: After supine rest fourteen obese (31±1 kg·m⁻²) middle-age (57±2 y) metabolic syndrome patients (84% hypertensive) underwent a bout of HIIT (45 min)

and CE (70±5 min) in a random order and then returned to supine recovery for another 45 min. Exercise trials were isocaloric and compared to a no-exercise trial (CONT). Before and after exercise we assessed blood pressure (BP), heart rate (HR), cardiac output (Q), systemic vascular resistance (SVR), intestinal temperature (T_{INT}), forearm skin blood flow (S_kBF) and percent dehydration.

RESULTS: During CONT blood pressure and the rest of variables remained unchanged. HIIT produced larger PEH than CE (systolic BP -14±4 versus -4±2 mmHg; $P=0.024$) and larger increases in post exercise resting HR (27±2 versus 4±2 beats·min⁻¹; $P<0.005$). Post-exercise T_{INT} and S_kBF increased only after HIIT ($P<0.05$). PEH after HIIT correlated with the reductions in SVR ($r=0.58$; $P<0.030$) the increases in Q ($r=-0.91$; $P<0.001$) systolic BP prior to exercise ($r=0.60$; $P<0.023$).

CONCLUSIONS: Our findings suggest that HIIT is a superior exercise mode than CE to transiently reduce hypertension in MSyn subjects. PEH seems to be enhanced by some factor positively related the elevations blood pressure during the previous exercise bout.

Supported by a Grant from the Spanish Ministry of Economy and Competitivity (DEP2014-52930-R)

303 Board #124 May 31 11:00 AM - 12:30 PM

Effects of Warm up and Cool Down on Wingate Anaerobic Power Test Hemodynamics

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The impact of warm-up (WU) and cool down (CD) on systemic vascular resistance (SVR[dyn.s/cm]) relative to high intensity exercise is limited. SVR (mean arterial pressure – central venous pressure ÷ cardiac output [CO]) is an index of change in vascular resistance of individual vascular beds and provides insight into local hemodynamic (H) function. **PURPOSE:** The purpose was to examine the effects of a WU and CD on power output and the cardiovascular (CV)/H response to the Wingate Anaerobic Power Test (WAPT). **METHODS:** Following familiarization with impedance cardiography and the WAPT, 20 subjects (21.9 ± 2.7 yr, 170.7 ± 10 cm, body mass 70.5 ± 10.9 kg, 7 ♂) were randomly assigned in a crossover design to the following trials: WU & CD (C1), WU & no CD (C2), no WU, but CD (C3), and no WU & no CD (C4) with 48 hours between trials. Both WU and CD were 3 min cycling @ 50 rpm @ 50 watts. No WU or no CD required 3 minutes of seated rest. All measures were monitored continuously until 5 min post-test. Blood pressure was measured immediately post exercise. **RESULTS:** Statistical analysis by ANOVA with repeated measures ($p<.05$) of combined data of WU trials (C1 & C2) vs no WU trials (C3 & C4) reveals a significant difference ($p<.05$) pre-WAPT between HR 102 vs 84 b/min, SV 95 vs 83 mL/b, CO 9.8 vs 7.0 L/min, and SVR 681 vs 950 dyn.s/cm, respectively. Combined data of CD trials (C1 & C3) vs no CD (C2 & C4) post-WAPT reveals significant differences ($p<.05$) in HR 141 vs 130 b/min, CO 16.0 vs 14.4 L/min, and SVR 415 vs 469 dyn.s/cm. SV of 114 vs 111 mL/b was not significantly different. No differences were found between trials performing the same type of WU or CD. Peak power and average power of all trials were 1131 ± 308 W and 583 ± 120 W with NSD among trials. **CONCLUSION:** Our data indicate that WU had no impact on Wingate Anaerobic Power Test performance. The differences in SV and HR were anticipated because of the protocol used with active and passive WU and CDs. The marked reduction in SVR of 39% from WU prior to WAPT substantiates improved local peripheral hemodynamic function and confirms the opportunity for improved metabolic exchange for a highly demanding anaerobic activity. The benefit of CD following intense exercise is demonstrated with a prolonged attenuation of SVR, which may enhance recovery.

304 Board #125 May 31 11:00 AM - 12:30 PM

The Hypotensive Effects of Isometric Training are Associated with Decreasing Daytime Sleepiness in Young Women

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Isometric exercise training (IET) has been conducted to reduce resting blood pressure; however, the underlying mechanisms are not fully understood. Sleep and sleepiness have been shown to be associated with cardiac risk factors including hypertension. In addition, although some studies indicate that exercise can improve sleep and sleepiness, it remains unknown whether IET can influence sleep, sleepiness, and their relationship with hypotensive effects. **PURPOSE:** To investigate whether IET influences sleep, sleepiness, and to determine their relationship with reduced resting blood pressure (BP). **METHODS:** Twenty-two normotensive young women were assigned to either control (n=11) or training (n=11) group. The training group

performed unilateral isometric handgrip (IHG) sessions three times per week for 8 weeks (wks). The training protocol consisted of four 2-min bouts of IHG exercise at 25 % of maximal voluntary contraction, separated by 3-min rest periods. Sleep and sleepiness were assessed using the Pittsburgh Sleep Quality Index (PSQI) and the Epworth Sleepiness Scale (ESS). Resting blood pressure was measured pre and post 8 wks of training. PSQI and ESS were measured at pre (0 wk), middle (4 wk), and post (8 wk) training. BP was compared between pre and post training, using paired T-test in each group. PSQI and ESS were analyzed by two-way analysis of variance (time x group), using post hoc Tukey HSD test. A Pearson correlation was determined between resting BP change ratio and change ratio for PSQI and ESS from pre to post training period. **RESULTS:** Following 8 wks, IHG training significantly reduced systolic BP (-4.5±6.3 mmHg, $p<0.05$) and mean BP (-3.8±4.6 mmHg, $p<0.05$), but not diastolic BP (-3.4±5.3 mmHg, $p=0.058$); no BP changes were noted in the control group. The PSQI scores were not significantly different among groups. A significant interaction effect was observed in ESS, which indicated that ESS significantly decreased from pre to post training period in the training group (10.3±3.7 to 8.4±4.6, $p<0.05$). ESS change ratio was significantly associated with the resting mean BP change ratio ($r=0.732$, $p=0.01$). **CONCLUSION:** This study indicates that isometric exercise training could reduce resting blood pressure and was associated with daytime sleepiness in young women.

A-45 Free Communication/Poster - Chronic Disease and Disability

Wednesday, May 31, 2017, 7:30 AM - 12:30 PM
Room: Hall F

305 Board #126 May 31 9:30 AM - 11:00 AM

Balance Confidence Predicts Fall Frequency but not Physical Activity in Individuals with Parkinson's Disease.

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Parkinson's disease (PD) is a neurodegenerative movement disorder that affects approximately one million Americans. Physical activity has been shown to be beneficial in the management of PD, however, motor symptoms associated with the disease may create a barrier to participating in exercise. The activities balance confidence (ABC) scale is an index of an individual's confidence in their balance during activities of daily living and is predictive of fall risk but the association between ABC scores and physical activity behavior in individuals with PD has yet to be determined.

Purpose: To assess the relationship between balance confidence and fall frequency, disease severity and objectively-measured physical activity in individuals with PD. **Methods:** Ten participants diagnosed with PD (63.5 ± 11.2 years old, $n = 3$ females) completed the validated ABC scale and gave self-report of their fall frequency over the past 12 months. Disease severity was assessed via the Unified Parkinson's disease ratings scale (UPDRS) by trained personnel. Finally, participants were given a wrist-mounted, physical activity monitor (Movband 3) to measure physical activity behavior over a one-week period. Physical activity during all waking hours and was recorded as the number of steps taken per hour of activity monitor wear. **Results:** Pearson's correlation analyses revealed significant negative correlations ($r \geq -0.59$, $p \leq 0.05$) between the ABC scale score and both the number of falls reported over the previous 12 months and UPDRS scores. In other words, as balance confidence increased, the number of falls reported and disease severity decreased. However, ABC scores were not ($r = -0.06$, $p = 0.85$) associated with physical activity.

Conclusion: While individuals with Parkinson's disease who had poor balance confidence did have more frequent falls and greater disease severity, their physical activity behavior was not different than those with greater balance confidence. Therefore, poor balance confidence may not decrease physical activity behavior in individuals with Parkinson's disease.

306 Board #127 May 31 9:30 AM - 11:00 AM

Effectiveness Of Multi-component Exercise On Physiological Function Among Older Adults With Diabetes And Hypertension

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(No relationships reported)

The increasing prevalence of older adults with diabetes and hypertension has resulted in a major public health issue and seriously challenged healthcare professionals in China. **PURPOSE:** The purpose of this study is to design a multi-component exercise program (MEP) with a randomized controlled trial and examine the effectiveness of the MEP on fitness and physiological function among older adults with diabetes, hypertension or mixed at a community sitting in China. **METHODS:** Seventy older adults (34 men, 36 women; M age = 66±5.5 year old) randomly assigned for the MEP participated in 60 minutes of supervised exercise consisting of various activities related to flexibility, strength, balance, and endurance three times per week for 12 weeks. An experimental pretest-posttest design was employed measuring physical fitness: strength, endurance, flexibility, balance and VO₂ peak, and physiological function: a systolic blood pressure (SBP), diastolic blood pressure (DBP), total cholesterol (TC), triglyceride (TG), high density lipoprotein (HDL), low-density lipoprotein (LDL), and fasting glucose (FG). Paired *t*-tests were utilized to analyze for within-group comparisons between baseline and the results after three months. **RESULTS:** The results revealed that fitness variables were improved significantly in strength (bench press, seated row, arm curl, knee extension, leg press), endurance (VO₂ peak), flexibility (hamstring flexion, knee flexion, shoulder flexion,) and balance (8 foot up and go and chair stand) ($P < 0.05$) after training, meanwhile, the results showed greater decrease in DBP ($t = 3.34 P = 0.00$) SBP ($t = 3.49 P = 0.00$). Biomarkers further demonstrated that the MEP had a significant effect on physiological function: TC ($t = 3.89 P = 0.00$), LDL ($t = 3.20 P = 0.00$), FG ($t = 2.85 P = 0.01$), but no significant effect emerged on TG ($t = -1.01 P = 0.34$), HDL ($t = -0.73 P = 0.56$) in pretest-posttest. **CONCLUSIONS:** The findings from this intervention indicated that this MEP has significant effects on physical fitness, aerobic capacity, blood pressure and biomarkers among older adults with diabetes and hypertension. Such intervention should be expanded to a larger older population.

307 Board #128 May 31 9:30 AM - 11:00 AM

Muscle Weakness and Diabetes Jointly Exacerbate the Rate of Functional Disability among Older Mexican Americans

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PURPOSE: Preserving muscle strength and avoiding chronic diseases such as diabetes may reduce the rate of developing a functional disability at an older age, especially among at risk populations. The purpose of this study was to determine the independent and joint contributions of muscle weakness and diabetes on the incidence of activities of daily living (ADL) disability in an older Mexican American cohort. **METHODS:** A subsample of 2,378 Mexican American males and females aged 65 years and older at baseline were followed for 17 years. Muscle strength was assessed with a handheld dynamometer and was normalized to body weight (normalized grip strength [NGS]). Male and female participants were considered weak if their NGS was ≤ 0.46 and ≤ 0.30 , respectively. The presence of diabetes, ADL disability, and the age of each diagnosis was self-reported by participants. Males and females were classified into four separate groups depending on their muscle strength and diabetes status. Sex-stratified Cox proportional hazard models were used to examine the independent and joint effects of muscle weakness and diabetes on incident ADL disability after adjusting for relevant covariates. **RESULTS:** Males and females that were weak and had diabetes at baseline had a 2.36 (95% confidence interval [CI]: 2.29-2.43; $p < 0.0001$) and 1.96 times higher rate (CI: 1.92-2.20; $p < 0.0001$) of ADL disability compared to males and females that were strong and did not have diabetes at baseline, respectively. Strong male and female participants that had diabetes at baseline had a 1.84 (CI: 1.76-1.93; $p < 0.0001$) and 1.36 times higher rate (CI: 1.33-1.40; $p < 0.0001$) of ADL disability than males and females that were strong and did not have diabetes, respectively. Weak males and females that did not have diabetes at baseline had a 1.36 (CI: 1.32-1.39; $p < 0.0001$) and 1.11 times higher rate (CI: 1.09-1.12; $p < 0.0001$) of ADL disability than males and females that

were strong and did not have diabetes, respectively. **CONCLUSION:** Preserving muscle strength and avoiding diabetes reduces the rate of incident ADL disability in older Mexican Americans. Older Mexican Americans should engage in behaviors and activities that are conducive to healthy aging in order to reduce future declines in physical functioning.

308 Board #129 May 31 9:30 AM - 11:00 AM

Prevalence Of Leisure Time Physical Activity In Adults With Seizure Disorders: 2013 And 2015 Nhis

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PURPOSE: Examine the prevalence of self-reported leisure time physical activity (LTPA) participation by intensity using a representative sample of U.S. adults (18-64 years old) with a seizure disorder or epilepsy. **METHODS:** Data from the 2013 (n=587) and 2015 (n=647) National Health Interview Survey cycles were utilized to examine the prevalence of meeting the 2008 Physical Activity Recommendations for U.S. adults. **RESULTS:** In the 2013 NHIS, the prevalence of adults with a seizure disorder or epilepsy reporting insufficient (< 150 min), sufficient (150-300 min [meets rec]), or high volumes of LTPA (> 300 min [meets rec]) were 92.5%, 6.6%, and 0.9%, respectively. In the 2015 NHIS, the prevalence of adults with a seizure disorder or epilepsy reporting insufficient (< 150 min), sufficient (150-300 min [meets rec]), or high volumes of LTPA (> 300 min [meets rec]) were 92.4%, 7.1%, and 0.5%, respectively. An estimated 19.6% and 15.8% of those with a seizure disorder or epilepsy reported meeting the MSA recommendation during 2013 and 2015, respectively. **CONCLUSIONS:** Adults reporting a seizure disorder or epilepsy may not be impeded by their condition to participate in LTPA or MSA.

309 Board #130 May 31 9:30 AM - 11:00 AM

Patterns of Sedentary Behavior in The First Month After Acute Coronary Syndrome

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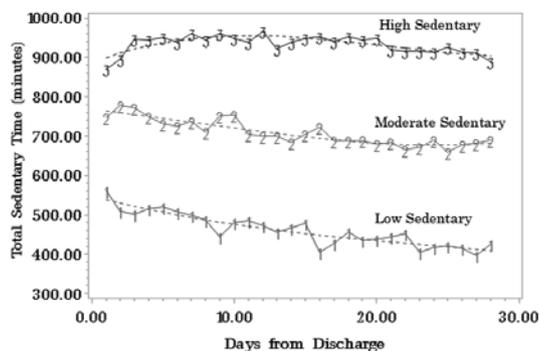
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(No relationships reported)

Sedentary behavior (SED) is a key contributor to cardiovascular disease in the general population. Few data exist on objectively measured SED patterns in acute coronary syndrome (ACS) patients in the first month after an ACS event; a critical period when lifestyle behaviors are reformed.

PURPOSE: To characterize SED patterns and their correlates in ACS patients over the first month post-discharge. **METHODS:** Participants (n=177) with confirmed ACS (myocardial infarction or unstable angina) from a university hospital in Upper Manhattan were examined. SED was objectively measured for 28-days post-discharge via Actical wrist accelerometry. Group-based modeling at the day-level was used to characterize SED patterns (trajectories) over the 28-days. Logistic regression was used to determine correlates of SED trajectories. Correlates included sociodemographic, hospitalization, physical and psychosocial factors. Models were adjusted for age, sex, race and ethnicity. **RESULTS:** Participants spent a mean (SD) of 12.3±3.2 hrs/day in SED the first month post-discharge. Three distinct SED trajectory groups were identified (Fig 1). The high SED group (38%) spent a mean (SD) of 15.6±1.3 hrs/day in SED with no change in day-level SED. The moderate SED group (41%) spent a mean (SD) of 11.8±1.2 hrs/day in SED with little change in day-level SED. The low SED group (21%) spent a mean (SD) of 7.6±1.5 hrs/day in SED, with a gradual decline in SED from immediately post-discharge (~9 hrs/day) to 28-days post-discharge (~7 hrs/day). In multivariable models, left ventricular ejection fraction < 40 , length of hospital stay and coronary artery bypass grafting were identified as significant correlates of the high SED group ($p < 0.05$ for all). **CONCLUSION:** ACS survivors accrued alarmingly high volumes of SED during the first month post-discharge, with little to no change in day-level SED over time. ACS survivors with greater disease severity were more likely to accrue higher volumes of SED.

Figure 1. Trajectories of sedentary time post-discharge in ACS patients.



310 Board #131 May 31 9:30 AM - 11:00 AM
Association of Sedentary Behavior with Cardiovascular Disease Risk Factors in Osteoarthritis Patients.
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INTRODUCTION: Cardiovascular disease has been a significant public health concern among US adults. Recently, great attention has been given to the sedentary behavior (SB) in relation to health indicators such as CD risk factors (CDRF); however, the relationship between sedentary behavior (SB) and CDRF has been little known in patients with osteoarthritis.

PURPOSE: The aim of this study was to investigate the association between leisure-related SB (LSB) time and CDRF among US adults suffering with osteoarthritis.

METHODS: Data from the 2004-2005 Osteoarthritis Initiative Database were analyzed for this study. 4,796 adults (male = 1,992; average age 61.16 ± 9.2 years), currently experiencing or at risk of developing severe osteoarthritis, were included in this analysis. LSB time was defined as leisure time sitting hours per day for past 7 days, categorized into less than 1 hour, 1 hour to less than 2 hours, 2-4 hours and more than 4 hours. Patients with CDRF were operationally defined as presence of any one of hyperlipidemia (blood cholesterol ≥240 mg/dl), obesity (BMI ≥30 kg/m²), hypertension (BP ≥140/90 mmHg), and diabetes (blood glucose ≥200 mg/dl). Logistic regression analysis was used to examine the association between LSB and CDRF when controlling covariates (i.e., age, sex, race, education, and marital status). Statistical analyses were conducted using SPSS (v.22). Significance level was set at 0.05.

RESULTS: 57.1% of participants had CDRF. 79.4% of the participants had leisure time sitting for more than 2 hours per day. The adjusted odds ratios (OR) were statistically significant between LSB time and CDRF for less than 1 hour (reference) vs 2-4 sitting hours (OR = 1.47, 95% CI: 1.01 - 2.13) and less than 1 sitting hour vs more than 4 sitting hours (OR = 1.80, 95% CI: 1.24 - 2.62). Sitting time for 1 hour but less than 2 hours was not significant.

CONCLUSIONS: The results of this study indicate that LSB time associates significantly with CDRF among osteoarthritis patients. This finding suggests that avoiding LSB may be beneficial for lowering the risk of CD in US adults with osteoarthritis.

311 Board #132 May 31 9:30 AM - 11:00 AM
Prevalence of Physical Activity and Sitting in People with Inflammatory Bowel Disease and Healthy Individuals
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Inflammatory bowel disease (IBD) is an autoimmune disease characterized by the cyclical nature of flare and remission periods, with little known about the prevalence of physical activity and sedentary behaviors, such as sitting, in this population.

PURPOSE: To determine the prevalence of physical activity and sitting in people with IBD (in remission and disease flare) compared to healthy individuals. **METHODS:** Participants with IBD (n=242; 96 in disease flare [IBD-flare] and 146 in disease remission [IBD-remission]), and healthy controls (n=265) participated in an online survey. Self-reported walking, moderate-to-vigorous physical activity (MVPA) and

sitting were collected using the International Physical Activity Questionnaire. Data were analyzed using analysis of covariance with age, sex, education status, disease history, and smoking habits as covariates. **RESULTS:** People with IBD reported lower levels of walking (329±422 minutes/week, p=0.03) and MVPA (279±412 minutes/week, p<0.01) than healthy individuals (477±536 min and 481±529 minutes/week, respectively). There were no differences between IBD-flare and IBD-remission participants for levels of walking (301±466 vs. 335±368 minutes/week, respectively) or MVPA (227±315 vs. 330±481 minutes/week, respectively, p>0.05 for both). Physical activity guidelines were met in 45% of people with IBD and 73% of healthy individuals (p<0.05). Although sitting was not different between groups, there was a trend for higher sitting in those with IBD (424±196 minutes/day) compared to healthy individuals (395±182 minutes/day, p=0.07). **CONCLUSION:** Our findings indicate that people with IBD report lower levels of physical activity than healthy individuals but report no differences in weekday sitting. Furthermore, there were no negative consequences of a disease flare on physical activity. Our findings suggest that people with IBD are able to participate in varying levels physical activity despite there being no guidelines for this population. Future research should aim to develop physical activity recommendations to benefit people with IBD and reduce the amount of time spent sitting.

312 Board #133 May 31 9:30 AM - 11:00 AM
Seasonal Variation in Physical Activity of Children with Disabilities during Physical Education
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Children with disabilities are less physically active than their typically developing peers. Physical education (PE) is a primary school setting where children can accumulate health promoting physical activity (PA). Little is known about seasonal variation in PA of children with disabilities during PE in Hong Kong.

PURPOSE: To examine seasonal difference in PA of children with different types of disabilities in the context of PE in special schools.

METHODS: Nine schools designed for children with four disability types (i.e., sensory impairments, physical disabilities (PD), mild-to-moderate intellectual disabilities, and severe intellectual disabilities) in Hong Kong were recruited. Trained observers used SOFIT (System for Observing Fitness Instruction Time) to code PA levels (i.e., lying down, sitting, standing, walking, vigorous) of students during PE. Moderate-to-Vigorous PA (MVPA) was calculated by summing walking and vigorous codes. Observations were conducted on three normal school days in winter (December, mean 18°C) and summer (June, mean 28°C) respectively. Total session energy expenditure (TEE) and energy expenditure rate (EER) were calculated using standard formulae. Linear mixed models were used to determine difference in percentage of time spent in MVPA, TEE, and EER across disability types in two seasons, after adjusting for gender, grade level, duration of PE, and school-level clustering. Interactions among season, disability type, and gender were also examined.

RESULTS: A total of 179 PE classes (94 winter, 85 summer; mean length 38.5 minutes) were observed. Only main effects of *season* were significant for %MVPA (F=4.2, p=.042) and TEE (F=5.1, p=.026), with lower scores in winter (b=-5.1, 95% confidence interval [CI], -10.0 to -0.2 for %MVPA; b=-17.4, 95% CI, -32.7 to -2.1 for TEE) compared to summer.

CONCLUSIONS: PA of children with disabilities during PE varies with seasonality. Adaptation of the setting and program content is needed to promote year-round PA for children with disabilities.

Supported by General Research Fund (752712), University Grant Committee of Hong Kong SAR

313 Board #134 May 31 9:30 AM - 11:00 AM
Physical Activity Levels among Children with Physical Disabilities in Home and School Settings
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Children with physical disabilities (PD) are less physically active than their peers with other types of disabilities. Homes and schools are important settings where children can accrue physical activity (PA).

PURPOSE: To examine PA levels of children with PD in school and home settings.

METHODS: Participants were 147 children with PD recruited from three special schools in Hong Kong. *Behaviors of Eating and Activity for Children's Health: Evaluation System* was used to document PA levels in four settings at school (before-class, recess, lunch break, after-class) and one home setting (before dinner) on four normal school days. Linear mixed models with repeated measures (four measurement days) were used to examine the percentage of time spent in moderate-to-vigorous PA (%MVPA) in the five settings across gender, grade level (4-6, 7-9, and 10-12), and mobility level (walking with or without assistance) after adjusting for school as random effects.

RESULTS: In the before-class setting, significant main effects were found for gender ($F = 5.5, p < .05$) and grade level ($F = 3.8, p < .05$), with boys having less %MVPA than girls ($b = -6.2, 95\% \text{ CI} = [-11.4, -0.9]$), and children in Grades 4-6 and 7-9 having higher %MVPA than those in Grade 10-12 ($b = 7.8, 95\% \text{ CI} = [1.7, 13.9]$; $b = 7.0, 95\% \text{ CI} = [0.4, 13.6]$). A significant main effect of mobility was found separately for recess, lunch break, and after-class settings ($F = 48.6, p < .001$; $F = 34.1, p < .001$; $F = 12.1, p < .01$), with children walking without assistance accruing higher %MVPA ($b = 16.9, 95\% \text{ CI} = [12.1, 21.7]$; $b = 12.7, 95\% \text{ CI} = [8.4, 17.0]$; $b = 47.8, 95\% \text{ CI} = [22.9, 72.7]$). Additionally, a significant *grade by mobility* interaction effect was found in %MVPA during the after-class period ($F = 3.8, p < .05$), whereby the %MVPA of Grade 10-12 children who walked without assistance was greater than counterparts needing assistance. No significant effects of gender, grade level, and mobility on %MVPA were found at home setting.

CONCLUSIONS: Children have low levels of PA across settings, with the most inactive pattern at home and slightly more PA accrual at recess and after-class setting. Future research should pay more attention to their low activity level at home. A multifaceted intervention that considers the contextual and personal factors may help promote PA in children with PD. Supported by GRF 14409514.

314 Board #135 May 31 9:30 AM - 11:00 AM
The Epidemiology of Injuries in Turkish Athletes at Rio Paralympics

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Purpose: The aim of the study was to determine the characteristics and incidence of medical condition or injuries of Turkish team participated to Rio Paralympics. **Methods:** Medical condition information was collected from assessment forms which recorded by 6 team physiotherapists and one doctor. The assessments included demographic characteristics of athletes (sport type, age, gender), injury related questions (time-type and region of injury). **Results:** 81 Turkish athlete (35 female/45 male) participated to Rio Paralympics. A total of 148 application (75 female/73 male application) in 50 athletes were documented during the Paralympic Games. Of the application 63% was musculoskeletal system disorders, 12.8% was urinary system disorders, 2.7% was ophtalmologic problems, 6.8% was gastro intestinal, 2% was ear and 2.1% was allergic problems. Of these injuries 37.1% occurred before the games started. 31 athletes injured more than one time. The most commonly injured region was shoulder and neck (17.6%, 16.9% respectively). Of the athlete 41.9% received medical treatment alone, 43.2% received physiotherapy alone, 14.9% received both physiotherapy and medical treatment. **Conclusion:** This is the first comprehensive epidemiologic report of Turkish paralympic team. It is important to determine the injury prevalence and develop prevention strategies in paralympic sports.

315 Board #136 May 31 9:30 AM - 11:00 AM
Identifying Predictors of Health in Adults with an Intellectual Disability

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Body mass index (BMI) and age are well-known predictors of an individual's health (Peter et al., 2015). However, many studies recently suggest that there should be additional factors between BMI and health to strengthen the relationship (McAuley et al., 2014). This complicated process might apply to adults with an intellectual disability (ID), but there have been limited understanding on what other factors influence health over BMI and age in this underserved population. **PURPOSE:** To identify health predictors in adults with ID, controlling for BMI and age. **METHODS:**

We employed secondary data analysis using 6814 adults with ID (age 18-96 years; 56% men) from the 2013-14 Adult Consumer Survey by National Core Indicators to reveal the potential predictors. Tested variables included personal, health, residence, employment, daytime activities, home, friends/family/staff support, service satisfaction, community participation, and choice-related variables. Considering a type of the outcome variable (i.e., four health categories from poor to excellent), a forward model selection method based on ordinal multiple regression was employed to find out the best model explaining health in adults with ID. **RESULTS:** Mobility, moderate physical activity (PA) engagement, tobacco use, staff support, having a job, eating out in the past month, and having a vacation in the past year were all significant predictors of health in this population ($p < .001$), and the model containing those predictors explained 17% of variance on health of adults with ID, after accounting for BMI and age. Those who moved without mobility aids, engaged in PA, didn't smoke, had a job, received less staff support, ate out, and had vacation were significantly healthier than their counterparts. For instance, the ordered logit for adults with ID who didn't routinely engage in moderate PA being a less healthy category is .49 more than their counterparts. The goodness-of-fit test (Pearson $\chi^2 = 20241.5, p > .05$) revealed that this model fits well. **CONCLUSION:** Apart from BMI and age, we have to consider various personal, social and environmental predictors to better explain health of adults with ID. Interestingly, the health predictors found in this study are closely aligned with the International Classification of Functioning, Disability and Health (WHO, 2001).

316 Board #137 May 31 9:30 AM - 11:00 AM
Associations Among Residential Settings, Physical Activity And Health Outcomes In Adults With Intellectual Disabilities

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The impact of different forms of residential settings on the quality of life of people with intellectual disabilities (ID) has received considerable attention. Previous studies indicate positive effects of deinstitutionalization on social network, adaptive behavior, and many other behavioral outcomes. However, the relationship between residential settings and health-related outcomes in people with ID has not been adequately studied, despite the significance of health and health risk factors such as physical activity (PA). **PURPOSE:** To examine the relationships between perceived general health, PA engagement, body mass index (BMI), and types of residential settings in adults with ID. **METHODS:** We analyzed data from the 2013-2014 Adult Consumer Survey by National Core Indicators. Data were available from 13991 cases of adults with ID (8069 men; 5922 women) aged 18 to 96 years ($M = 43.35 \pm 14.97$ yrs). Perceived health, height, weight, BMI, mobility, engagement in moderate PA, age, and residential settings were extracted for secondary data analyses. Binary logistic regression, multinomial logistic regression, and univariate one-way ANOVA were used to answer the research questions. **RESULTS:** There were significant differences in BMI between adults with ID residing in different settings ($p < .001$). Individuals with ID who live in institutions have the lowest BMI, whereas those who live independently have the highest BMI. However, there are different results on perceived health and PA engagement. There are significant differences on PA engagement among adults with ID in different residential setting. People with ID living in institutions have approximately 38% of lower engagement in PA than those living with parents ($OR = .61$; $CI: .50 - .75$), after controlling for mobility. Individuals with ID who live in institutions are 4 times more likely to rate their health as poor than those who live with parents ($OR = 4.19$; $CI: 2.54 - 3.88$), after controlling for age. There are no significant differences on perceived health between those living independently and those living with parents. **CONCLUSION:** Although individuals with ID who reside in institutions have the lowest BMI, they are less likely to engage in moderate PA and to have lower perceived health than individuals who live independently or with their parents.

317 Board #138 May 31 9:30 AM - 11:00 AM
BMI Across Age-groups In Adults With Down Syndrome And Adults With Intellectual Disability

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The age-associated response of body mass index (BMI) in adults with Down syndrome (DS) has not been thoroughly examined. DS is associated with faster biological aging; thus, BMI may change differently in response to age between adults with DS and adults with other intellectual disabilities (ID). Differences between these groups in the age-associated response of BMI may reflect differences in how weight and height change as these people age. **PURPOSE:** To examine if BMI, weight, and height differ

across age-groups between adults with DS and adults with ID. **METHODS:** We conducted secondary analyses of data from the 2013-2014 National Core Indicators Adult Consumer Survey, containing 14,237 cases (age 18-96 y; 8208 men). Of these cases, 1,343 persons had DS (age 41 ± 13 y) and 11,289 persons (age 44 ± 15 y) had ID, but not DS. We extracted weight, height, BMI, sex, and age, and generated age groups: 18-29; 30-39; 40-49; 50-59; 60-69; 70-79; 80-89; 90-99 y. There were no DS cases in the 70-79, 80-89, and 90-99 y age groups. We used 2-way ANOVA and follow-up tests to examine differences in BMI, height, and weight across age groups. Height and weight were analyzed by sex. **RESULTS:** The BMI age-associated response was different between adults with DS and adults with ID ($p < 0.001$ for interaction). Adults with DS had higher BMI than adults with ID ($p < 0.001$) at ages 18-29 (30 vs. 27 kg·m⁻²), 30-39 (32 vs. 28 kg·m⁻²), and 40-49 y (31 vs. 29 kg·m⁻²). BMI did not differ between groups at 50-59, 60-69, and 70-79 y. For adults with DS, BMI was not significantly different between the 3rd, 4th and 5th decades of life and decreased after age 49 y (from 31 kg·m⁻² at age 40-49 y to 26 kg·m⁻² at age 60-69 y; $p < 0.001$). For adults with ID, BMI increased between the 3rd and 4th decade of life and decreased after age 59 y (from 28 kg·m⁻² at age 50-59 to 25 kg·m⁻² at age 80-89 y; $p = 0.015$). For both sexes, weight declined at earlier ages in those with DS than those with ID ($p \leq 0.019$ for interactions). Height was lower across all ages for both women and men with DS than their sex counterparts with ID ($p < 0.001$); however, the age-associated response in height did not differ between those with DS and those with ID. **CONCLUSION:** The age-associated changes in BMI and weight are different between adults with DS and adults with ID, but no DS. The results indicate earlier onset of weight loss in adults with DS.

318 Board #139 May 31 9:30 AM - 11:00 AM
Effect Of A Physical Education Program On Motor Performance In Down's Syndrome Children By Mabcb2
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PURPOSE: Previous studies suggest that children with Down's Syndrome, a genetically based neurodevelopmental disorder, demonstrate motor problems and cognitive deficits. Thus, the aim of study was to analyze the effect of an intervention based on a special physical education program on motor performance in children with Down's Syndrome. **METHODS:** A total of 16 participants (7 girls and 9 boys) from Riobamba (Ecuador) with Down's Syndrome aged between 7 and 10 years (7.00 ± 1.47) participated in this study. A special physical education program was implemented during 6 month (3 time-week; 2 hour per session). Motor performance was assessed at baseline and post-intervention through the Movement Assessment Battery Children-2 (MABC2-checklist) evaluating the following variables: manual dexterity, accuracy and catches, and balance. A pair sample t-test was conducted to compare the differences between baseline and post-intervention on motor performance variables means. **RESULTS:** Time to perform the test of Manual Dexterity significantly decreased post-intervention (baseline= 155.82 ± 94.06 -seconds vs post-intervention= 149.29 ± 90.19 -seconds; $p < 0.001$). The number of successful attempts in the test of accuracy and catches significantly improve post-intervention (baseline= 3.17 ± 1.98 vs post-intervention= 8.29 ± 4.62 ; $p < 0.001$). In the balance test, children significantly increased the time in balance state post-intervention (baseline= 11.23 ± 10.18 seconds vs post-intervention= 15.58 ± 7.50 seconds; $p < 0.001$). **CONCLUSION:** 6-month physical education program could improve motor performance (manual dexterity, accuracy and catches, and balance) in children with Down's Syndrome.

319 Board #140 May 31 9:30 AM - 11:00 AM
Physical Activity and Shoulder Muscle Strength in Spinal Cord Injured Individuals
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The participation in sport activities is important in individuals with spinal cord injury, namely to counteract their sedentary lifestyle and the loss of hand and upper limb function. However, there is a lack of knowledge regarding the effects of sport in moderate-to-vigorous physical activity levels and shoulder muscle strength. **PURPOSE:** To compare shoulder muscle strength and physical activity levels in sportive and non-sportive individuals with spinal cord injury. **METHODS:** This is a cross-sectional study encompassing 14 sportive (41.07 ± 9.99 yrs.) and 4 non-sportive men (32.0 ± 6.97 yrs.) with spinal cord injury (between T5 and L1). Sports

participation was determined by questionnaire. Physical activity was measured with triaxial accelerometry worn on wrist during 7 consecutive days. Data was expressed as average of minutes per day in moderate-to-vigorous physical activity. Shoulder strength was assessed in an isokinetic dynamometer at 60°/second. Shoulder movements considered were flexion/extension (range 0 - 50°), external/internal rotation (range 0 - 45°), and abduction/adduction (range 25 - 75°). Non-parametric statistics (Mann-Whitney) was used to compare differences between sportive and non-sportive men. **RESULTS:** Total moderate-to-vigorous physical activity of sportive compared to non-sportive individuals was significantly higher (126.50 ± 53.26 and 61.82 ± 28.8 min/day, respectively; $U=52.00$; $p=0.008$), and the same pattern was observed when considering only weekday moderate-to-vigorous physical activity (131.81 ± 58.66 and 62.47 ± 30.29 min/day, respectively; $U=52.00$; $p=0.008$). Regarding to isokinetic strength, the peak torque of the right and left shoulder extension was significantly higher ($U=49.00$; $p=0.025$) in sportive (72.45 ± 11.8 Nm and 73.95 ± 12.0 Nm, respectively) compared to non-sportive men (59.97 ± 7.46 Nm and 62.90 ± 12.42 Nm, respectively). **CONCLUSIONS:** In men with spinal cord injury, the participation in sport activities can lead to an increment in moderate-to-vigorous physical activity and shoulder extension strength that might be important for independency in daily activities. Supported by the CNPQ under grant number 206862/2014-8; CAPES under grant number 6099/13-0; CIAFEL under grant number UID/DTP/00617/2013.

320 Board #141 May 31 9:30 AM - 11:00 AM
Workplace Wellness Exercises For Individuals Who Use Wheelchairs
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Individuals who use wheelchairs for mobility face various barriers to physical activity during the workday. Worksite wellness exercises can be conducted during the workday to increase energy expenditure during sedentary time sitting at a desk. Research in the general population shows promising results for worksite wellness exercises conducted at specific intervals and intensities throughout the day increasing daily energy expenditure, which over an extended time period could have a significant impact on weight management. **Purpose:** To pilot test worksite wellness exercises for individuals who use wheelchairs for mobility. **Method:** Five worksite wellness exercises were chosen from surveys including: air punches, arm circles, chair push-ups, forward/lateral raises, and desk push-ups. The five exercises were pilot tested using the COSMED K4 portable metabolic cart in individuals who use wheelchairs of working age. Participants first rested for five minutes to measure resting energy expenditure. Exercises were performed for intervals of 60 seconds of work and 60 seconds of rest in a randomized order. Feasibility of worksite wellness exercise movement performance and trends in changes in energy expenditure were analyzed across the entire sample. **Results:** Participants included 14 individuals who use wheelchairs for mobility between 18 and 60. On average resting energy expenditure equaled 1.33 (SD= 0.35) Mets and 1.64 (SD= 0.39) Kcal/min and exercise energy expenditure equaled 2.38 (SD= 0.81) Mets and 3.08 (SD= 1.06) Kcal/min. Greatest increases shown in chair push-ups and desk push-ups. Three participants were unable to perform chair push-ups due to injuries or strength. Therefore, performing worksite wellness exercises for 13 minutes per workday could result in an extra 100 Kcal/week expended per week. **Conclusions:** Worksite wellness exercises are a feasible option for energy expenditure in the workplace for individuals in wheelchairs. Specific worksite wellness exercises are needed to suit their needs that could also be performed outside the workplace as an exercise regimen. This was a small, feasibility pilot study and larger studies need to be done to show reliability and validity of these exercises across diverse populations of individuals who use wheelchairs for mobility.

321 Board #142 May 31 9:30 AM - 11:00 AM
Using a Self Regulation Physical Activity Intervention to Improve Physical Function
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Limitations in physical function are risk factors for subsequent disability, institutionalization, and loss of independence for older adults and are directly caused or exacerbated by physical inactivity. Getting older adults to adopt and maintain physical activity (PA) is a challenge. Use of self-regulation (SR) strategies may be useful, especially for overweight and obese older adults. **PURPOSE:** To examine the effect of a 10-week group exercise and lifestyle behavior change program on physical function in older community-dwelling adults. **METHODS:** Fifty two older adults (mean age= 72.34 yrs ± 8.0 , mean BMI= 31.68 ± 6.53) completed the 10-week Physical Activity

for Life for Seniors (PALS) group exercise and lifestyle behavior change program. Ten exercises were performed in a circuit in 1 minute intervals over 40 minutes 3 days/week. The 30 minute lifestyle behavior change class included self-regulation problem solving strategies for staying active. Physical function was measured via the Physical Function Questionnaire (PFQ, 0=unable to do to 100=no difficulty in performing 6 functional tasks), Timed Up and Go (TUG, time in seconds to rise from a chair, walk 3 meters, return to chair and sit), 6 Minute Walk (6MW, feet) and Usual Gait Speed (UGS, meters/second to walk 6 m distance); PA via the CHAMPS questionnaire and SR via the Self-Regulation for Exercise Scale (1=never to 5=very often). Paired t-tests were used to examine mean differences in the variables pre and post intervention.

RESULTS: In this population of overweight and obese older adults, significant improvements ($p=.000$) were noted in physical function (PFQ: 72.85 ± 21.12 vs 79.31 ± 18.47 ; TUG: 10.89 sec ± 2.67 vs 9.45 sec ± 2.52 ; UGS: 1.19 m/s $\pm .22$ vs 1.26 m/s $\pm .22$; 6MW: 1112.06 ft ± 410.21 vs 1337.92 ft ± 361.04); PA (total PA: 2143.31 ± 2153.24 vs 4092.99 ± 2635.78 ; moderate PA: 742.84 ± 1476.00 vs 2366.96 ± 2112.94); and SR ($1.55 \pm .61$ vs $2.67 \pm .62$). **CONCLUSIONS:** These results suggest that a 10-week group exercise intervention that includes a SR behavior change component was effective in improving physical function and moderate intensity and total PA in this population of older adults. Participants indicated they liked the socialization the group format provided.

322 Board #143 May 31 9:30 AM - 11:00 AM
Determinants of Leisure-Time Physical Activity Participation in University Students with Physical Disabilities: A Multi-University Study

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Purpose: The purpose of this study was to investigate the participation rates and determinants of physical activity (PA) participation of university students with physical disabilities (SWD).

Methods: 40 SWD from 16 U.S. universities completed a mixed-methods online survey regarding their LTPA practices and influences to participation on their campus. Surveys used to measure variables of interest included LTPAQ-SCI and PASIPD (PA), WHO QOL-BREF (quality of life), ESES (exercise self-efficacy), SCOPE (social inclusion opportunities), B-PEDS (barriers to exercise), and Self-Regulation (SR) questions (intent to exercise). Short answer questions were included to allow participants to expand on answers and provide more detailed information. Kruskal-Wallis tests were used to examine differences in survey outcomes between gender and sport participation. Spearman's rho and multiple regressions analysis were used to examine the extent of the relationships between variables of interest and participant PA levels. Short answer responses were analyzed using thematic analysis strategies.

Results: A strong correlation was found between PA and all variables of interest ($p<.05$). Variables found to have the strongest correlation with PA included ESES ($r_s=0.63$, $p<.01$), SR ($r_s=0.74$, $p<.01$), WHO QOL-BREF ($r_s=0.45$, $p<.01$), and perceived opportunities for LTPA on campus ($r_s=0.51$, $p<.01$). Multiple regressions analysis revealed gender, SR, and perceived social inclusion on campus were significant predictors of PA level ($F=19.43$, $p<.01$, adj. $R^2=0.61$). Short answer responses reflected quantitative findings and provided rich elaboration on these constructs.

Conclusions: Results indicated SWD may be more active than previously thought, yet still critically low relative to physical activity guidelines for aerobic health. Although all external

and internal variables examined had significant relationships to PA level, internal variables had the strongest correlations to PA level. It was also found that significant internal variables had strong correlations to external variables, indicating a complex relationship between SWD external-environmental influences, internal-personal influences, and PA levels.

323 Board #144 May 31 9:30 AM - 11:00 AM
Cognitive Benefits Of A Dance Movement Therapy Program In Adults With Intellectual Disabilities

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INTRODUCTION: There is a constant connection between mind and body in Dance/Movement Therapy (DMT). This connection promotes the integration of the emotional, cognitive and physical dimensions of a person.

PURPOSE: to evaluate the cognitive improvement after a DMT program in adults with intellectual disability (ID)

METHODS: 28 adults with moderate-severe ID (16 men, 40-66 yr), recruited from a workshop center, participated in the study after obtaining their legal/tutors and their own informed consent. They were divided into Intervention group (IG; $n=15$) and Control group (CG; $n=13$). The IG followed a DMT program of 26 sessions of 1 hour 2 day/w plus their regular work, meanwhile the CG continued with their regular activities. The sessions were structured as proposed by Chace (1953). Human Figure drawing test, Illinois test for Psycholinguistic aptitudes and Pictures memory test were applied before and after the DMT program. Descriptive for all variables were obtained. T-test was applied to study within-group differences. ANCOVA was applied to study between-groups differences.

RESULTS: Significant deterioration for evolutionary indicator (EI), word verbal expression fluency (WVEF) and body part expression fluency (BPEF) were found in the CG. The IG significantly improves EI and picture's memory (PM). When controlling for age, gender, ID level and baseline values, a significant difference ($p<.05$) between IG and CG in the EI was found.

CONCLUSIONS: Even only EI showed between-groups significant differences, there is a cognitive improvement in persons with ID after following a DMT program. More research is needed with a larger sample and/or a longer DMT program.

Partially supported by: MEC (Ref: DEP2012-35335) & AGAUR (Ref: 2013FI_B2 00091)

Table 1. Characteristics of the participants

Variables	Control group (n=13)	Intervention group (n=15)
Age (years)	53 (9)	52 (7)
Gender (M/F)	9/4	7/8
ID level (%)	66.5 (11.0)	71.2 (7.7)

Table 2. Cognitive values for participants by Pre-Posttests

Variables	Control group (n=13)		P_1	Intervention group (n=15)		P_2	P_3
	T_1 Mean (SD)	T_2 Mean (SD)		T_1 Mean (SD)	T_2 Mean (SD)		
Evolutionary Indicator	17.1 (3.8)	14.9 (3.9)	.014	12.6 (5.5)	14.67 (4.9)	.014	.000
Picture's Memory	3.4 (2.2)	4.9 (2.3)	.621	2.6 (1.6)	3.8 (2.2)	.033	.554
Word verbal expression fluency	34.2 (13.09)	33.5 (14.1)	.007	28.3 (11.6)	31.3 (11.0)	.169	.812
Body part verbal expression fluency	10.0 (5.5)	8.9 (4.1)	.008	7.3 (4.1)	8.7 (3.8)	.068	.105

Abbreviations: T_1 , pre-test; T_2 , Post-test

P_1 : within-group differences for CG.

P_2 : within-group differences for IG.

P_3 : ANCOVA between-groups differences, controlling for baseline values, age, gender and Intellectual Disability level.

324 Board #145 May 31 9:30 AM - 11:00 AM

Validity Of The Maps Score As A Functional Measure In Adults With Incomplete Spinal Cord Injury

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Current functional measures for adults with spinal cord injury are limited in their ability to assess person-environment interaction as defined by the World Health Organization. The Movement and Activity in Physical Space (MAPS) score, an objective functional measure encompassing physical activity and person-environment interaction, has been successfully applied to measure various patient populations. However, the validity of the MAPS score in adults with incomplete spinal cord injury (iSCI) has not been evaluated.

PURPOSE: To validate the MAPS score in adults with iSCI using evidence of convergent and known-group difference validity.

METHODS: 9 adults (48.1 \pm 16.4 yrs) with iSCI wore a GT3X accelerometer and carried a LandAirSea model Tracking Key GPS receiver when outside of their residence to measure free-living physical activity and record location (latitude/longitude), respectively. In this analysis, participants who wore an accelerometer and GPS for at least 3 days were included ($n=9$; 5.8 \pm 1.5 days). MAPS scores were calculated by combining data from the accelerometer and GPS to assess patient function. Functional ambulation measures included walking speed, 6-minute walk distance (6MWD), and Walking Index for Spinal Cord Injury (WISCI - II).

Convergent validity evidence was obtained by quantifying the relationship between MAPS score and the three functional ambulation measures using Pearson product moment correlations, and known-group difference validity evidence was assessed using an independent t-test to compare participants who displayed greater (n=7; ASIA Impairment Scale: B) and lesser (n=2; ASIA Impairment Scale: C and D) severity of functional impairment (GSFI vs LSF1).

RESULTS: The MAPS score was moderately correlated with walking index ($r=.74$), walking speed ($r=.64$) and 6MWD ($r=.56$). A significant difference in MAPS score was also observed between GSFI (5.27 ± 7.12) and LSF1 (35.65 ± 23.55) groups, $t(6.47)=-2.97, p=.023$.

CONCLUSIONS: Our findings provide support for using the MAPS score as a functional outcome measure in adults with incomplete spinal cord injury.

325 Board #146 May 31 9:30 AM - 11:00 AM
Sex Differences in Resting Heart Rate and Heart Rate Recovery in Low Back Pain Subjects

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(No relationships reported)

Resting heart rate (RHR) and heart rate recovery (HRR) are two easy to obtain measures providing a quick estimate of cardiovascular health (CVH). There is conflicting and inconclusive evidence regarding the association of CVH and low back pain (LBP), although it is known that deconditioning is prevalent in this population. **PURPOSE:** To examine sex differences in RHR and HRR, and the relationship between RHR and HRR in subjects with LBP. **METHODS:** RHR and 1 minute HRR were assessed via Polar heart rate monitoring in 31 patients (18 females) seeking therapy for chronic non-specific LBP. HRR was assessed after repeatedly lifting a 25-pound weight from a 1 foot stool to chest height in an erect posture (Rep Lift) for 1 minute at a self-selected cadence, using self-selected biomechanics, as well as after 15 minutes of steady state treadmill walking (TMW) at a self-selected brisk pace. **RESULTS:** Males and females were similar in age (55.4 ± 14 years), BMI (28.6 ± 5.4 kg/m²), resting blood pressure ($127/78$ mmHg), pain intensity (2.8 ± 2.5), and self-reported disability (Oswestry score of 35.8 ± 17.1). Additionally, there were no significant differences between males and females in RHR (72.3 ± 1.9 bpm), peak heart rate of Rep Lift and TMW (107.0 ± 20.0 and 96.0 ± 13.7 bpm respectively), and HRR after Rep Lift and TMW (18.0 ± 10.3 and 15.8 ± 6.4 beats, respectively). However, RHR predicted HRR after Rep Lift and TMW in males ($p<.01, R^2=.55$ and $.46$ respectively) but not in females ($R^2=.05, p=.11$ and $R^2=.03, p=.48$ respectively). **CONCLUSIONS:** RHR is often measured and interpreted as a sign of CVH, or rather deconditioning, in patients with LBP. However, it appears that RHR predicts cardiac recovery after activity in males but not females with LBP. Thus, assumptions of exercise tolerance and CVH in females with LBP should not be based on RHR, but rather on HRR. The reason for the above findings in women compared to men is unclear and warrants further investigation. This study also highlights the potential value of HRR after functional tasks such as repetitive lifting and steady state walking.

326 Board #147 May 31 9:30 AM - 11:00 AM
The Success Rate of iCan Bike Participants with Multiple Diagnoses

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Individuals with cognitive and physical disabilities must endure daily challenges that may decrease overall well-being. The iCan Bike program, a subdivision of the iCan Shine organization, utilizes an individualized intervention for teaching mentally and physically challenged individuals how to ride a two-wheeled bicycle as a means to increasing well-being and self-confidence. **PURPOSE:** The purpose of this study was to investigate the relationship between the learning success rate in the iCan Bike program and the quantity of participant diagnoses. **METHODS:** Participants were 2,652 boys (n = 1,705) and girls (n = 947) with varying diagnoses. The amount of diagnoses per rider were as followed: one (n = 1896), two (n = 639), three (n = 100), and four (n = 17). Each participant attended a five day camp, 75 minutes per day. During the week, participants progressed through a series of interventions, adapted equipment, and typical two-wheeled bicycles. Successfully riding a two-wheeled bicycle was defined as riding unassisted for 75 feet. Descriptive statistics were conducted using IBM SPSS (v23). **RESULTS:** Overall, participants achieved a 67.7% rate of success (males = 70.2%; females = 60.4%) for learning to independently ride a two-wheeled bike. The participants' success rate per amount of diagnoses were as follows: one diagnosis = 67.9% (males = 70.3%; females = 63.5%), two diagnoses =

67.0% (males = 68.2%; females = 64.7%), three diagnoses = 71.0% (males = 81.4%; females = 56.1%), and four diagnoses = 58.9% (males = 63.6%; females = 50.0%). **CONCLUSIONS:** These findings support past research, indicating this teaching style is an effective way for individuals with any amount of diagnoses to learn how to ride a two-wheeled bicycle. Interestingly, participants with three diagnoses saw a higher success rate (primarily due to a higher male success rate) when compared to the participants that had one, two, or four diagnoses. More research needs to be conducted to better define the relationship between success rate, quantity/combination of diagnoses, and gender differences among iCan Bike participants.

327 Board #148 May 31 9:30 AM - 11:00 AM
Exercise Results in Physiological Improvements in Individuals Living with Disabilities

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PURPOSE: Individuals who have a disability are at risk for becoming overweight or obese which has been associated with secondary health conditions including heart disease, stroke, diabetes, and cancer. In fact, individuals who have a disability triple their risk for these aforementioned conditions compared to adults without disabilities. This population is likely to become overweight due to physical inactivity or inadequate physical activity. Reasons cited for exercise barriers include residual physical impairments related to their health condition, or a lack of access to programs that provide appropriate accommodations. This study aimed to determine the effects of an exercise intervention on physical functioning, which may ultimately be linked to chronic disease development, in individuals with disabilities. **METHODS:** Participants were recruited from a group home through convenience sampling. At baseline and following the 6-week exercise intervention, participants underwent a battery of physiological and functional tests including body weight, resting heart rate (RHR), resting blood pressure, cardiorespiratory fitness, fall risk, muscular strength and endurance. The exercise intervention consisted of three 60 minute supervised sessions per week with two sessions held at the Miracle Field and one held at the group home. **RESULTS:** Participants included 12 group home residents, (n = 8 males) with an average age of 46 years old with varying degrees of cognitive impairments. Significant improvements were found in balance and muscular endurance. Fall risk scores improved from 37.42 ± 4.47 to 55.98 ± 6.82 ($p = 0.02$) and the number of repetitions performed on the lateral raise improved from 5.60 ± 0.93 to 8.10 ± 0.60 ($p = 0.01$) from pre- to post-intervention. Additional improvements, although not statistically significant, were found in RHR, systolic blood pressure, cardiorespiratory fitness, muscular strength, and number of push-ups performed. **CONCLUSIONS:** A supervised exercise intervention seems to be a safe and effective way to improve functional outcomes in individuals with disabilities living in a group home.

328 Board #149 May 31 9:30 AM - 11:00 AM
Sedentary Patterns In People with Intellectual Disability

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Introduction: Adults and older adults with intellectual disabilities (ID) have low physical activity levels (PALs) and very little is known about the patterns of sedentary time (ST) among them. **Purpose:** To analyze ST patterns of adults and older adults with ID. **Methods:** A group of 42 adults and 42 older adults with mild to severe ID were recruited. A health screening questionnaire was completed by each participant and/or legal guardian. Height and weight were obtained to calculate BMI. ST patterns were assessed with ActiGraph accelerometers for 7 consecutive days. **Results:** Non-significant differences in ST throughout the week were observed. Non-significant differences between gender groups were found for ST. A significant difference was found for age groups where adults present a higher number of breaks per sedentary hour than older adults ($P = 0.048$) and the obese participants spent more time on SB than those participants with a normal BMI ($P = 0.042$). We also found that the number of bouts in SB per day increased in those participants with higher BMI values ($P = 0.005$). **Conclusions:** These groups of subjects with ID showed a high prevalence of ST (79.4% of monitoring time). Interestingly, when comparing age and/or gender groups, no differences were observed for ST. Our findings provide novel and valuable information to be considered in future interventions aiming to increase PAL and reduce ST. Well-designed interventions and preventive health strategies in this specific population are recommended.

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Table 1. Descriptive characteristics of the participants.

Variable	All n = 84	Males n = 49	Females n = 35	P_1	Adults n = 42	Older adults n = 42	P_2
Age (yr)	44 (12)	45 (11)	43 (13)	0.499	35 (7)	54 (6)	< 0.001
Height (cm)	160.5 (11.3)	165.5 (9.7)	153.5 (9.5)	< 0.001	161.0 (12.8)	159.9 (9.7)	0.642
Weight (kg)	73.5 (14.4)	72.4 (12.0)	75.2 (17.3)	0.385	70.3 (14.0)	76.8 (14.3)	0.037
BMI (kg·m ⁻²)	28.8 (6.5)	26.5 (4.1)	32.1 (7.9)	< 0.001	27.1 (4.6)	30.5 (7.7)	0.016

Note: data are expressed as mean (SD). Abbreviations: BMI, body mass index.
 P_1 Difference between genders based on t-tests. P_2 Difference between age groups based on t-tests.
 BMI, body mass index; WC, waist circumference.

Table 2. Time in sedentary, percentage of sedentary behavior·day⁻¹, number of sedentary bouts·day⁻¹, and number of breaks per sedentary hour.

Variable	Sedentary behavior (min·day ⁻¹)	P_1	Percentage of wear time in sedentary behavior·day ⁻¹	P_2	Number of bouts in sedentary behavior·day ⁻¹	P_3	Number of breaks per sedentary hour	P_4
All	612.9 (80.1)		79.4 (6.5)		64.8 (11.7)		6.2 (0.7)	
Age group [†]		0.155		0.654		0.553		0.048
Adults	599.7 (76.8)		79.1 (5.6)		64.1 (9.5)		6.4 (0.6)	
Older Adults	626.0 (82.2)		79.7 (7.3)		65.5 (13.7)		6.1 (0.7)	
Gender [†]		0.369		0.431		0.491		0.593
Males	607.7 (86.0)		78.9 (7.4)		64.1 (12.1)		6.3 (0.6)	
Females	620.2 (71.6)		80.1 (4.9)		65.8 (11.4)		6.2 (0.7)	
BMI (kg·m ⁻²)		0.039		0.111		0.005		0.138
Normal	577.2 (90.8)		77.0 (8.1)		57.9 (11.1)		6.5 (0.6)	
Over-weight	619.4 (74.1)		79.9 (5.5)		66.7 (10.4) [§]		6.2 (0.6)	
Obese	634.0 (71.1) [§]		80.7 (5.8)		68.0 (11.9) [§]		6.1 (0.7)	

Note: data are expressed as mean (SD). Abbreviations: BMI, body mass index; WC, waist circumference.
 P_1 Between age groups, gender, BMI category and WC category difference in sedentary behavior (min·day⁻¹).
 P_2 Between age groups, gender, BMI category and WC category difference in sedentary behavior·day⁻¹ (%).
 P_3 Between age groups, gender, BMI category and WC category difference in the number of bouts in sedentary behavior·day⁻¹.
 P_4 Between age groups, gender, BMI category and WC category difference in the number of breaks per sedentary hour.
[†]Differences between age groups based on linear models adjusted for gender; differences between genders based on linear models adjusted for age group. [§]Significant difference ($p < 0.05$) when compared to Normal BMI.

329 Board #150 May 31 9:30 AM - 11:00 AM
Physical Conditioning Program To Improve Isometric Strength And Body Composition In People With Down Syndrome.
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It is calculated that in Mexico there exists about 250,000 people with Down Syndrome (DS). However due to the lack of activities that stimulate an optimum development causes a poor quality of life than the rest of the population. **PURPOSE:** To determine the effect of a physical conditioning program on isometric strength

and body composition in people with DS. **METHODS:** The design of the study was an experimental type. Twenty two children participated with DS. Thirteen in the experimental group (EG) and nine in the control group (CG), that did not present any history of heart diseases and which didn't practice any type of physical activity or sport. The isometric strength (manual hydraulic dynamometer model SH5001), the height (stadiometer SECA 213), weight (Tanite Scale Bc533) were measured and BMI was calculated. Also the triceps and the medial calf skinfolds (Slimguide Caliper) were measured. Later a physical activity program was implemented with a frequency of five times per week with sessions of 55 minutes of duration for a period of 16 weeks. **RESULTS:** In the EG the age was 12.3 + 2.06 years, while in the CG was 11.4 + 1.94 years. The height was 134.6 + 6.4 cm and 132.7 + 4.8 cm for the GE and GC respectively. The BMI in the EG was 22.2 + 2.5 kg/m² and 20.7 + 2.5 kg/m² at the beginning and at the end of the intervention, respectively ($p=0.0001$). Meanwhile in the CG the BMI was 23.29 + 4.9 kg/m² and 21.9 + 4.6 kg/m² during the pretest and posttest respectively ($p=0.001$). In regards to the calf skinfold in the EG was 14.9 + 5.5 mm at the beginning and 14.55 + 3.2 mm at the end ($p=0.008$), while in the CG no significant difference were found ($p = 0.39$). No significant differences for the triceps skinfold were found. Isometric strength in EG at baseline was 2.4 ± 4 kg and 9.2 ± 2 kg at the end ($p=0.0001$), while in the CG no significant difference were observed ($p = 0.1$). **CONCLUSION:** A physical conditioning program can improve the body composition and the isometric strength in people with DS. People with DS need to engage in physical activity because of their tendency to be overweight and obese, this would significantly improve their quality of life.

330 Board #151 May 31 9:30 AM - 11:00 AM
Ballroom Dance Improves Heart Rate Variability and Depression in Persons with Multiple Sclerosis
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Multiple Sclerosis is a neurodegenerative disease of the central nervous system. Symptoms include fatigue, depression, gait disturbances, and cognitive changes, all which affect quality of life (QOL). Heart Rate Variability (HRV), an indication of cardiac autonomic balance, can be altered in persons with Multiple Sclerosis (PwMS) and has been associated with depression and other health risks in other populations. In turn, depression as well as HRV, can be improved with aerobic exercise. The relationships between depression, QOL, and other self-reported measures to HRV in PwMS are largely unknown. We previously showed that ballroom dance (BD) may improve physical fitness, cognition, fatigue, depression and QOL in PwMS. **PURPOSE:** The purpose of this study was to investigate the relationship of depression with HRV in PwMS and test whether BD can improve HRV concurrent with depression. **METHODS:** Thirteen PwMS participated in an 8-week BD program (MSD). Twelve PwMS served as a control group (C). BD classes were 1 hour/day, 2x/week and taught by a professional BD instructor. Each MSD subject was paired with a non-MS patient. All subjects were ambulatory, independent to modified independent. Patient Determined Disease Steps (PDDS) did not differ between groups (MSD=2.0(1.9), C=1.4(1.8)). Pre- and post-measures included QOL (PROMIS Global Well Being), Fatigue Impact Scale (FIS), Beck Depression Inventory (BDI), Heart Rate Variability (HRV), and 6-minute walk test (6MWT). Nonparametric and parametric statistics were used with $p \leq 0.05$. Data are mean (SD) or md (Q1,Q3) for self-report measures. **RESULTS:** In both MSD and C groups prior to BD, QOL correlated with FIS ($r_s = -0.63$) and BDI ($r_s = -0.70$). FIS correlated with BDI ($r_s = 0.72$). HRV correlated with QOL ($r_s = 0.47$) and BDI ($r_s = -0.56$) but not with FIS. ($r_s = -0.32$). No variables correlated with 6MWT. For the MSD group, HRV (pre = 31 (19) post = 38 (19) ms, $p = 0.03$) and 6MWT (pre = 432 (114) post = 462 (126) m, $p = 0.03$) increased. Of the self-report outcomes, BDI improved (pre = 9 (5,15) post = 4 (0,10), $p = 0.04$). There were no changes in any measured outcome for the C group. **CONCLUSION:** BD can lead to significant improvements in HRV and depression. Further, HRV but not 6MWT might mediate improvements in QOL through depression in pwMS. This study was supported by the Greater Milwaukee Foundation.

331 Board #152 May 31 9:30 AM - 11:00 AM
The Effect of Step Count Increase on Role Limitations for People Living with HIV/AIDS
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Individuals living with HIV/AIDS experience many daily struggles beyond the complications associated with physical illness. These could include psychological stress, mood disorders, and depression, all of which can greatly impact an individual's

daily life. This secondary data analysis was conducted to examine a potential relationship between increase in physical activity and health-related quality of life for people living with HIV/AIDS (PLWHA).

Methods: Participants were recruited as part of a home-based PA intervention aimed to reduce risk factors of cardiovascular disease for PLWHA taking ART. A secondary data analysis was conducted by separating participants into groups according to increases in step count. Clinical and psychological assessments were conducted at baseline and 18 week follow-up. Self-reported mental health was measured using the SF-36 and its specific subscales were used. This analysis focuses on the subscale role limitations due to emotional wellbeing (RE). PA levels were measured via accelerometer. Accelerometer data was considered compliant if the participant had a total on-body time of at least 10 hours a day for 4 days. PA was determined by using the average step count per day. The comparison group consisted of those who increased daily steps by 10% or more.

Results: 34 females and 28 males with valid armband data were used for final data analysis. No significant differences were observed between groups at baseline. Those who increased their PA from baseline to follow-up had an average increase of 1502 steps/day and showed a significant increase in their self-reported RE score from 18.18 ± 6.84 at baseline to 40.91 ± 7.89 at 18 weeks on the SF-36 form ($p = 0.03$), whereas those with no changes in and/or who decreased daily PA by an average of 1195 steps/day showed no change.

In conclusion, people living with HIV/AIDs who increased their step count by 10% after 18 weeks showed a significant increase in RE. A relationship between physical activity and emotional well-being could provide a foundation for further study aimed to increase health-related quality of life for people with chronic disease, especially considering the impact it can have on activities or daily living. This project was supported by funding through the NIH/NINR R21 Grant 1R21NRO11281 and Theraband®

332 Board #153 May 31 9:30 AM - 11:00 AM

Exploring The Impact Of A Pilot Physical Activity Intervention On Youths With Type 1 Diabetes.

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Purpose: Type 1 Diabetes (T1D) is rising globally. Youths with T1D have poorer health and lower levels of physical activity (PA) than those without diabetes. The ActivPals study aimed to support youths with T1D to increase PA levels. The intervention incorporated a PA consultation, key behaviour change techniques and a wearable PA self-monitoring device. The aim of this study was to qualitatively explore the impact of the ActivPals pilot PA intervention on youths with T1D.

Methods: Semi-structured interviews with participants and one of their parents (N=16) were carried out between May and July 2016. Participants were recruited after delivery of the ActivPals 4- week intervention. Interviews were recorded, transcribed verbatim and analysed thematically using a six-stage iterative process. Codes were applied to data extracts in an inductive manner as recurring ideas, events or beliefs were identified.

Results: Factors contributing to intervention effectiveness are presented as three main themes. Each main theme had two sub-themes. The themes were: 1) Intervention impact (sub themes: new ways to exercise and sustained exercise); 2) Intervention components (sub themes: behaviour change techniques and one to one consultation); and 3) Intervention technology (sub theme: barriers/issues and recommendations for future interventions). The ActivPals intervention had a positive impact on young people with Type 1 diabetes. Most notably, the PA consultation and behaviour change techniques were important for increasing PA levels. The intervention technology was seen as both a facilitator and a barrier to PA. Participants provided important feedback on the intervention. For example, role modelling and self-monitoring were seen as critical to the intervention and the wearable activity monitors were problematic and should be redesigned or an alternative used, for future work with this population.

Conclusion: This research will contribute to the development of evidence based, user informed and pragmatic interventions leading to healthier lifestyles in youths with T1D.

This study was funded by Yorkhill Children's Charity.

333 Board #154 May 31 9:30 AM - 11:00 AM

Increases In Physical Activity Improves HDL Cholesterol In People Living With HIV/AIDS Taking Antiretroviral Therapy

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(No relationships reported)

People living with HIV/AIDS (PLWHA) and taking antiretroviral therapy (ART) medications are at increased risk for cardiovascular disease (CVD) and metabolic disorders once they begin therapy. The presence of metabolic disorders, such as increased blood lipids, make it difficult to manage CVD. Physical activity (PA) has been shown to reduce modifiable risk factors of CVD. The purpose of this analysis was to compare the blood lipid profiles of PLWHA while being treated with ART who increased their daily step count compared to those who did not.

Methods/design: Participants were recruited as part of a home-based PA intervention aimed to reduce risk factors of cardiovascular disease for PLWHA taking ART. A secondary data analysis was conducted by separating participants into groups according to changes in step count. The comparison group consisted of those who increased daily steps by 10% or more, with the remaining participants serving as the reference group. Assessments conducted at baseline and 18 week follow-up included waist circumference and fasting blood lipids including total cholesterol and triglycerides, HDL-C, LDL-c, and glucose. Height, weight, and PA levels via accelerometer were also collected. Accelerometer data was considered compliant if the participant had a total on-body time of at least 10 hours a day for 4 days. PA was determined by using the average step count per day. Groups were determined by changes in step count from baseline to follow-up with an increase in PA by 10% or more as group 1.

Results: A total of 34 females and 28 males with valid armband data were used for final data analysis. No significant differences were observed between groups at baseline. Those who increased their PA at 18-weeks had an average increase of 1502 steps/day and showed a significant increase in HDL cholesterol from 44.10 ± 2.79 pre to 49.01 ± 3.51 post ($p = 0.03$), whereas those with no changes and/or decreased daily PA by an average of 1195 steps/day showed no change.

Conclusion: These data show that a small increase in daily step count of 10% or more increased HDL levels compared to those who did not. In conclusion, something as simple as increasing step count can improve blood lipid profile for PLWHA while being treated with ART.

This project was supported by funding through the NIH/NINR R21 Grant 1R21NRO11281 and Theraband®

A-46 Free Communication/Poster - Ergogenic Aids I

Wednesday, May 31, 2017, 7:30 AM - 12:30 PM
Room: Hall F

334 Board #155 May 31 11:00 AM - 12:30 PM

10-Week Guanidinoacetic Acid Supplementation Affects Inflammatory Markers in Healthy Men and Women

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(No relationships reported)

Cellular bioenergetics largely depends on guanidinoacetic acid (GAA, also known as glycoylamine or betacyamine), a natural metabolic precursor of creatine, and an investigational dietary supplement. Previous animal studies have shown that supplemental GAA could induce inflammatory responses yet no human studies so far evaluated possible pro-inflammatory effects of this compound. **PURPOSE:** To examine the effects of 10-week supplementation with 3 grams per day of GAA on serum and urinary inflammatory markers in apparently healthy men and women. **METHODS:** Twenty healthy volunteers (10 men and 10 women; age 22.0 ± 2.3 years, weight 75.5 ± 22.9 kg, height 173.3 ± 10.5 cm) participated in this open-label, repeated-measure interventional study. All participants were assigned to receive GAA for 10 weeks, and were evaluated at baseline, and following 10-weeks of ingestion. The primary endpoint was the change in serum levels of high-sensitivity C-reactive protein (hsCRP) assessed at baseline and at 10 weeks follow-up. Secondary outcomes included change from baseline to end of treatment in values for serum ferritin, white blood cell (WBC) count and differential, and urinary inflammation markers. **RESULTS:** Serum hsCRP levels increased non-significantly during GAA intervention (1.6 ± 1.0 mg/L at baseline vs. 1.8 ± 2.1 mg/L at 10-week follow-up; $P = 0.72$). Supplementation with GAA yielded a statistically significant increase (7.5%

corresponding to 4.1 g/L; $P = 0.012$) of the mean serum ferritin levels. In addition, WBC count tended to increase at post administration ($6.7 \pm 0.9 \cdot 10^9$ vs. $7.3 \pm 1.5 \cdot 10^9$; $P = 0.09$), while urinary markers were not affected by GAA intervention ($P > 0.05$).

CONCLUSION: It appears that dietary GAA might have a pro-inflammatory effect during medium-term intake in healthy humans. GAA-driven elevation in serum ferritin should be considered as a possible adverse effect of the intervention. This project was partly supported by the Serbian Ministry of Education, Science and Technological Development (Grant no. 175037), the Provincial Secretariat for Higher Education and Scientific Research (Grant No. 114-451-710/2016-03) and the Faculty of Sport and Physical Education, University of Novi Sad (2016 Annual Award).

335 Board #156 May 31 11:00 AM - 12:30 PM

Sprint Cycling Performance Improvement Post-Creatine Supplementation is Associated with Increase in Lean Body Mass

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Reported Relationships: D.L. Crisafulli: *Contracted Research - Including Principle Investigator; Albion Laboratories, Inc., Clearfield, UT.*

Creatine supplementation is recommended as an ergogenic aid to improve repeated cycling sprint performance. Creatine absorption is increased in the presence of electrolytes. Research examining the effect of a creatine-electrolyte (CE) supplement on repeated sprint cycling performance failed to show post-supplementation improvement. These results can be attributed to inadequate recovery periods between repeated sprints. A recovery of 2-minutes is adequate for phosphocreatine resynthesis and may allow for maximal performance during repeated cycling sprints.

PURPOSE: To investigate the effect of a 6-week CE supplementation intervention on peak power and average work performed during repeated cycling sprints interspersed with 2-minute recovery periods.

METHODS: Peak power and average work performed by 38 recreational cyclists (CE group: $n = 17$; 23.4 ± 4.0 years; placebo (P) group: $n = 18$; 23.4 ± 4.0 years) were measured on a Velotron ergometer as they completed five, 15-s cycling sprints, with two minutes of recovery between sprints, pre- and post-supplementation. Peak power was the highest overall power measured across the sprints. Average work was the mean of total work performed across the five sprints. Participants' body composition was estimated using three site skinfold measurements. Mixed-model ANOVAs were used for statistical analyses.

RESULTS: For almost all participants, the peak power was generated during the first sprint. A supplement-time interaction showed a 4% increase in peak power (27 W; $p < 0.001$) and a 5% increase in average work (376 J; $p < 0.001$) from pre- to post-supplementation for the CE group. For the P group, no differences were observed in these variables from pre- to post-testing. Similarly, the lean body mass increased by 2% (1.4 kg; $p = 0.001$) from pre- to post-testing for the CE group, whereas no differences were found for the P group (supplement-time interaction; $p = 0.001$). For the CE group, a modest association ($r = 0.626$; $p = 0.007$) was observed between the increases in peak power and lean body mass from pre- to post-supplementation.

CONCLUSION: A CE supplement improves repeated short duration cycling sprint performance when sprints are interspersed with adequate recovery periods. Additionally, the ergogenic effect of CE supplement is associated with an increase in lean body mass.

336 Board #157 May 31 11:00 AM - 12:30 PM

The Effect of Bacillus Coagulans and HMB On Muscle Integrity and Inflammation During Military Training

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BACKGROUND: β -Hydroxy- β -methylbutyrate (HMB) is a derivative of the branched chain amino acid leucine, and has been demonstrated to enhance recovery and attenuate muscle damage from high intensity exercise. Recent evidence has suggested that the use of a probiotic may enhance protein absorption, as such the combination of a probiotic with HMB ingestion may be more beneficial during

field operations. **PURPOSE:** To compare the co-administration of the probiotic *Bacillus coagulans* (BC30) with HMB calcium (CaHMB) to CaHMB alone on the inflammatory response and muscle integrity during 40-days of intense military training. **METHODS:** Soldiers from the same unit were randomly assigned to one of two groups: CaHMB with BC30 (CaHMBBC30; $n=9$) or CaHMB with placebo (CaHMBPL; $n=9$). A third group of participants from the same unit served as a control (CTL; $n=8$). During the 40-day study, all participants performed the same daily protocol. During the first 28 days soldiers were garrisoned on base and participated in the same training tasks. During the final 2-weeks soldiers navigated 25-30 km per night in difficult terrain carrying ~35 kg of equipment. All assessments (blood draws and diffusion tensor imaging to assess muscle integrity) were conducted prior to and approximately 12-hours following final supplement consumption. Analysis of covariance was used to analyze all blood and muscle measures. **RESULTS:** Significant attenuations were noted in IL-1 β , IL-2, IL-6, CX3CL1, and TNF- α for both CaHMBBC30 and CaHMBPL compared to CTL. The response of plasma IL-10 concentrations was significantly attenuated for CaHMBBC30 compared to CTL only. A significant decrease in apparent diffusion coefficients was also observed for CaHMBBC30 compared to CaHMBPL. **CONCLUSION:** Results of this study provide further evidence that HMB supplementation may attenuate the inflammatory response to intense training, and that the combination of the probiotic *Bacillus coagulans* with CaHMB may be more beneficial than CaHMB alone in maintaining muscle integrity during intense military training.

337 Board #158 May 31 11:00 AM - 12:30 PM

The Physiological And Psychological Effects Of A Pre Exercise Amino Acid Supplement

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(No relationships reported)

Purpose: The research literature suggests that amino acid supplementation may be beneficial for many different modes of exercise. Thus, the purpose of this study is to determine if a pre-exercise amino acid supplement improves performance of a 5 mile time trial test and to assess whether there are changes in cognition.

Methods: Eight recreationally active male college students were recruited for this repeated measures design study. Participants consumed either a commercially available BCAA supplement (BCAA) or placebo (CON) 15 minutes prior to performing a Wingate test, followed by a brief break and then a 5 mile time trial test. Blood samples were collected before, during and after exercise to measure glucose, lactate and insulin levels. The Go/No Go and Stroop tests were used to assess cognition before and after exercise.

Results: There were no significant performance differences between BCAA and CON treatments for the Wingate test (Pre-Exercise: BCAA 10.7 ± 0.5 W/kg vs. CON 11.1 ± 1.2 W/kg, Post-Exercise: BCAA 11.4 ± 1.1 W/kg vs. CON 10.8 ± 1.5 W/kg; $p < 0.05$). Also there were no significant difference in performance for the time trial test (BCAA 26.7 ± 0.9 min vs. CON 25.9 ± 1.4 min; $p < 0.05$). Furthermore, blood glucose, lactate and plasma insulin levels were similar at each time point for both treatments. Lastly, participants performed equally well on the cognitive tests both before and after exercise (Go/No Pre-Exercise: BCAA 93.2 ± 1.6 % correct vs. CON 93.6 ± 2.0 % correct, Post-Exercise: BCAA 92.8 ± 1.9 % correct vs. CON 93.0 ± 0.9 % correct; Stroop Pre-Exercise: BCAA 83.9 ± 4.5 % correct vs. CON 85.3 ± 4.6 % correct, Post-Exercise: BCAA 86.3 ± 2.7 % correct vs. CON 85.5 ± 3.2 % correct; $p < 0.05$).

Conclusion: Under these testing conditions BCAA supplementation does not appear beneficial for 5 mile time trial performance, on physiological markers or cognition. However, the effects of BCAA supplements under different conditions is warranted. Grant Funding:

- Research, Scholarship, and Creative Activities Grant, awarded to Dr. Jeffrey Bernard.

338 Board #159 May 31 11:00 AM - 12:30 PM

Effects Of Branched-chain Amino Acids On Resting Metabolic Rate, Body Composition, And Satiety In Females

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Branched-chain amino acid (BCAA) supplementation may have beneficial effects by raising amino acids in the blood, however, nearly all of the research has examined effects only in males. **PURPOSE:** To examine the effects of BCAAs on resting metabolism, body composition, and satiety in females. **METHODS:** Twenty four females (mean \pm SD; Age: 22.6 ± 5.3 y; Height: 166.4 ± 7.3 cm; Weight: 66.0 ± 11.4 kg) completed baseline testing, which assessed body composition, resting

energy expenditure (REE) and respiratory exchange ratio (RER). REE and RER were measured through indirect calorimetry for 20 minutes while participants laid in a supine position. Body composition was measured by seven site skinfolds and bioelectric impedance analysis to determine body fat percentage (%BF). Questionnaires using Likert scales were completed to evaluate hunger and satiety. Participants were then randomly stratified to either the treatment group of BCAAs (28.5 g/day) or placebo group (4 g/day non-caloric sweetener), and consumed the supplement three times daily mixed with 12 oz. of water, between meals (between breakfast and mid-day meal, between mid-day meal and evening meal, and between evening meal and sleep) for 21 days. After supplementation, participants repeated baseline testing. Prior to the first testing visit and during the last week of consuming the supplement, participants completed two separate 3-day diet logs. **RESULTS:** There were no significant differences pre- to post-testing in weight, %BF, or RER for either group ($p < 0.05$). There was no main effect for treatment ($p = 0.65$) or time ($p = 0.84$) for REE. There was a significant interaction between groups for REE ($p = 0.025$) with REE increasing after BCAA supplementation ($\Delta 85.5 \pm 142.2$ kcal) and REE decreasing after placebo consumption ($\Delta -74.5 \pm 139.5$ kcal). Confidence intervals (95% CI) demonstrated a significant increase in REE after BCAA supplementation ($p < 0.05$). The BCAA group reported feeling more satiated in the evening, according to 95% CI ($p < 0.05$). **CONCLUSIONS:** Supplementing with BCAAs between meals resulted in a higher resting metabolic rate and greater feelings of satiety in women. Initial results suggests consuming BCAAs between meals may have positive implications for weight maintenance or loss in women, due to increases in resting energy expenditure and satiety.

339 Board #160 May 31 11:00 AM - 12:30 PM
Effects Of A Combined Protein And Antioxidant Supplement On Muscle Recovery In College - Aged Males

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Eccentric contractions (ECC) result in muscle fiber damage from mechanical stress and a pro-inflammatory, pro-oxidant response, leading to a decline in muscle function and rise in muscle soreness. Individually, protein (PRO) and antioxidant (AO) supplements have been shown to improve recovery after eccentric exercise-induced muscle damage, though have yet to be combined. **PURPOSE:** Determine if a combined protein and antioxidant supplement (PRO+AO) improves muscle soreness (MS) and muscle function (MF) following fatiguing eccentric contractions over PRO alone or a control. **METHODS:** 60 sedentary college-aged males participated in a randomized, single-blind, parallel design study. Peak isometric torque (PIT), peak isokinetic torque (PIKT), thigh circumference (TC), and muscle soreness (MS) were measured prior to 100 maximal ECC of the knee extensor muscles, immediately after the ECC, as well as at 1, 2, 6, and 24h post ECC. Immediately post ECC, 6h post ECC, and 2h prior to the 24h assessment, participants consumed one of three isocaloric supplements (~30 g, 120 kcal ea.) of either a carbohydrate control (CHO; $n = 14$), PRO ($n = 16$), or PRO+AO (dehydrated berry-mixture; $n = 17$). **RESULTS:** All groups had similar baseline MS, TC, MF, macro and micronutrient intakes, and performed a similar amount of total work during the ECC (all, $p > 0.05$). There was a significant effect for time ($p < 0.05$) for PIT (~25% decrease), PIKT (~25% decrease), TC and MS (~1 and 35% increase, respectively). There was an effect of group over time for PIKT (PRO and PRO+AO $>$ CHO, $p < 0.05$). At the 24h time point, there was a trend towards improved relative MF for PRO and PRO+AO compared to CHO (~11% difference for PIT, ~17% difference for PIKT). For MS there was a group x time interaction indicating PRO+AO having the lowest MS ($p < 0.05$). **CONCLUSION:** These results suggest PRO facilitates recovery of muscle function and soreness within 24h following fatiguing ECC, however addition of AO ameliorates MS more than PRO alone. As eccentric contractions are a component of many types of physical activity, under circumstances requiring a short turn around to a subsequent bout (e.g. occupational, military, or sport), combined PRO+AO supplementation may better mitigate ECC-induced muscle soreness with equal restoration of performance. Support: Connelly Research Foundation.

340 Board #161 May 31 11:00 AM - 12:30 PM
Effect of Creatine Supplementation on Exercise Performance following a Short-term Low Carbohydrate Diet

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 (No relationships reported)

Consumption of a low carbohydrate (low-CHO) diet typically leads to fatigue and decreases in exercise performance. **Purpose:** This study determined if a creatine supplement (CS) prevents the decrease in exercise performance associated with consuming a low-CHO diet. Compared to the placebo (PL) group, we hypothesized that CS would prevent the decline in performance as demonstrated by an equal or improved time to task failure (completed intervals). **Methods:** Fourteen healthy subjects (5 males, 9 females; 25.7 ± 5.4 yrs, (\pm SD)) were randomly assigned to either CS or PL group. Each subject performed 2 high intensity interval exercise sessions at 90% peak work rate. The test sessions were separated by a 10 day low-CHO diet and either CS or PL supplementation. Peak work rate was determined using a 25 W/min ramp test to volitional fatigue. Baseline aerobic fitness (as peak oxygen uptake (VO_{2peak})) was determined as the highest 10 s average obtained during the ramp test. The high intensity interval session (i.e. performance trial) consisted of a 1:1 ratio of 30 s exercise at 90% peak work rate followed by 30 s of loadless cycling. Heart rate was collected at baseline and during each interval of the performance trial using a standard electrocardiogram. Subjects consumed a loading dose of creatine monohydrate (20 g/day) or placebo, while adhering to a low-CHO diet of $< 25\%$ CHO total daily consumption. Subjects kept detailed food and exercise logs for the duration of the study. **Results:** Results of the preliminary exercise test indicated that the baseline fitness of the CS group (36.1 ± 5.3 ml/kg/min) was similar ($p > 0.05$) to the PL group (36.9 ± 5.8 ml/kg/min). There was a significant improvement in the CS group compared to the PL group for the high intensity interval exercise performance pre- and post-diet ($p < 0.001$). On average, the CS group improved $20.8 \pm 27.7\%$ for the total number of exercise bouts performed, whereas the PL group demonstrated a $35.9 \pm 14.5\%$ decrease in the total number of bouts performed post-diet. No change in body composition (% body fat) was observed between groups (CS; $1.4 \pm 1.5\%$ vs PL; $1.3 \pm 0.8\%$, $p > 0.05$). **Conclusion:** Results of the present study suggest that creatine loading may effectively attenuate the fatigue associated with a low-carbohydrate diet, and may, in fact, improve high-intensity interval exercise performance.

341 Board #162 May 31 11:00 AM - 12:30 PM
Beta-hydroxy-beta-methylbutyrate Supplementation On Low-frequency Fatigue Following Fatiguing Exercise

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 (No relationships reported)

Participation in any strenuous form of physical activity will result in a decline in skeletal muscle performance during and following the activity, this decline is commonly called fatigue. Low-frequency fatigue (LFF), a form of fatigue, is characterized by a loss of force at low frequencies of stimulation, a slow recovery of force and is reported following eccentric contractions. β -Hydroxy- β -Methylbutyrate (HMB) is a nutritional supplement that claims to prevent and improve skeletal muscle recovery following muscle damage producing contractions. **PURPOSE:** To determine if three weeks of HMB supplementation could attenuate the effects of LFF caused by eccentric muscle contractions in young healthy adults. **METHODS:** 33 participants (18 males, 15 females; 23.2 ± 4.3 yr.) completed the study. Participants performed 4 sets of 25 eccentric (ECC) contractions of the tibialis anterior muscle. Outcome measures were recorded prior, following, throughout a 20-minute recovery period, and at 48 and 96 hours following an ECC fatiguing protocol. Outcome measures included: isometric peak torque, 10 and 50 Hz peak torque, and 10/50 Hz peak torque ratio. Participants served as their own control and lower limbs were randomly assigned as control (CTL) or supplement (SUP). Following the pre-supplement test-day, participants completed 3 weeks of 3g/day of HMB supplementation. Post-supplementation, the ECC fatiguing protocol was completed and outcome measures were obtained. **RESULTS:** The ECC fatiguing protocol reduced isometric peak torque in both the CTL and SUP limbs by 49.3% and 48.4%, respectively ($p < 0.01$). Ten Hz peak torque (pre-ECC fatigue: 4.8 ± 2.2 Nm vs. 96-hr post-ECC fatigue: 4.2 ± 2.4 Nm) and the 10/50 Hz peak torque ratio (pre-ECC fatigue: 0.51 ± 0.14 vs. 96-hr post-ECC fatigue: 0.44 ± 0.14) in the CTL limb were reduced at the 96-hour time point ($p < 0.01$), indicative of LFF. The SUP limb displayed no LFF (pre-ECC fatigue: 0.49 ± 0.11 vs. 48-hr post-ECC fatigue: 0.47 ± 0.11) at the 48-hour time point ($p > 0.05$), suggestive of a faster recovery. The CTL limb showed a 19.2% reduction in isometric peak torque at the 48-hour recovery time point ($p < 0.01$); whereas, the SUP limb displayed only a 6.4% reduction in isometric peak torque. **CONCLUSIONS:** Three weeks of HMB supplementation attenuated LFF and force loss after an ECC fatigue protocol.

342 Board #163 May 31 11:00 AM - 12:30 PM
The Acute Effect of a Four-Main Ingredient Pre-workout Supplement on Lower Body Muscular Endurance
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(No relationships reported)

Most pre-workout supplements have various ingredients that when ingested together claim to have positive ergogenic effects. However, many supplements lack scientific evidence from independent research. **PURPOSE:** To determine the acute effect of a pre-workout supplement on lower body muscular endurance in college aged males. **METHODS:** This study was a double-blind, crossover design. Twenty-five participants (23.8 ± 1.3 years) visited the University Fitness Center on two separate occasions. Each visit was one week apart. During both visits participants completed the same warm up and maximal repetition seated leg press test at 75% of their body weight. Treatment order for each participant was randomized prior to testing. The control treatment consisted of a placebo supplement and the experimental treatment included a pre-workout supplement. Both treatments consisted of consuming eight fluid ounces, 15 minutes prior to testing, as recommended by the manufacturer. The treatment supplement included four main ingredients comprising beta alanine, creatine nitrate, N-Acetyl L-tyrosine, and caffeine. **RESULTS:** No significant difference in maximum repetitions was observed between the control treatment supplement (56.56 ± 24.74) and the experimental pre-workout supplement (60.56 ± 26.20), $F(1,24) = 1.481$, $p=0.235$. **CONCLUSION:** Despite popularity for pre-workout supplements while weight training, acute positive effects may not be realized. Recommendations for future research may evaluate timing of consumption and long term effects of particular pre-workout supplements.

343 Board #164 May 31 11:00 AM - 12:30 PM
Effects of a Pre-Workout Supplement on Hyperemia Following Leg Extension Resistance Exercise at Different Intensities
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(No relationships reported)

PURPOSE: We sought to determine if a multi-ingredient pre-workout supplement (PWS) given prior to resistance exercise was effective in increasing post-workout reactive hyperemia compared to placebo (PBO). **METHODS:** Thirty, recreationally trained males participated in this double-blinded, PBO controlled study. All participants reported for two visits, separated by one week. At visit 1, participants consumed a multi-ingredient PWS with seventeen active ingredients (including citrulline, norvaline, caffeine, creatine and anti-oxidant blends) or PBO. 45-min after consumption of PWS/PBO, participants performed four sets of leg extension resistance exercise to failure at 30 or 80% of their 1-RM. At visit 2, subjects consumed the same supplement as in visit 1, but exercised at the alternate intensity. Heart rate (HR), blood pressures, and femoral artery blood flow were assessed at baseline (BL), 45-min following PWS/PBO consumption (PRE), and at 5-min following the last set of resistance exercise (POST). Repeated measures ANOVA was performed with time, supplement, and training intensity as the independent variables. Data are reported as mean \pm sem. **RESULTS:** Significant main effects of time ($P < 0.01$), but no interactions were observed for blood pressures, femoral artery diameter, and retrograde femoral artery blood flow. A significant time*supplement interaction ($P < 0.05$) was observed for HR and antegrade and mean femoral artery blood flow. Change in HR from BL and PRE to the POST time point was significantly greater in the PWS group compared to the PBO group ($+27.3 \pm 2.5$ vs. $+19.8 \pm 2.2$ bpm and $+34.6 \pm 2.1$ vs. $+25.0 \pm 2.3$ bpm for change from BL and PRE, respectively; $P < 0.03$). Similarly, change in mean femoral artery blood flow from BL and PRE to the POST time point was significantly greater in the PWS group compared to the PBO group ($+590 \pm 56$ vs. $+404 \pm 52$ mL/min and $+687 \pm 60$ vs. $+484 \pm 50$ mL/min for change from BL and PRE, respectively; $P < 0.02$). **CONCLUSIONS:** The PWS did increase the reactive hyperemia response observed following resistance exercise though no specific interactions with the intensity of the resistance exercise were observed.
Funding was provided through a gift-in-kind to M.D.R. from FutureCeuticals, Inc. (Mokenca, IL, USA) and through a contract to J.S.M. through Maximum Human Performance (West Caldwell, NJ, USA).

344 Board #165 May 31 11:00 AM - 12:30 PM
Nighttime Consumption of Whey and Casein Protein: Effects on Morning Metabolism and Resistance Exercise Performance
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(No relationships reported)

Whey protein (WP) and casein protein (CP) consumed at night before sleep has been shown to have positive satiating and metabolic effects the next morning. No data exist regarding the effect of nighttime consumption of WP and CP on the ability to perform resistance exercise (RE) the following morning. **PURPOSE:** To determine the effect of WP and CP at two different doses, when consumed before sleep on next morning appetite, resting metabolic rate (RMR), and RE volume compared to a non-caloric placebo (PLA). **METHODS:** Eleven physically active men and women (age, 24 ± 5 yrs; body fat, $18.8 \pm 4.9\%$) participated in this randomized, double blind, crossover study. One-repetition maximums (1-RM) were performed on six exercise machines to determine RE intensity. A single dose of 24g WP, 48g WP, 24g CP, 48g CP, or PLA was consumed 30 minutes prior to sleep and each trial was separated by 48-72 hours. Measurements of appetite (visual analogue scales (VAS) for satiety, hunger, and desire to eat), RMR (indirect calorimetry), and RE volume were performed the next morning (0600-0900 hours). Appetite was assessed immediately before and after RMR measurements, and immediately after RE. RMR measurements were collected for 30 minutes and the last 25 minutes were analyzed. Outcome variables were oxygen consumption (VO_2), RMR, and respiratory quotient (RQ). RE was performed for 2 sets of 10 repetitions and a 3rd set to failure at 60% of 1-RM. Statistical analyses were conducted using 5×3 (group by time) repeated-measures ANOVA for appetite variables and one way ANOVA for metabolic variables and RE volume. All significance was accepted at $p < 0.05$. **RESULTS:** There were no time effects and no group \times time interactions in satiety, hunger, and desire to eat. There were no significant differences in VO_2 , RMR (24g WP: 1795 ± 517 kcal/d; 48g WP: 1810 ± 371 kcal; 24g CP: 1691 ± 351 ; 48g CP: 1858 ± 416 ; PLA 1775 ± 346 kcal; $p > 0.05$) and RQ. In addition, there was no significant difference in RE volume (24g WP: 11812 ± 2972 kcal; 48g WP: 11913 ± 2575 kcal; 24g CP: 12646 ± 3759 kcal; 48g CP: 11753 ± 2456 kcal; PLA: 11680 ± 2654 kcal; $p > 0.05$). **CONCLUSION:** Varying doses of WP and CP prior to sleep did not have an effect on morning appetite, RMR, and RE volume. Nighttime consumption of WP and CP can be consumed without impeding next morning metabolism and training volume, but does not improve exercise performance.

345 Board #166 May 31 11:00 AM - 12:30 PM
Promoting Training Gains And Recovery With Nutrition: Beneficial Effects Of A Native Whey Supplementation
 Vincent Martin¹, Sebastian Garcia-Vicencio¹, Céline Gryson¹, Enzo Pignonier¹, Jacqueline Brasy², Marion Bucas³, Victoire Visseaux⁴, Yann Connan⁴, Yves Boirie⁵, Sébastien Rati¹.
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Reported Relationships: V. Martin: Contracted Research - Including Principle Investigator; Study funded by Lactalis.

PURPOSE: Electrostimulation (ES) training can trigger muscular and nervous adaptations, leading to an improvement of muscular strength and power. However, this training modality generates a high fatigue level, that translates into training and recovery issues. However, it has been shown that a supplementation with native whey (NWH) can decrease neuromuscular fatigue during a strength-training session. Therefore, the purpose of this study was to assess if NWH supplementation could promote recovery and training gains after an ES training program. **METHODS:** This pilot, randomized, double-blinded trial, involved 50 moderately active men (21.5 ± 3.2 y). They were allocated into 3 groups, supplemented 5d/week, either with 15 g of NWH, or whey (WH), or placebo (PLA). All the groups underwent a 12-week ES training program. Maximal concentric power (Pmax) was evaluated before, immediately after, as well as 30', 60', 24h et 48h after the 1st, 4th and last ES training session. In addition, the maximal voluntary contraction force (CMV), the evoked twitch amplitude (Pt), anatomical cross-sectional area (CSA) and the maximal voluntary activation level (VA) of the knee extensors were measured before (T0), and after 6 (T1) and 12 weeks of training (T2). **RESULTS:** Pmax recovery kinetics differed between groups ($P < 0.01$). Pmax started to recover at 30' in NWH, 24h in WH and 48h in PLA. Training gains also differed between groups. CMV increased between T0 and T2 in NWH ($+11.8\%$, $P < 0.001$) and WH ($+7.1\%$, $P < 0.05$), but not PLA. Nevertheless, the adaptations kinetics differed: CMV increased in NWH and WH between T0 and T1, but a additional gain was only observed between T1 and T2 in NWH. In addition, VA was depressed at T1 and T2 in PLA (-3.9% , $P < 0.05$), at T2

in WH (-3.5%, $P < 0.05$), and was unchanged in NWH. Finally, Pt and CSA improved with training, but did not differ between groups. **CONCLUSIONS:** These results suggest that NWH initiate the power recovery process earlier than WH or PLA after an ES-training session. This quicker recovery seems associated with strength gains along the entire training period, that are accounted for by hypertrophy and VA preservation. Conversely, the VA decreases in WH and PLA could be indicative of overtraining. Thus, as compared to WH, NWH could promote recovery and neuromuscular adaptations after training.

346 Board #167 May 31 11:00 AM - 12:30 PM
Differently Formulated Creatine Effects On Fatigue, Work, And Power In Resistance-trained Subjects

D. R. Miller, L. R. Brilla, FACSM, J. G. San Juan, D. N. Suprak, H. H. Buddhadev. *Western Washington University, Bellingham, WA.* (Sponsor: Lorrie Brilla, FACSM)

Reported Relationships: D.R. Miller: *Contracted Research - Including Principle Investigator; Partially supported by Albion Laboratories, Inc.*

Creatine is an effective supplement for improving strength, power, and reducing fatigue, especially in high intensity, repeated activities. Various nutritional strategies have been utilized to enhance creatine efficacy, including concurrent intake of carbohydrates, electrolytes, and nutrients with alkaline quality, such as magnesium. **Purpose:** This study examined the effects of two differently formulated creatine supplements, creatine monohydrate (CM) or creatine-magnesium chelate (CC), compared to placebo (P) on fatigue, work, and power during knee extensions. **Methods:** The study evaluated effects in resistance-trained participants, repeating measures after six-weeks of supplementation. Subjects ($n=23$; 21.9 ± 1.8 years) maintained their regular resistance training program and had not supplemented creatine in the previous 6 months. Supplementation was 4 g creatine daily for CM and CC, plus 400 mg magnesium in CC. Maximum torque and fatigue of knee extensors at $180^\circ \text{ sec}^{-1}$ were determined using an isokinetic dynamometer for 2 sets of 30 repetitions each, with 2 minutes rest between sets. Fatigue was calculated by the ratio between the first 1/3 and the last 1/3 of work for each set. Body composition was determined with the three-site skin folds test. Statistical analyses were performed using mixed ANOVA. **Results:** Fatigue results demonstrated no significant differences ($p > 0.05$). For work and average power, there were no significant interaction effects ($p > 0.05$) in either set 1 or 2. However, there was a significant group effect for work (P: 1987.49 ± 617.65 J, CM: 1978.55 ± 723.21 J, CC: 2485.57 ± 677.58 J; $p < 0.05$; partial $\eta^2 = 0.371$) and average power (P: 165.4 ± 70.33 W, CM: 160.59 ± 56.28 W, CC: 186 ± 66.71 W; $p < 0.05$; partial $\eta^2 = 0.407$) in set 1; with no significant differences in set 2 ($p > 0.05$). There were no significant effects of time or group from pre- to post-test for body composition ($p > 0.05$). **Conclusion:** There were no significant differences for fatigue in either set. In the first set, CC demonstrated greater total work performed and greater average power. There were no significant differences in these variables for the second set in any group. The small improvement observed in work and power for CC indicates that the magnesium may enhance creatine's effects.

347 Board #168 May 31 11:00 AM - 12:30 PM
 β -alanine Supplementation To Improve Exercise Capacity And Performance: A Systematic Review And Meta-analysis

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PURPOSE: To conduct a systematic review and meta-analysis of the evidence on the effects of β -alanine supplementation on exercise capacity and performance. **METHODS:** This study was designed in accordance with PRISMA guidelines. A three level mixed effects model was used to model effect sizes, along with the influence of various moderators including participant training status, duration and type of exercise (capacity and performance). Three databases (PubMed, Google Scholar, Web of Science) were searched using a number of terms (" β -alanine" and " β -alanine" combined with "supplementation", "exercise", "training", "athlete", "performance", and "carnosine"). Inclusion/exclusion criteria limited articles to double-blinded, placebo-controlled studies investigating the effects of chronic β -alanine supplementation on an exercise measure. All healthy participant populations were considered. A single outcome measure was extracted from each exercise test and converted to effect sizes for meta-analyses. **RESULTS:** Forty individual studies employing 65 different exercise protocols and totaling 70 exercise measures in 1461 participants were included in the analyses. A significant overall effect size of 0.18 (95%CI: 0.08, 0.28) was shown. Meta-regression demonstrated that exercise duration significantly moderated effect sizes ($P = 0.004$).

Subgroup analyses also identified the type of exercise as a significant ($P = 0.013$) moderator of effect sizes within an exercise time-frame of 0.5-10 min with greater effect sizes for exercise capacity [0.4998 (95%CI: 0.246, 0.753)] vs. performance [0.1078 (95%CI: -0.201, 0.416)] based tests. There was no moderating effect of training status ($P = 0.559$), intermittent or continuous exercise ($P = 0.436$) or total amount of β -alanine ingested ($P = 0.438$). Co-supplementation with sodium bicarbonate resulted in the largest effect size when compared to placebo [0.43 (95%CI: 0.22, 0.64)]. **CONCLUSIONS:** β -alanine supplementation had a significant overall effect while sub-group analyses revealed a number of modifying factors, including exercise duration and type. These data allow individuals to make informed decisions as to the likelihood of an ergogenic effect with β -alanine supplementation based upon their chosen exercise modality.

348 Board #169 May 31 11:00 AM - 12:30 PM
The Effects of Beta-Alanine and Sodium Bicarbonate Supplementation on Anaerobic Performance in Trained Males

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 (No relationships reported)

PURPOSE: The study was designed to examine the effects of chronic beta-alanine supplementation and acute sodium bicarbonate supplementation on anaerobic performance using a cycle ergometer protocol. **METHODS:** Ten trained males (O_{2peak} $52.14 \pm 4.24 \text{ ml} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$) performed an 8 minute anaerobic exercise cycling protocol before, after chronic beta-alanine supplementation, and after the combination of chronic beta-alanine and acute sodium bicarbonate supplementation. Subjects were instructed to take 6.4 grams of beta-alanine in 4 doses spread throughout the day at the same time each day for 4 weeks. At the completion of the beta-alanine experimental session each subject was given a sodium bicarbonate supplement to take acutely for 24 hours prior to the combination of chronic beta-alanine and acute sodium bicarbonate supplementation experimental session. Each subject took 0.5 grams of sodium bicarbonate per kilogram of bodyweight ingested in 4 doses evenly spread throughout the 24 hours prior to the final session. The 8 min intermittent cycling protocol used for each session included 30 seconds of maximum effort followed by 30 seconds of active recovery for 8 rounds. The performance variables measured every minute included lactate, RTW (relative total work), RAAP (relative average anaerobic power), TREPS (total repetitions), RPE, O_2 and RER. **RESULTS:** Significant interactions were found for RTW, RAAP, TREPS and RPE. RTW was significantly greater post supplement 2 ($M_{ps2} = 131.68 \pm 4.44$) compared to control ($M_c = 116.86 \pm 3.25$) at time point 3:30. RAAP was significantly greater post supplement 1 ($M_{ps1} = 4.42 \pm .19$) compared to control ($M_c = 4.05 \pm .21$) for time point 3:30. Although RTW and RAAP were only significant at one time point (3:30), a trend toward an increase in RTW and RAAP was found. **CONCLUSION:** A trend toward higher RTW and RAAP during the 8 min intermittent cycling protocol may indicate the benefit of chronic beta-alanine combined with acute sodium bicarbonate supplementation outside the widely studied exercise length of 60-240 seconds.

349 Board #170 May 31 11:00 AM - 12:30 PM
Twenty-four Weeks Of Beta-alanine Supplementation Increases Muscle Carnosine Content Despite Downregulation Of Beta-alanine Transporter Expression

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Skeletal muscle carnosine content can be increased via chronic beta-alanine ingestion, but the maximum increase achievable with supplementation is unknown. Additionally, the effects of prolonged supplementation on carnosine-related gene expression in humans are not known. Since athletes are likely to supplement for extended periods of time, determination of the long-term effects of beta-alanine supplementation is warranted. **PURPOSE:** To investigate the effects of 24-weeks of beta-alanine supplementation on muscle carnosine content and expression of genes related to carnosine metabolism. **METHODS:** Twenty-four males were supplemented with 6.4 g $\cdot \text{day}^{-1}$ of sustained release beta-alanine (BA; $N=15$) or placebo (PL; $N=9$) for 24 weeks. Every 4 weeks participants provided a muscle biopsy from the *m. vastus lateralis*, which was subsequently analysed for muscle carnosine content and gene

expression (*CARNS*, *TauT*, *ABAT*, *CNDP2*, *PHT1*, *PEPT2*, *PAT1*). **RESULTS:** Carnosine content was increased from baseline at every time point in BA (all $P < 0.0001$; Week 4: $+11.4 \pm 7.0$ mmol·kg⁻¹·dm, Week 8: $+13.9 \pm 7.8$ mmol·kg⁻¹·dm, Week 12: $+17.0 \pm 8.6$ mmol·kg⁻¹·dm, Week 16: $+17.6 \pm 8.4$ mmol·kg⁻¹·dm, Week 20: $+21.2 \pm 7.9$ mmol·kg⁻¹·dm, Week 24: $+20.2 \pm 7.6$ mmol·kg⁻¹·dm), but not PL (all $P > 0.05$). Maximal changes ranged from $+17.1$ to $+41.3$ mmol·kg⁻¹·dm, and absolute maximal content ranged from 31.8 to 63.9 mmol·kg⁻¹·dm. There was an effect of supplement ($P = 0.002$) on *TauT* with lower expression in BA (-36%, -39%, -27%, -57%, -46% and -35% at Weeks 4, 8, 12, 16, 20 and 24); no further differences in gene expression were shown. **CONCLUSION:** Twenty-four weeks of beta-alanine supplementation increased muscle carnosine content in all individuals at all time points, although absolute maximal changes were variable. Downregulation of the beta-alanine transporter *TauT* suggests it plays an important role in muscle carnosine accumulation with beta-alanine supplementation. These data demonstrate that individuals who supplement with beta-alanine for prolonged periods can maintain elevated muscle content throughout supplementation, despite downregulation of beta-alanine transporter expression.

350 Board #171 May 31 11:00 AM - 12:30 PM

The Effect of Six Weeks of Beta-Alanine Supplementation on Incremental Exercise Performance

Carol A. Weideman, Timothy J. Michael, FACSM, Krysten Binfet, Ashley Haldeman, Bret Gruden, Nicholas J. Hanson, Michael G. Miller. *Western Michigan University, Kalamazoo, MI.*

(No relationships reported)

Beta-alanine supplementation has been proposed as a means to improve exercise performance by increasing intramuscular buffering capacity. By increasing buffering capacity, exercise performance should improve by delaying the onset of fatigue. **PURPOSE:** The purpose of this study was to determine if beta-alanine supplementation is able to reduce fatigue associated with incremental exercise to exhaustion among males and females. **METHODS:** 25 (12 male and 13 female) healthy, recreationally active volunteers completed this study. Subjects were age 22.6 ± 3.5 years with a BMI of 24.4 ± 3.9 . A double blind study was conducted over a 6-week period. Each subject completed an incremental exercise bout on an electromagnetically braked cycle ergometer once every 2 weeks for 6 weeks. Timing of data collection was as follows: week 0 (no supplementation/ baseline measure), end of week 2, 4, and 6. Supplementation consisted of either a 400mg capsule of beta-alanine (treatment) or 400mg capsule of dextrose (placebo) taken 4 times per day for 6 weeks. **RESULTS:** Performance and physiological measures collected included time to exhaustion (TTE), maximum power output (PO max), $\dot{V}O_2$ peak, Ventilatory Threshold (VT), and peak heart rate (HR peak). Results were analyzed using repeated measures ANOVA with significance set *a priori* at $p < 0.05$. There were no significant differences over time or within sex, therefore data is collapsed and is presented as treatment vs. placebo (mean \pm SE). TTE (seconds) 1051.1 ± 39.1 vs. 976.4 ± 37.6 ; PO max (Watts) 206.7 ± 6.7 vs. 195.5 ± 6.5 ; $\dot{V}O_2$ peak (ml/kg/min) 34.1 ± 1.4 vs. 35.9 ± 1.3 ; VT (L/min) $1.84 \pm .08$ vs. $1.83 \pm .07$; and HR peak (beats/min) 180.3 ± 3.4 vs. 178.2 ± 3.3 . **CONCLUSIONS:** Assessed variables showed no significant differences ($p > 0.05$) between treatment and placebo at time points 2, 4, and 6 weeks. This finding was also found when isolating assessment to males and females. These results suggest that beta-alanine supplementation was not effective in improving exercise performance as used in this study.

351 Board #172 May 31 11:00 AM - 12:30 PM

Glutamine and Alanine Supplementation Improves Cytoprotective Parameters in Rats Submitted to Progressive Resistance Exercise

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(No relationships reported)

Excessive exercise can lead to an inflammatory process and, recently described, liver dysfunction. Heat shock proteins, especially HSP70, have important anti-inflammatory properties by blocking the activation of the NF- κ B pathway, which is also suppressed by Sirtuin 1 (SIRT1). Glutamine availability is critical for the optimal regulation of HSP response and SIRT1 concentration, and its metabolism is compromised under catabolic situations, such as intense exercise. Glutamine and alanine supplementation, in their free form or as dipeptide, can increase the HSP70 response in heavy aerobic training. However, less is known about these cytoprotective effects in resistance exercise (RE). **PURPOSE:** Evaluate the effect of chronic oral supplementation with glutamine and alanine, in their free form or as dipeptide, on SIRT1 and HSP70 concentration and NF- κ B activation in liver of rats submitted to progressive RE. **METHODS:** Adult male Wistar rats (n 8/ group) were submitted to 8-week RE and

supplemented with L-alanine and L-glutamine, in their free form or as dipeptide (ALA, GLN+ALA and DIP groups, respectively), or water (SED and CTRL group). RE consisted to climb a ladder for 3 to 6 sets with progressive loads (25 to 100% of body weight). In the last 21 days of training, supplements were given in a 4% solution dissolved in drinking water. SIRT1 and HSP70 concentration and DNA binding activity of NF- κ B were determined in liver. **RESULTS:** RE slightly decreased HSP70 concentration in liver of CTRL group. However, all supplementations promoted a 3-fold increase in HSP70 levels ($P < 0.05$ v. CTRL group), denoting liver protection. Trained groups exhibited significantly increased level of SIRT1, consistent with the reduction of NF- κ B activation. Interestingly, DIP supplementation induced higher level of SIRT1 (by 280%, $p < 0.05$ when compared with trained groups), as well as greater cytoprotection demonstrated by suppression of NF- κ B activation (by 52%, compared with GLN+ALA and ALA groups) in liver of trained rats. **CONCLUSIONS:** Chronic oral supplementation with L-glutamine, given with L-alanine or as dipeptide, induced cytoprotective effects mediated by increased HSP70 and SIRT1 concentrations, which may have attenuated NF- κ B activation in liver of rats submitted to progressive RE. Financial support: FAPESP, CAPES and CNPQ.

A-47 Free Communication/Poster - Genetics

Wednesday, May 31, 2017, 7:30 AM - 12:30 PM

Room: Hall F

352 Board #173 May 31 9:30 AM - 11:00 AM

CYP19A1 Gene Polymorphism of Aromatase is Associated with Arterial Stiffness in Healthy Japanese People

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(No relationships reported)

INTRODUCTION: CYP19A1, the aromatase enzyme gene, is responsible for the biosynthesis of estrogens that have anti-arteriosclerotic effects. Previous studies have shown that the rs10046 genotype of CYP19A1 is associated with increased incidence of coronary artery disease. However, no studies have investigated whether this genotype is correlated with arterial stiffness. Additionally, it is unknown whether the rs10046 genotype is associated with a relationship between arterial stiffness and cardiorespiratory fitness. **PURPOSE:** To determine the effects of CYP19A1 gene polymorphism (rs10046) on arterial stiffness, and their associations with cardiorespiratory fitness in healthy Japanese people. **METHODS:** Nine hundred forty-seven healthy Japanese adults (Men: N=280, 43 \pm 17 years; Women: N=67, 46 \pm 17 years, Mean \pm SD) participated in a cross-sectional study. The rs10046 (C>T; transposition in the 3' untranslated region) genotype was determined by real-time PCR with Taqman probe. Arterial stiffness was measured by brachial-ankle pulse wave velocity (baPWV). Cardiorespiratory fitness was evaluated by peak oxygen uptake. Subjects were divided into high- or low-cardiorespiratory fitness groups based on the median value of peak oxygen uptake in each sex and decade of life. **RESULTS:** One-way ANOVA revealed that there were significant differences in age, weight, blood triglyceride level, and systolic blood pressure among the genotypes. After adjusting for these covariates, baPWV of individuals with the TT genotype of rs10046 were significantly lower than those of other genotypes (TT; 1211 \pm 195, TC; 1253 \pm 250, CC; 1251 \pm 257 cm/sec). For both sexes, the same pattern was observed, but these findings were not significant. The rs10046 genotype had no impact on differences of arterial stiffness associated with cardiorespiratory fitness level. **CONCLUSION:** CYP19A1 gene polymorphism (rs10046) of aromatase is related to arterial stiffness in healthy Japanese people but has no impact on the relationship between arterial stiffness and cardiorespiratory fitness.

353 Board #174 May 31 9:30 AM - 11:00 AM
Genes' Polymorphisms Related To Athletic Physical Performance: A Descriptive Study In Estonian Elite Athletes
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 (No relationships reported)

Genetic predisposition has a substantial role in the development of athletic physical performance and is characterized by a large number of gene polymorphisms and the interaction of these variations.

PURPOSE: (1) to examine the prevalence of genotypes of 6 genes related to physical performance (*ACE1/D*, *ACTN3 R577X*, *PPARGC1A Gly482Ser*, *AGT Met235Thr*, *AMPD1 Gln12Ter*, *NOS3 786C/T*) in Estonian elite athletes; (2) to compare the distribution of gene variations between representatives of 2 sports groups (predominantly endurance-oriented and mostly for speed and/or power-oriented sports groups).

METHODS: the study group consisted of 130 elite athletes (23 females and 107 males); current and former Estonian national team members; in age range 28.3±5.6 years; involved in 19 different sports disciplines. There were 77 representatives of endurance-oriented sports (17 females and 60 males) and 53 representatives of speed and power-oriented sports (6 females and 47 males). 26 athletes of the study group were medallists or finalists in the Olympic Games, World or European championships. Peripheral venous blood samples were collected for DNA extraction and genotyping (6 candidate genes) from all study subjects. For statistical analysis, a descriptive analysis and χ^2 test were used to determine significant differences between the frequencies of gene variations. P-values of ≤ 0.05 were set as statistically significant.

RESULTS: the higher prevalence of the RR genotype of the *ACTN3* gene among athletes of endurance-oriented sports compared to athletes of speed and power-oriented sports was statistically significant ($p=0.025$). We did not find any significance in the distribution of other gene variations between the two sports groups. We observed the trend of a higher prevalence of the *NOS3* TT genotype ($p=0.076$) and a lower prevalence of the *AMPD1* TT genotype ($p=0.09$) in the endurance-oriented sports group compared to the speed and power-oriented sports group, but it was not statistically significant.

CONCLUSIONS: our study results reveal a significantly higher prevalence of the *ACTN3* RR genotype in athletes of the endurance-oriented sports group, which is in accordance with our previous study among young skiers and this may be an advantage for the explosive speed and power capacity in endurance sports.

354 Board #175 May 31 9:30 AM - 11:00 AM
Novel Genes Associated with Elite Athlete Performance Via Inflammatory Pathways
 Kylene Boka, Helen Piontkivska, Kenneth Sparks, Scott Habowski, Ellen Glickman, FACSM. *Kent State University, Kent, OH.* (Sponsor: Dr. Ellen Glickman, FACSM)
 (No relationships reported)

There is a known relationship between inflammation and its alteration in exercise performance. In addition, a number of inflammatory processes are linked to the major histocompatibility complex (MHC) on the short arm of chromosome 6.

As our understanding of genetics expands, over 140 genes have been linked with exercise performance; however, the role of inflammatory pathways remains unclear.

PURPOSE: The purpose of this study was to investigate whether 3 genes, unique to the elite athletes, and located on the short arm of chromosome 6 are connected to the immune/inflammation MHC genes cluster. **METHODS:** Eleven elite runners (VO₂max: 70-88.3 mL/kg, included Olympic Trial qualifiers and Olympic athletes) and eleven control athletes (VO₂max: 54-57 mL/kg, locally competitive cyclists and runners) had their genome sequenced. Exome reads were mapped to the hg19 using CLC Genomics ver. 8.5 with respective amino acid variants called and annotated. Variants shared by at least 75% of the respective groups (elites vs. controls) were further investigated using the Database for Annotation, Visualization, and Integrated Discovery (DAVID) v6.7. The top 3 functional groups of genes in each category were analyzed further and certain genes identified for further research. **RESULTS:** *GABBR1/OR2H2* (6p21.31), *OR14J1* (6p22.1), and *SLC17A4* (6p22-p21.3) were identified as genes, unique to the elite athletes, located close to an important immune cascade pathway on chromosome 6. The hypothesis is that the close proximity of these genes to the MHC cluster (6p21.2) is likely related to the inflammation pathways in the elites that influences their exercise performance ability.

CONCLUSIONS: These results indicate that there may be underlying genetic traits that are unique to elite athletes that allow for their extraordinary athletic performance and that are related to inflammatory markers.

355 Board #176 May 31 9:30 AM - 11:00 AM
Genome-wide Association For Exercise Tolerance In The TIGER Study
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 (No relationships reported)

PURPOSE: The genetic basis of physical activity has been firmly established through both animal and human studies. The purpose of this study was to examine genetic variation across the genome for association to quantitative measures of exercise dose, intensity, duration, and adherence.

METHODS: Young adults (18-35 y) underwent 15 weeks of aerobic exercise training while wearing computerized heart rate monitors. Exercise intensity was defined as age- and gender-specific percent heart rate reserve, and exercise dose was calculated as session duration adjusted for exercise intensity, summed over all exercise sessions. A total of 1,012 non-Hispanic white, 700 African American, and 332 Hispanic subjects were genotyped for ~200K genetic markers using the Illumina Metabochip, and genome-wide association analysis was performed using PLINK. Principal component analysis was used to control for racial/ethnic background and population substructure.

RESULTS: SNPs in 10 genes exceeded a genome-wide significance of $p < 10^{-4.5}$, including *FN3KRP*, *FAM148A*, *CUX2*, *RIPK2*, *ABC11*, *B3GNTL1*, *BRE*, *BDNF*, *ZHX3*, *IDE*, and *TBCD*. Pathways contributing to lipid metabolism, neural signaling, muscle contraction, and adiposity were significantly represented by SNPs with a nominal $p < 0.0001$. The brain-derived neurotrophic factor (BDNF) signaling pathway emerged as a central factor linking multiple other pathways, highlighting neural signaling as a target for exercise tolerance. Two SNPs in the *CEP112* gene were significantly associated with exercise adherence ($p < 10^{-6}$); this gene has previously been implicated in smoking cessation, suggesting a common genetic pathway for persistent behavior.

CONCLUSIONS: This study represents the first genome-wide analysis of exercise tolerance and adherence in a multi-racial sample of young adults; neural signaling pathways appear to be important in both outcomes.

356 Board #177 May 31 9:30 AM - 11:00 AM
Osteoarthritic Extracellular RNA Biomarkers in Synovial Fluid
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 (No relationships reported)

The molecular mechanisms influencing the initiation and progression of osteoarthritis (OA) are unclear. Therefore, current clinical management of predominately involves symptomatic treatment of end-stage diagnosed OA. Understanding the pathogenesis of OA at the pre-clinical stage may aid in both diagnostic and preventative modalities in the management of this chronic disease. **PURPOSE:** To determine the synovial extracellular RNA (exRNA) changes associated with OA. **METHODS:** Synovial fluid was collected from the injured knee of a cohort of 14 individuals (ages 15-47, 10 males and 4 females) undergoing surgical repair following ACL and/or meniscus injuries.

Each knee had arthroscopically graded OA and divided the cohort into 5 individuals in the OA group (OA in >1 knee compartment) and 9 individuals in the non-OA group (OA in ≤ 1 knee compartment). Total exRNA was extracted from the synovial fluid collected at the time of surgery, >30 million reads generated per sample using massively parallel sequencing, and differential abundance of RNA was calculated between the two groups. **RESULTS:** A total of 19 protein coding exRNAs were significantly different ($FDR \leq 0.05$) between the two groups: 13 increased in the OA group, 6 decreased. While no specific pathways were enriched, these genes included several genes known to influence OA pathways including *ADAM12* (metalloprotease-disintegrin 12) and *BMPRIA* (bone morphogenetic protein receptor type 1A). In addition, 3 miRNAs were different: 2 increased, 1 decreased. One of these increased miRNAs was mir30a which has a known role in promotion of extracellular matrix degradation. **CONCLUSIONS:** These data suggest that the profile of extracellular RNA molecules are dysregulated arthroscopically diagnosed OA. While the specific intercellular signaling role of these exRNA are yet to be elucidated, they offer intriguing biomarkers and suggestions of dysregulated molecular pathways in OA. Changes in the genes *ADAM12*, *BMPRIA*, and mir30a suggest that exRNA markers of extracellular matrix degradation are biomarkers for the initiation and/or progression of OA. These findings have the potential clinical utility to differentiate patients at risk for the development of OA, introducing the possibility for intervention at pre-symptomatic stages.

357 Board #178 May 31 9:30 AM - 11:00 AM

Acute Exercise Induced Changes of Gene-Specific DNA Methylation in Natural Killer Cells

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As part of the innate immune system, natural killer cells (NK cells) have the ability to detect and eliminate virus-infected and neoplastic cells. The amount of tumor infiltrating NK cells is connected with the prognosis of various tumor diseases. Acute physical exercise influences the mobilization of NK cells and increases their cytotoxicity. Previous studies indicate that a load-dependent variation of the NK cells is induced by epigenetic modifications.

Purpose: The aim of this investigation was to examine to what extent has the promoter methylation of activating (KIR2DS4) and inhibiting (KIR3DL1) NK cell receptors changed after acute exhaustive exercise.

Methods: A total of 18 healthy female subjects (age of 55, 2 ± 5, 7) were asked to perform a spirometry on a cycle ergometer. The spirometry protocol was a step test of 1 min rest measurement at the beginning, followed by a 3 min warm-up phase with 50 watts of power output and an increase of 25 watts for every 2 minutes of the test until exhaustion. Before (T0) and after (T1) spirometry test, venous blood was collected from which NK cells were isolated and DNA was extracted. Accordingly, the KIR2DS4 and KIR3DL1 NK cell receptors were examined through Targeted Deep Amplicon Sequencing.

Results: The promoter methylation of the activating KIR2DS4 receptor reduced after single exercise load (T0 vs T1). The significant changes were observed in two close (distance of 4 base pairs), identified CpGs (p=.007 and p=.008). No effects found on the inhibiting KIR3DL1 receptor. There was no correlation found between the promoter methylation and the maximum oxygen uptake of the subjects. However, the data showed a positive correlation of the promoter methylation between both genes at T0 and T1.

Conclusions: Acute exercise reduces the promoter methylation of the activating NK cell receptor KIR2DS4. This finding may be related to reduced KIR2DS4 gene expression by natural killer cells. The correlation between the methylation of both genes indicates that reduced methylation of the activating receptor proves to be reduced for the inhibiting receptor as well. However, only the activating receptor is sensitive to epigenetic modulations after exhaustive exercise. Therefore, high-load acute exercise represents a promising positive influence for the innate immune system.

358 Board #179 May 31 9:30 AM - 11:00 AM

Exercise Induced Natural Killer (NK) Cell Genomic Response in Pediatric Acute Lymphoblastic Leukemia (ALL) Survivors

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(No relationships reported)

Despite remarkable success in achieving remission, pediatric ALL survivors face increased risk of physical activity related metabolic, cardiovascular, and bone disease. The mechanisms of these threats to the healthspan are unknown. NK cells play a role in therapy and immune surveillance in ALL and along with other immune cells, are also involved in the molecular pathways by which exercise benefits health. NK cells increase in the circulation in response to brief exercise to a greater degree than any other leukocyte. **PURPOSE:** To examine the effect of brief exercise on NK cell gene expression (RNA seq), in children and adolescents who have survived ALL. **METHODS:** 9 ALL survivors and 9 sex and age-matched controls (14.8±0.7 & 15.0±0.9 y/o) performed 8, 2-min bouts of cycle ergometer exercise interspersed with 1-min rest at a constant work equivalent to 65±1% of peak $\dot{V}O_2$. RNA Seq was performed using standard techniques. The trimmed reads were aligned to Human hg19 reference genome. Differential analysis was performed using DESeq (v.1.18.0). Paired design was used to account for samples from same patient (FDR<0.05). Differential expression genes were classified into pathways using the Kyoto Encyclopedia of Genes and Genomes (KEGG) database (EASE score<0.05). **RESULTS:** 17 annotated genes were expressed significantly different from controls in ALL survivors at baseline (before exercise) and were enriched in MicroRNAs in Cancer KEGG pathway. Brief exercise significantly altered 4407 genes in control and 4126 genes in ALL. 220 genes were altered differently in response to exercise in ALL survivors compared to controls. Those genes were enriched in KEGG Pathways involved in immune surveillance; e.g., hematopoietic cell lineage, central carbon metabolism in cancer, HIF-1 signaling pathway, pathways in cancer and antigen processing and presentation which included 3 killer-cell immunoglobulin-like receptors (regulate the killing function of NK cells)

that had reduced response in ALL. **CONCLUSION:** Exercise altered the expression of thousands of NK cell genes in both ALL and controls with a distinct pattern in ALL. Among several possible health effects, exercise may improve NK cell function in immune surveillance in ALL survivors. Supported by UCI SOM Faculty Research Grant, PERC System Biology Fund, and NIH Grant P01HD-048721

A-48 Free Communication/Poster - Hypoxic Exercise

Wednesday, May 31, 2017, 7:30 AM - 12:30 PM
Room: Hall F

359 Board #180 May 31 9:30 AM - 11:00 AM
FGF21 is Produced By Active Skeletal Muscle during Intense Exercise in Humans: Influence Of P_iO₂

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Fibroblast growth factor 21 (FGF21) is a peptide produced mostly by the liver and other tissues as skeletal muscle. Recent work supports that the main source of circulating FGF21 during exercise is the hepato-splanchnic circulation. Nevertheless, increased FGF21 mRNA has been reported in human skeletal muscle after prolonged exercise. Given the great increase of skeletal muscle blood flow during exercise, a small amount of FGF21 released by active skeletal muscles could have escaped detection by a-v differences.

PURPOSE: to determine whether skeletal muscle produces FGF21 in response to exercise and the influence of muscle metabolism and oxygenation on this process. **METHODS:** Eleven volunteers performed incremental exercise (IE) to exhaustion in normoxia (Nx, P_iO₂:143 mmHg) and hypoxia (Hyp, P_iO₂:73 mmHg) while muscle metabolites and FGF21 protein expression (Western Blot) were measured before (control) and immediately after IE in Nx and Hyp. Immediately after IE, the circulation of one leg was instantaneously occluded (300 mmHg) and vastus lateralis muscle biopsies obtained after 10s from the occluded leg, and simultaneously from both legs at 60s.

RESULTS: At 10s muscle lactate ([La]) was increased and phosphocreatine (PCr) and ATP reduced in Nx and Hyp, without differences between conditions. Muscle [La] was increased by 25% from 10 to 60s in the occluded leg (P<0.05) and unchanged in the non-occluded leg (+5% P=0.71). After 60s, PCr was reduced by 94 and 48%, in the occluded and non-occluded leg, respectively (P<0.05). Compared to pre-exercise, FGF21 protein expression was increased in the occluded leg by 55 and 57% at 10s and 60s, respectively (time effect P=0.02) and by 10% (P=0.42) in the non-occluded leg at 60s, without influence of P_iO₂. No association was observed between metabolite accumulation and FGF21 expression.

CONCLUSIONS: FGF21 is produced during intense exercise in human skeletal muscle. The fact that FGF21 was not increased 60s after the end of exercise in the leg recovering with free circulation highlights the utility of total occlusion of the circulation to trap in the muscle myokines released in small amounts by the muscle during contractile activity.

Funding: MINECO Ref.: DEP2015-71171-R

360 Board #181 May 31 9:30 AM - 11:00 AM

The Effect Of Normobaric Hypoxic Endurance Training On Forearm Muscle Blood Flow

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The effects of intermittent hypoxic exposure (live low train high) on skeletal muscle oxygenation kinetics remain poorly understood. However, recent developments in technology have meant that the monitoring of skeletal muscle blood flow in response

to training is possible. **PURPOSE:** The aim of the current study was to determine whether handgrip dynamometry (HGD) training in normobaric hypoxia (14% FiO₂) altered blood flow in the non-dominant flexor digitorum profundus (FDP) at rest and during exercise.

METHODS: Following institutional ethical approval, 7 healthy males who were not forearm trained (mean age: 20.7 ± 1.1 years; stature: 1.77 ± 0.08 m; body mass: 84.0 ± 14.2 kg) volunteered to take part in the study. In a randomized, crossover design participants completed four weeks of progressive HGD endurance training (0.3Hz in week one increasing to 1.2Hz in week 4) in both normoxia and hypoxia. There were four training sessions per week and each consisted of 30 min intermittent handgrip exercise at 30% of maximal voluntary contraction (MVC), followed by a 60s maximal 'sprint'. A six week washout period separated normoxic and hypoxic training. Before and after the training intervention, forearm muscle blood flow was determined at rest and during exercise (25% MVC) using near-infrared spectroscopy and the venous occlusion method. Forearm blood flow was calculated by evaluating the rate of increase in total haemoglobin (thb) during the first few seconds of venous occlusion (60 mmHg).

RESULTS: Two-way repeated measures ANOVA revealed a significant interaction (time x condition; *p* = 0.028) in blood flow during exercise at 25% MVC, but not during rest (*p* = 0.114); further there was no significant main effect for condition (*p* = 0.059) or time (*p* = 0.077). Follow up paired samples *t*-tests revealed that forearm muscle blood flow during exercise was greater than baseline following normobaric hypoxic training (*p* = 0.049, MD = 1.59, 95% CI = 0.24 - 3.21 ml·min⁻¹·100ml⁻¹), but not following normoxic training (MD = 0.05, 95% CI = -0.45 - 0.54 ml·min⁻¹·100ml⁻¹).

CONCLUSIONS: Thirty minutes of handgrip dynamometry training a day for 4-weeks in normobaric hypoxia has the potential to increase forearm muscle blood flow. Future studies should seek to determine whether these hypoxia induced changes translate to an enhanced endurance performance.

361 Board #182 May 31 9:30 AM - 11:00 AM

The Effect of Hypoxia on PGC-1α

Roksana Zak, Robert Shute, Dustin Slivka, FACSM. *University of Nebraska-Omaha, Omaha, NE.* (Sponsor: Dustin Slivka, FACSM)

(No relationships reported)

Markers for mitochondrial function in the skeletal muscle appear to be reduced after extended exposure to altitude. However, short term training at altitude enhances aerobic capacity. Further investigation is needed to determine the skeletal muscle response to altitude.

PURPOSE: The purpose of this study was to determine the impact of exposure to normobaric hypoxia after exercise on the gene expression and subcellular location of PGC-1α protein compared to a normoxic environment.

METHODS: Six male participants (age 25 ± 2, height 180 ± 4 cm, weight 82 ± 2 kg) completed two 90 min cycling trials in laboratory conditions followed by a 6 h recovery in either ambient conditions (975 m) or in a hypoxic environment (5000 m). Biopsies were taken from the *vastus lateralis* before exercise, after exercise, and following 6 h recovery. Samples were analyzed for PGC1-α gene expression using RT-qPCR and subcellular location using western blot on cytosolic and nuclear fractions.

RESULTS: Exposure to hypoxia following exercise resulted in significantly lower expression of PGC-1α (*p* = 0.014) but no significant differences were found in protein translocation between the cytosolic (*p* = 0.225) and nuclear (*p* = 0.211) fractions.

CONCLUSIONS: It appears that the post-translational events of PGC-1α are not altered by acute hypoxia after exercise, despite a reduced transcriptional response of PGC-1α. It is unclear if these cellular events would account for the deficit in mitochondrial function observed with extended exposure to a hypoxic environment. This project was funded by grants from the Department of Defense (W81XWH-10-Z-0120) and NASA Nebraska Space Grant.

362 Board #183 May 31 9:30 AM - 11:00 AM

Exercise Induced Oxidative Stress During Normobaric And Hypobaric Hypoxic Exercise Recovery

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PURPOSE: Altitude exposure and exercise provoke an acute oxidative stress response in muscle and blood tissues. Prior work indicates that redox-sensitive exercise recovery responses are attenuated above 1500m, although the independent impact of hypobaric and hypoxia on these responses are unknown. Moreover, given that the wealth of existing exercise and altitude data are conducted primarily in males, the current study

was designed to understand exercise recovery responses in males and females exposed to various hypoxia and hypobaric conditions following a common bout of aerobic exercise.

METHODS: Sixteen active males (n=8) and females (n=8) between the ages of 18-40 performed cycle ergometer exercise for 60 minutes at 70% watts max at a base elevation of 975m. In a randomized counter-balanced crossover design subjects recovered in an environmental chamber for 4 hours in three conditions; 1000m normobaric normoxia (NN, 675mmHg, 18.8%FiO₂), a simulated 4400m normobaric hypoxia (NH, 675mmHg, 12% FiO₂), or a simulated 4400m hypobaric hypoxia (HH, 440mmHg, 12% FiO₂). Pulse oximetry was used to measure O₂ saturation throughout the exercise trials and to confirm hypoxia during recovery. Six muscle biopsies obtained from the vastus lateralis at baseline and following each exercise recovery were examined for hypoxia and redox sensitive transcripts including endothelial PAS domain protein-1 (EPAS-1), hemeoxygenase-1 (HMOX1), superoxide dismutase-2 (SOD2), and nuclear factor erythroid-derived 2-like 2 (NFE2L2).

RESULTS: No sex-dependent differences in gene transcripts were observed for any markers examined (*p*>0.05). No differences were observed for EPAS-1 (variable 2 fold increase, *p*>0.05) or NFE2L2 (1.29 fold increase, *p*>0.05). Time-, but not trial-, dependent differences existed for HMOX1 (8.4 fold increase, *p*<0.000) and SOD2 (1.4 fold increase, *p*=0.017) and indicate a similar redox stimulus was present 4 hours post exercise in all three recovery condition.

CONCLUSIONS: These data suggest exercise recovery in simulated conditions of NH and HH do not impact EPAS-1, HMOX1, SOD2 or NFE2L2. Additional redox-sensitive markers in blood and muscle should be examined to determine whether additional adaptive responses are impacted by NH and HH recovery conditions.

363 Board #184 May 31 9:30 AM - 11:00 AM

Hypoxic Training Promotes Apelin Expression In Skeletal Muscles Of High Fat Diet-induced Obese Mice

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(No relationships reported)

PURPOSE: To investigate the effects of hypoxia, exercise, and hypoxic exercise training on the expression of apelin and APJ in skeletal muscle of obese mice.

METHODS: 60two-month oldC57BL/6Jmice were randomly divided into two groups: 10 in normal diet group(N) and 50 in the high fat diet (HFD) groups. After two months of feeding, the HFD mice whose body weight 20% higher than the average weight of N group were selected as obese mice and were furtherallocatedinto four groups: Control (C), Exercise (E), Hypoxia (H), and Exercise plus Hypoxia (E+H), at 8-9 mice/group. Besides body weight, measured variables in skeletal muscle were protein/mRNA levels of apelin/APJ, AMPKα-Thr172 phosphorylation, hypoxia inducible factor-1α(HIF-1α),mRNA levels ofperoxisome proliferator-activated receptorα (PPARα), estrogen-related receptor (ERRα),and nuclear respiratory factor1 (NRF1).

RESULTS: Obese mice had significantly lower mRNA and protein expressions of apelin/APJ in skeletal muscles than the normal body weight mice. After four weeks of interventions, hypoxic exercise training decreasedbody weight andincreased mRNA and protein expressions of apelin and APJ, mRNA expression of ERRα, and protein expression of HIF-1α.

CONCLUSIONS: These results indicate that changes of body weight may be associated with the levels of apelin/APJ expressions in skeletal muscle.

364 Board #185 May 31 9:30 AM - 11:00 AM

Metabolomic Analysis Of Skeletal Muscle In Horses Trained In Hypoxia.

Hajime Ohmura¹, Kazutaka Mukai¹, Yuji Takahashi¹, Toshiyuki Takahashi¹, James H. Jones². ¹Japan Racing Association, Shimotsuke-shi, Japan. ²University of California, Davis, Davis, CA.

(No relationships reported)

Hypoxic training is effective for improving athletic performance. In horses, hypoxic training increases maximal oxygen consumption (VO₂max) more than normoxic training. However, the effects of hypoxic training on well-trained horses is unclear, and its effects on muscle metabolism have not been investigated. We hypothesized that VO₂max of well-trained horses would increase and muscle metabolomics would differ before and after hypoxic training. **PURPOSE:** To determine the effects of hypoxic training on VO₂max and muscle metabolomics of well-trained horses.

METHODS: We studied 5 well-trained horses in which VO₂max had not increased over 3 consecutive weeks of supramaximal treadmill training in normoxia twice a week. Horses trained with hypoxia (15% O₂) twice a week. Before and after 3 weeks of hypoxic training, VO₂max was measured on the treadmill and biopsy samples for metabolomics analyses were taken from the gluteus medius muscle at rest. Data were analyzed with Welch's t-test. **RESULTS:** VO₂max increased after 3 weeks of hypoxic training (176 vs. 194 ml/(kg×min), *p* < .05) even though all-out training in normoxia had not increased VO₂max. From metabolomic analysis, Acetyl CoA (0.150 vs.0.048

nmol/g, $p < .05$), ATP (8.3 vs. 7.6 $\mu\text{mol/g}$, $p < .05$), and pyruvic acid (141 vs. 116 nmol/g, $p < .05$) decreased after hypoxic training. However, BCAAs (302 vs. 407 nmol/g, $p < .05$) and methionine (33 vs. 41 nmol/g, $p < .05$) increased after hypoxic training. **CONCLUSION:** Hypoxic training may increase $\text{VO}_{2\text{max}}$ even though it is not increased by normoxic training. Finding changes in muscle metabolomics in hypoxia may suggest a mechanism for potentially increasing racing performance by increasing $\text{VO}_{2\text{max}}$.

A-49 Free Communication/Poster - Military Physiology

Wednesday, May 31, 2017, 7:30 AM - 12:30 PM
Room: Hall F

365 Board #186 May 31 9:30 AM - 11:00 AM Physical Discomfort And Relationship To Performance During A 12-mile March In US Army Soldiers

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(No relationships reported)

Long road marches carrying heavy loads are a common military task. While it is anecdotally accepted that discomfort related to physical pain and soreness increases during long marches, there is little data available which has quantified this discomfort or determined its effect on march performance. **PURPOSE:** To quantify pain and soreness (P&S) during a 12-mile march and determine how it affects pacing. **METHODS:** While carrying a load weighing ~46.4 kg, 46 male and 26 female Soldiers performed a 12 mile foot march. A mandatory rest break of 10 minutes was enforced at the 3 and 9 mile marks, and a 30 minute break was enforced at the 6 mile mark. Time splits were taken every 3 miles. At the start, each rest point, and finish, soldiers rated their P&S from 0 (No Discomfort) to 3 (Extremely Uncomfortable) using an image of the body mapped into 21 regions (scale adapted from Dimov et al, *AIHAJ*, 2000). Increases in P&S over time were assessed using rmANOVA. Correlations were examined between changes in P&S (finish-start) for each site and load carried per body mass and with changes in pace (time for last 3 miles – time for first 3 miles). **RESULTS:** Total march time was 244 ± 35 minutes (mean \pm SD). Average overall P&S of the 21 body regions increased during the march from 0.13 ± 0.11 prior to the march to 0.46 ± 0.24 at the end ($p < 0.01$ for trend), and did not significantly differ by sex ($p = 0.24$). Of the 71 soldiers, 64 (90%) reported a P&S of 2 or 3 for at least one body region, with 36 (51%) reporting a P&S of 3. The sites of the greatest soreness were the shoulders (End P&S 1.99 ± 0.96) and the feet (End P&S 1.36 ± 1.20) ($p < 0.05$ for both). Significant increases in P&S were observed in the neck, shoulders, mid-to-lower back, hips/waist, thighs, legs/feet, and ankles ($p \leq 0.05$ for trends). Load carried per body mass correlated with changes in neck P&S ($r = 0.24$, $p = 0.04$). Increases in P&S of the hips/waist were associated with decreasing their pace ($r = 0.32$, $p = 0.01$). **DISCUSSION:** Due to the high load over a long distance, P&S increased over the march and may have interfered with performance. These data provide quantitative evidence of the changes in reported physical discomfort during long marches. To minimize soldier discomfort and improve performance, improvements in road march policy, equipment ergonomics, and training of proper gear fitting should target these body regions.

366 Board #187 May 31 9:30 AM - 11:00 AM Relationship Between Soldier Performance on the Two-Mile Run and Beep Test: Ability to Predict $\text{VO}_{2\text{max}}$

Maria C. Canino, Stephen A. Foulis, Jan E. Redmond, Edward J. Zambraski, Marilyn A. Sharp. *U.S. Army Research Institute of Environmental Medicine, Natick, MA.*
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(No relationships reported)

Aerobic fitness is vital for military personnel to perform their physically demanding job tasks. The Army currently uses a two-mile run (TMR) as part of the Army Physical Fitness Test to measure aerobic fitness levels. The Beep Test (BT) is also currently being used by the Army as a pre-enlistment screening test. Both tests have been validated to predict an individual's aerobic capacity. An advantage of the BT is that it can be performed indoors, offering an alternative to the TMR when outdoor conditions could affect performance. A comparison of the results of these two tests has not been made. **PURPOSE:** To determine the relationship between the TMR and BT and to compare their $\text{VO}_{2\text{max}}$ estimations. **METHODS:** 404 male and 128 female soldiers participated in this study. The TMR results were self-reported from their most recent APFT. To screen for maximal effort, all soldiers included reached a post BT heart rate within 10 bpm of their age-predicted maximal heart rate (220-age). Correlations and

simple linear regression were used to analyze the relationship between TMR and BT. **RESULTS:** The regression model obtained for predicting TMR time (min) from BT shuttles (#) was $\text{TMR} = 19.101 - 0.067 * \text{BT}$, $R^2 = 0.53$ ($p < 0.001$), $\text{SEE} = 1.137$ min. For example, completing 60 and 30 shuttles would be similar to TMR times of 15.08- and 17.09 min, respectively. The mean TMR time was 15.01 min (range: 10.9-22.2 min). The mean BT score was 61 shuttles (range: 16-113 shuttles; test duration: 2.2-12.2 min). There is a significant moderate correlation between the TMR and BT estimated $\text{VO}_{2\text{max}}$ ($R^2 = 0.64$; $p < 0.001$), with mean $\text{VO}_{2\text{max}}$ values for TMR and BT 50.5 ± 5.1 and $39.4 \pm 6.1 \text{ mL} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$, respectively. **CONCLUSIONS:** A significant moderate relationships exist between both TMR times and BT shuttles and TMR and BT estimated $\text{VO}_{2\text{max}}$. Further, in the same individuals TMR estimated $\text{VO}_{2\text{max}}$ was 22% higher than what was predicted by BT performance. Reasons for this large discrepancy could include inflation of their performance on the TMR due to subject recall, motivational differences to perform to their maximum, and/or significant differences in the ability of these two tests to actually estimate $\text{VO}_{2\text{max}}$. Additional studies are needed to concurrently measure TMR, BT, and a laboratory measure of $\text{VO}_{2\text{max}}$ in the same individual.

367 Board #188 May 31 9:30 AM - 11:00 AM The Physiological Demands of a 16 km Loaded Patrol

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(No relationships reported)

The Royal Air Force (RAF) Regiment (Regt) is a close combat unit, their primary role is to secure the safety of an operational airfield. One of the critical tasks of the RAF Regt is a patrol, this can last approx. 4.5 hours, covering a distance of 16 km. **PURPOSE:** To determine the physical demand of a simulated 16 km loaded patrol in RAF Regiment Regt personnel, specifically if differences occurred between the first and fifteenth km. **METHODS:** 26 participants from the RAF Regt performed a 16 km loaded (31.50 kg) patrol over 4 hrs 28 min. Participants received 2 x 10 min breaks at 1 hr 25 min and 3 hrs 20 min and a 20 min break at 1 hr 54 min. Rating of Perceived Exertion (RPE) was recorded at the first and second break and on completion. Walking speed was paced at 4.20 km.h⁻¹ for the duration of the patrol. Heart rate (HR) was measured for the duration of the patrol. Oxygen consumption (O_2) was measured using Douglas bag collections of 1 min at 1 km, 3 km, 5 km, 10 km and 15 km. O_2 was calculated as $\text{mL} \cdot \text{kg}^{-1} \cdot \text{metre}^{-1}$ to allow for the variations in actual marching speed (3.80 km.h⁻¹ to 4.92 km.h⁻¹). **RESULTS:** No differences were reported in O_2 between the first, third, fifth or tenth km in comparison with 15 km. A meaningful significant increase in O_2 was observed at 10 km compared to the first km (0.24 ± 0.03 vs $0.22 \pm 0.02 \text{ mL} \cdot \text{kg}^{-1} \cdot \text{metre}^{-1}$; $p = 0.002$; Cohen's d effect size (ES) 0.60; Post hoc power (PhP) = 0.92; $n = 25$) and 10 km compared to the third km (0.24 ± 0.03 vs $0.22 \pm 0.03 \text{ mL} \cdot \text{kg}^{-1} \cdot \text{metre}^{-1}$; $p = 0.006$; ES 0.65; PhP = 0.85; $n = 19$). Significantly higher ($p \leq 0.0125$) O_2 was reported at 5 km compared to 3 km, however low ES and power were observed. During periods of work a linear cardiac drift was observed; mean \pm SD HR of $93 \pm 12.03 \text{ b} \cdot \text{min}^{-1}$ at 1 km to $110 \pm 14.98 \text{ b} \cdot \text{min}^{-1}$ at 16 km. RPE remained the same for the first and second breaks (median (range): 7 (6 to 13), increasing to 8 (6 to 14) on completion of the patrol. **CONCLUSION:** The metabolic, cardiovascular and perceived demands were low and remained low for the duration of the patrol. These data highlight that whilst the metabolic demand remained constant from the first to last km, HR increased linearly during the active element of the patrol. This suggests that HR should not be used to predict or estimate the metabolic workload of long duration activities such as the patrol.

368 Board #189 May 31 9:30 AM - 11:00 AM Neuromuscular Responses to Consecutive Day Military Load Carriage.

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(No relationships reported)

Previous research has shown that lower limb peak torque (PT) is reduced up to 72 hours after treadmill load carriage. PT can occur at a range of muscle lengths and as such are unable to define the changes in muscle function, which may occur because of load carriage. **PURPOSE:** To determine changes in lower limb neuromuscular output, in responses to consecutive day military load carriage on a treadmill compared to an unloaded control group. **METHODS:** 12 participants (10 males: $88.8 \text{ Kg} \pm 16.8 \text{ Kg}$, $188.72 \text{ cm} \pm 8.5 \text{ cm}$; 2 females: $63.4 \text{ kg} \pm 12 \text{ kg}$, $164.2 \text{ cm} \pm 8 \text{ cm}$) walked on a level treadmill carrying 32kg across webbing, backpack and rifle, at a speed of 5.4 km-h⁻¹ for two hours on two consecutive days. 8 participants (6 males: $92.8 \text{ Kg} \pm 11.8 \text{ Kg}$, $187.22 \text{ cm} \pm 8.5 \text{ cm}$; 2 females: $64.2 \text{ kg} \pm 12 \text{ kg}$, $154.1 \text{ cm} \pm 8 \text{ cm}$) completed the protocol without the military equipment. Neuromuscular output of the ankle and knee flexors and extensors were studied by observing changes in torque by isokinetic dynamometry.

Knee extensor and flexor muscles were studied at 0, 60, 180 °-s-1. Ankle dorsi and plantar flexors were observed at 0, 60, 120 °-s-1. Measurements were taken pre and post load carriage on day one and day two. Torque was recorded as PT and at 5° intervals during isokinetic contraction. **RESULTS:** Statistically significant reductions in PT were observed post load carriage on day one and two in the dorsiflexors at 60 and 180°-s-1 (P<0.05) and knee flexors and extensors at 60 and 0°-s-1 (P<0.05), these are supported by torque reductions throughout the movement (70° to 0°)(P<0.05). PT returned to baseline 24 hours post exercise while torque at serial muscle lengths remained reduced. No changes were observed between unloaded and loaded walking. **CONCLUSIONS:** Findings indicate that two hours of treadmill load carriage causes a bimodal change in neuromuscular function of the knee extensors and flexors and the ankle dorsiflexors, characterised by a reduction in the PT and torque over two days of repeated exercise. However, no significant difference was observed between loaded and unloaded groups. While temporal results find support in the previous literature, the inclusion of an exercising control group, that demonstrates no significant change, suggests that they fail to observe that load carriage causes no greater reduction in neuromuscular function than unloaded walking.

369 Board #190 May 31 9:30 AM - 11:00 AM
Optimal Number of Practice Sessions for Performance of Heavy Loading Tasks in Soldiers

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 (No relationships reported)

All U.S. Army soldiers must perform the physically demanding tasks of their job prior to graduation from initial entry training. Armored personnel are required to conduct a tank ammunition loading task (TAL), while Field Artillery (FA) personnel perform the FA Ammunition Supply Vehicle reloading task (FAR). As these are graduation requirements, it is important to determine the influence of practice on performance of the TAL and FAR to guide training. **PURPOSE:** To determine the number of practices needed to optimize performance and pass rates of the TAL and FAR in soldiers unfamiliar with the tasks. **METHODS:** A sample of 43 soldiers (22 men, 21 women) performed the TAL 4 times and 41 (23 men, 18 women) also performed the FAR 4 times. Tasks were performed on four different days over a two week period with ≥48 hours rest between trials (T). To perform the TAL a soldier lifted and carried 18, 25 kg rounds a distance of 5 m, and handed them to another crewmember standing on the deck of the tank (lift height=1.63 m). The rate of loading was calculated in rounds·min⁻¹ with a passing rate of ≥ 2.4 rounds·min⁻¹ (18 rounds in 10 min). To perform the FAR 30, 45 kg rounds were lifted from the vehicle tailgate, carried 3 m and loaded into a rack with openings from floor to shoulder height. Soldiers had 15 min (3 5-min bouts, with 2.5 min of rest between each bout) to load 30 rounds. A passing score for the FAR was ≥ 2 rounds·min⁻¹ (30 rounds in 15 min). Repeated measures ANOVA were used to examine the effects of repeated trials. The number of soldiers failing the standard at each T was determined. **RESULTS:** The scores were significantly improved (p<0.01) from T1 to T4 for TAL (T1= 3.54 and T4=5.36 rounds·min⁻¹) and from T1 to T3 for FAR (T1=2.45 and T3= 3.47 rounds·min⁻¹). FAR plateaued T3 to T4 at 3.64 rounds·min⁻¹. The number of failures decreased with each trial on the TAL (T1=17, T2=14, T3=10, T4=6) and on the FAR (T1=19, T2=16, T3=11, T4=10). **CONCLUSIONS:** For trainees, it is important to provide 2-3 trials on each of these tasks to maximize the number passing, while not utilizing an inordinate amount of training time. Soldiers who are unable to perform to standard after 3 practices may need remedial progressive resistance training to be successful.

370 Board #191 May 31 9:30 AM - 11:00 AM
Body Composition and Physical Determinants of Physiological and Musculoskeletal Readiness in Marines

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 (No relationships reported)

Combat arms are now open to women across all Armed Forces. Identifying physicality of men and women with enhanced, cumulative physiological and musculoskeletal fitness may optimize Force Readiness. **PURPOSE:** To assess body composition and physical characteristics of male and female Marines from the Marine Corps' Ground Combat Element Integrated Task Force classified by performance clusters. **METHODS:** 302 Marines (age=22.0±2.7 yrs, height=1.5±0.1 m, mass=76.1±12.2 kg) underwent body composition testing (air displacement plethysmography); arm span and leg length; and a battery of laboratory and field strength, aerobic/anaerobic,

balance, biomechanics, and flexibility tests. A k-means cluster analysis was performed to characterize Marines with similar lab and field characteristics, regardless of sex, body composition or physicality. Twenty-three clustering validity indices were calculated to determine the optimal cluster number using R. One-way ANOVA or Kruskal Wallis tests were utilized to test for group differences, as appropriate, followed by Bonferroni adjusted pair-wise comparisons (p<0.05, two-sided). **RESULTS:** Three clusters (C) were identified: C1 with the best strength and aerobic/anaerobic characteristics, C3 with the worst strength and aerobic/anaerobic characteristics, and C2 between C1 and C3; clusters were then stratified by sex (Men: C1M, C2M, C3M; Women: C2W, C3W). C1M, C2M, and C3M had significantly less BF% than C2W and C3W. Fat free mass was significantly different among all groups. C1M and C2W had significantly greater fat mass than C3M. C1M and C2M had significantly greater arm span and leg length than all other groups. (Table 1) **CONCLUSIONS:** Fat free mass may have a stronger association with performance on strength, aerobic, and anaerobic tests than BF% or fat mass. These results can assist in developing tools to identify Marines with enhanced physiological and musculoskeletal readiness.

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Table 1. Body Composition and Physical Characteristics by Cluster and Sex

	C1 (men: N=76)		C2 (men: N=132)		C2 (women: N=14)		C3 (men: N=10)		C3 (women: N=70)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Body Fat %	19.4	5.3*	18.9	6.3*	22.8	4.4	16.3	7.0*	24.7	5.0
Fat Free Mass (kg)	71.7	6.3***	62.3	5.2***	54.8	5.1***	53.2	3.5***	47.3	4.6***
Fat Mass (kg)*	17.1	8.8**	14.4	7.1*	16.8	6.0*	8.9	6.5**	16.0	6.4
Arm Span (cm)	165.0	6.7***	179.9	7.3***	169.5	8.3**	172.8	6.7**	164.0	6.7**
Leg Length (mm)	958.9	37.3***	927.8	45.2***	882.9	46.7**	883.3	45.9**	857.9	36.4**

One-way ANOVA and post-hoc Bonferroni tests performed
 *Kruskal-Wallis and post-hoc Mann-Whitney U tests performed; Median and IQR presented instead of Mean and SD
 *Significantly different compared to C1 men (p<0.05)
 **Significantly different compared to C2 men (p<0.05)
 ***Significantly different compared to C2 women (p<0.05)
 *Significantly different compared to C3 men (p<0.05)
 **Significantly different compared to C3 women (p<0.05)

371 Board #192 May 31 9:30 AM - 11:00 AM
Distribution Of Cardiorespiratory Fitness Levels Of US Army Recruits From 2010-2013 By State

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PURPOSE: To characterize the cardiorespiratory fitness (CRF) levels of US Army recruits by state. **METHODS:** Data on US Army recruits from all 50 states and Washington, DC who entered basic combat training (BCT) between 2010-2013 were provided by the US Army Public Health Center. CRF was assessed in a subset of recruits from their first diagnostic Army Physical Fitness Test during BCT by two-mile run time (run time) in minutes. States were ranked into quartiles based on median run times of recruits from that state aged 17 - 35 yrs in the total sample and stratified by sex. **RESULTS:** A total of 168,160 recruits (79.46% male) were analyzed. Median age, BMI, and run time were 20.0±3.6 years, 24.4±3.6kg/m², and 16.2min (range of 8.1-60.0 min), respectively. There were significant (p<0.0001) differences in median run time between males (16.0±2.2 min) and females (19.3±2.8 min). The distribution of median run times across states, with states ranked into one of three groups: 1) top 25% (lowest run times/highest CRF), 2) middle 50%, and 3) bottom 25% (highest run times/lowest CRF); is shown for the overall sample and by sex in Figure 1. Of the 14 states in the bottom 25% of median CRF in the total sample (Figure 1A), 11 of them were from the southern/southeastern regions (AL, AR, FL, GA, LA, MS, NC, OK, SC, TN, TX). These 11 states remained in the bottom 25% of median CRF in models stratified by sex (Figure 1B-C), with the exception being KY replacing OK in models restricted to male recruits (Figure 1C). **CONCLUSION:** The CRF levels of US Army recruits entering BCT differ by state. Our results show that recruits from the southern and southeastern states tended to have lower CRF compared to recruits from the rest of the country. This is relevant given previously established associations between CRF and training-related injuries sustained during BCT. Investigating state level factors contributing to the fitness of Army recruits (and theoretically all state residents of a given age-range) is an important next step.

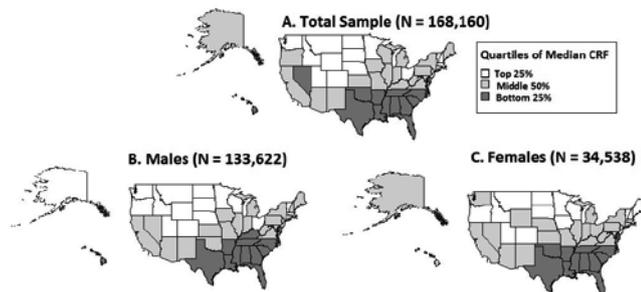


Figure 1. States ranked by quartiles of cardiorespiratory fitness based on median 2-mile run times of US Army recruits entering basic training from 2010-2013 (A-total sample), as well as separately in male (B) and female (C) recruits.

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Dose Dependent Increases in Electrodermal Activity During Exercise in Military Men: Absolute Versus Relative Workloads
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Preliminary evidence suggests that electrodermal activity (EDA) is a prospective surrogate marker of sympathetic nervous system (SNS) activity during exercise. However, the validity of EDA in the context of aerobic exercise must be established before its translational potential can be realized. **PURPOSE:** To evaluate the validity of EDA as a measure of SNS activity during exercise and the moderating effects of aerobic fitness utilizing absolute (AW) and relative (RW) workloads. **METHODS:** Forty healthy, U.S. Navy active duty males (age: 36.2±6.9 yrs) completed a graded exercise test to assess maximal oxygen consumption (VO_{2max}). EDA was recorded at baseline, during exercise, and seated recovery. Relative changes were compared with baseline. A median split established the high-fit (AW: n=11, VO_{2max} 48.9±1.9; RW: n=20, VO_{2max} 50.5±4.3) and low-fit groups (AW: n=13, VO_{2max} 43.6±2.1; RW: n=20, VO_{2max} 41.1±2.7). A 2 (group) x 6 (stage) repeated measures ANOVA evaluated EDA changes across stages of exercise, as well as between fitness levels. To evaluate validity, EDA responses of high-fit and low-fit men measured by AW and RW were then compared to the established literature characterizing plasma catecholamine responses during exercise. **RESULTS:** Mean percent changes from baseline for AW were +71.1 to +107.4% from stages 1-4, with a decrease in seated recovery (+88.3%) ($p<0.001$, $\eta^2=0.38$), and for RW were +78.1 to +120.3% from 25% to 100% VO_{2max} , with a decline in seated recovery (+105.5%) ($p<0.001$, $\eta^2=0.24$). A significant interaction between fitness and workload was observed for RW ($p=0.003$, $\eta^2=0.11$). Specifically, high-fit showed a linear increase in EDA from 25 to 100% VO_{2max} , with a steady decrease into seated recovery. By contrast, low-fit maximal EDA response occurred at 75% VO_{2max} , followed by a blunted decline in seated recovery. This interaction did not prevail using AW ($p>0.05$). **CONCLUSION:** Similar dose dependent increases in EDA were observed utilizing AW and RW, although RW alone captured a rise in high-fit EDA above low-fit at maximal exertion. The noted differences between high-fit and low-fit men measured by AW and RW emulate the established literature characterizing plasma catecholamine responses during exercise. These findings imply that EDA is a potentially valid proxy of SNS activity during exercise.

373 Board #194 May 31 9:30 AM - 11:00 AM
Identifying The Critical Tasks Of The Raf Regiment
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The Royal Air Force Regiment (RAF Regt) delivers the ground close combat role for the RAF, protecting airfield assets and personnel. There is a requirement for a Physical Employment Standard for the RAF Regt and identifying the critical tasks is the essential first step in this process.

PURPOSE: To identify the critical tasks of the RAF Regt including the method of best practice (MOBP) and minimum acceptable standard (MAS) for undertaking these tasks. **METHOD:** Task Analysis Questionnaires (TAQ), were sent to 13% (n=530) of the RAF Regt. SME focus groups were conducted to describe the critical tasks in a realistic scenario and identify a MOBP and MAS. A Military Judgement Panel (MJP) was asked to review the proposed critical tasks. The authorised critical tasks were presented to a further focus group of SME to finalise the scenario for each task, the MOBP and MAS. **RESULTS:** 279 TAQ were returned providing 1849 task descriptions, allocated to 22 generic task categories. SME identified the most physically demanding critical tasks, which were presented to the MJP for endorsement. A final SME focus group provided the following description, including a MOBP and MAS, for each endorsed task as follows:
 Tactical Advance to Battle: Carrying total weight 47.1 kg, walk over mixed terrain for 16 km at 2-4 km.h⁻¹ moving tactically including pausing to make observations and taking regular navigation checks.
 Point of Entry: climb over/through 1.2 m wall/window unaided.
 React to Effective Enemy Fire: assault and withdraw, conduct fire and movement over 200 m in 5-10 m bounds, zig-zag movement.
 Casualty Evacuation (CASEVAC) - One person drag under fire: sprint to casualty 15 m away then drag casualty (total weight 116.5 kg), for 15 m to a point of cover.
 CASEVAC - Fireman's carry: after removing casualty's daysack, lift with assistance a casualty weighing 107.9 kg, then fireman carry 100 m out of immediate danger area.
 CASEVAC by stretcher: in a team of 4, carry a casualty (total weight 107.9 kg) on a stretcher over difficult terrain for 1 km.
 Construct a defensive position: as part of a section, for 6 hr period construct a sangar on the second floor of a building, including lift, lift and carry sandbags.
CONCLUSION: The critical tasks of the RAF Regt have been established. The MOBP and MAS are currently being established for these tasks.

374 Board #195 May 31 9:30 AM - 11:00 AM
Identification and Verification of Critical Physically Demanding Tasks Undertaken by Royal Marines
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The first stage to develop role-related, gender-free Physical Employment Standards (PES) is to identify and describe the physically demanding tasks undertaken in a role. **Purpose:** To identify the essential physically demanding tasks undertaken by Royal Marines (RM). **Methods:** 158 male RM volunteered and data were collected in two parts. Part 1: A facilitated two-day focus group where subject matter experts (SMEs; from ranks of Private to Major) generated a list of essential physically demanding tasks undertaken in the RM role. Part 2: 149 participants (5% of each rank in the incumbent RM force) were presented the SME tasks list and identified if they had completed the task, the task importance (1-6 scale, not applicable - critical) and physical demands (1-6 scale, very light - maximum). **Results:** The focus group participants identified 23 tasks and the task completion rate, importance and physical demands were rated in the survey (Table 1).

Table 1 - RM tasks with survey data [data presented as mode (range)]

TASK DESCRIPTION	COMPLETED THE TASK? (%)	IMPORTANCE (1-6)	PHYSICAL DEMAND (1-6)
Battle Preparation – Moving Stores and Equipment	89	6 (5)	4 (5)
Establish a Company Defensive Position	89	5 (5)	5 (5)
Reconnaissance Patrol from a Harbour Area / Defensive Location	100	6 (2)	4 (6)
Establish an Observation Point (OP) Screen	81	6 (5)	5 (4)
Company Attack	96	6 (4)	5 (4)
Casualty Drag from Point of Wounding to Point of Cover	91	6 (3)	5 (5)
Casualty Evacuation – Fireman’s Carry	97	6 (4)	5 (3)
Casualty Evacuation by Light Weight Stretcher	95	6 (3)	5 (3)
Movement Through Ship With Load	79	5 (5)	4 (5)
Amphibious Transit by Small Craft	83	6 (5)	3 (5)
Re-embark an Offshore Raiding Craft from the beach	97	6 (5)	3 (5)
Vertical Assault	95	6 (5)	5 (5)
Ski March	37	5 (5)	5 (4)
Snow Shoe March	34	5 (5)	5 (3)
Ski-joring (on skis, pulled by vehicle)	30	5 (5)	4 (4)
Long Distance Insertion March	98	6 (5)	5 (5)
Boarding Operations – Surface to Vessel	41	5 (5)	4 (5)
Boarding Operations – HELO to Vessel	42	5 (5)	3 (4)
Barrel Change in a Jackal	30	6 (5)	4 (5)
Lift HMG on to Viking/ Jackal	37	5 (5)	3 (5)
River crossing	98	5 (5)	3 (5)
Ice Breaking	33	5 (5)	4 (5)
Urban Operations	98	6 (5)	4 (5)

Conclusion: The essential physically demanding tasks identified in this study can be used to select those most critical to the RM role, and underpin the development of future relevant role-related PES.

375 Board #196 May 31 9:30 AM - 11:00 AM
The Potential for Sex Bias in Physical Employment Test Design
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 (No relationships reported)

Physical employment tests often simulate job-related tasks. The implementation of such tests can be constrained by cost, ease, and simplicity, which may unintentionally create a sex bias. **PURPOSE:** To investigate potential sex bias in prototype UK Royal Navy (RN) physical employment tests. **METHODS:** One hundred and fifty RN personnel volunteered (men n=75, women n=75). Physical characteristics, mean ± SD were (men vs. women): age 32 ± 8 vs. 29 ± 6 years; stature 1.77 ± 0.06 vs. 1.65 ± 0.05 m; body mass 81.0 ± 10.7 vs. 67.5 ± 9.8 kg. Five tests were developed with cylindrical, sand-filled Powerbags that simulated manual handling tasks performed onboard RN warships. Tests included two variants of an Aft Casualty Carry (35.0 kg and 41.5 kg, 10 m), Fore Casualty Carry (27.0 kg, 10 m), Foam Drum Carry (2 × 21.6 kg, 60 m), and Damage Control Timber Carry (28.4 kg, 50 m). Loads and distances were derived from equipment, infrastructure, Subject Matter Expert opinion, and anthropometric norms. Tests were performed as quickly as possible. A sub-sample

of women (n=19) also performed a modified Aft Casualty Carry test using a *Barbell* (circumference 0.08 m) instead of a *Powerbag* (circumference 0.91 m). Cut-scores were developed for all tests. **RESULTS:** All men (100%) passed all tests. Compared to men the pass rates of women were above 80% in three tests (Fore Casualty Carry (88%), Foam Drum Carry (92%), Damage Control Timber Carry (89%)), but lower than 80% in both Aft Casualty Carry tests (29% 35.0 kg test; 8% 41.5 kg test). The lifting phase accounted for the majority of Aft Casualty Carry failures (49% 35.0 kg test; 77% 41.5 kg test). Within the sub-sample (n=19), 100% of women successfully lifted the *Barbell* Aft Casualty Carry loads, but markedly less lifted the same loads in the *Powerbag* version of the test (58 % and 32 % in the 35.0 kg and 41.5 kg tests, respectively). **CONCLUSIONS:** The larger circumferential girth of the *Powerbag* in the Aft Casualty Carry test was not representative of the anthropometric dimensions of a casualty, and appeared to create a sex bias against women. This highlights the potential risk of sex bias if physical employment test implementation considerations are prioritised above the faithful replication of simulated job-based tasks.

376 Board #197 May 31 9:30 AM - 11:00 AM
Fitness Trumps Gender; Next Fit Soldier Up
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The full integration of women into combat arms & relatively limited force structure demands every Soldier be a premium physical performer. **PURPOSE:** Investigate the role of fitness & gender integration of unit Soldier Performance Index (SPI) scores of a “mock” Airborne unit. **METHODS:** 71 subjects; 69 Airborne men: 26 officers (Rock LT), 43 soldiers (Rock S), 2 selected U.S. Service Academy female cadets (FC); tested on the SPI: Strength: Cadence Pull-ups {CPU}; 155-lb Bench Press {155BP}; Muscular Endurance: 65-lb BP {65BP}; 45-lb Dumbbell Squat {45SQ}; Endurance/Mobility: 2 Mile Run {2MR}; 300-Meter Forward/Backward Run (300M). APFT: (2-Min. Push-ups, Sit-ups, 2MR). Composite scores tabulated SPI scoring, age-gender scoring (APFT). Ten member mock units were created with highest Officer & different combinations of 9 highest Soldiers (HOS), 8 highest soldiers & highest female (H8F) 7 highest soldiers & 2 highest female soldiers (72F), 9 lowest male soldiers (LOS). **RESULTS:** Using SPI as true indicator of robust fitness profile, group affiliations & mean performances revealed HOS as highest physical performance. No significance was found between 3 groups (HOS, H8F, 72F), LOS group was significantly lower (p = .001) versus all 3 former groups. APFT paralleled SPI measure (p = .002). Objectively examining a multitude of physical indices, LOS achieved 78% of HOS, H8F achieved 98.5% of HOS ability & 72F achieved 96.7% HOS ability. Importantly H8F & 72F had only mean 80.7% of strength ability of HOS group. FC were only 68.4 % of SPI ability of the mean Rock LT group yet 17.6% greater ability than Rock LT group on APFT. **DISCUSSION:** Universal indicators of fitness, (i.e. SPI) are more critical to predicting performance in ground combat units than gender as a single variable. SPI indicated 2 FC were 19.1% higher than 9 LOS, however related to strength (155BP), the fit FC had 0 reps compared to mean of 5.2 reps for the LOS. APFT, devoid of a strength measure, indicates FC to be 29.4% greater than LOS. **CONCLUSIONS:** In physical performance of ground combat units, SPI is more illuminative than either gender or current APFT. Integration of Airborne units should be based on an index similar to the SPI; minimally, the index should include valid measures of endurance, mobility & perhaps most importantly a strength metric.

377 Board #198 May 31 9:30 AM - 11:00 AM
Gender Differences in British Army Infantry Representative Military Task Performance
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 (No relationships reported)

British Army Infantry personnel must currently pass three Representative Military Tasks (RMTs) at the of end training: (1) A Loaded March (LM; 12.8 km, carrying 25 kg, <2 h); (2) A Jerry Can Carry (JCC; two 20 kg jerry cans for 150 m); and a Single Lift (SL; 40 kg Powerbag™ from the floor on to a 1.45 m platform). Female personnel have not previously been permitted to serve in Infantry roles in the British Army. Therefore, differences in RMT performance between serving male and female British Army personnel to an Infantry standard have not been examined. **Purpose:** To evaluate differences in RMT performance between male and female British Army personnel to an Infantry standard. **Methods:** 135 participants [48 female (age; 27 ± 5 y; body mass; 66.5 ± 8.4 kg; 2.4 km run time 11:11 ± 01:01 min:s) and 87 male (age; 25 ± 4 y; body mass; 78.8 ± 10.1 kg; 2.4 km run time 09:43 ± 00:42 min:s)] completed two sessions separated by at least 7 days. Session 1: Height, body mass, and body composition measured using dual energy X-ray absorptiometry (DXA). Participants

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also completed the SL and JCC RMTs and a 2.4 km run to an individual best effort. Session 2: Participants completed a 12.8 km LM carrying 25 kg (6.4 km paced in 60 min and 6.4 km individual best effort). Participants wore a heart rate monitor during all physical tests. Differences between genders were compared using independent sample t-tests. Data are presented as the mean \pm SD and significance set at $p < 0.05$. **Results:** Compared to female participants, male participants had faster 2.4 km run times ($p < 0.01$), greater body mass ($p < 0.01$), greater total lean body mass ($p < 0.01$), higher SL scores ($p < 0.01$), achieved greater JCC distances ($p < 0.01$) and faster LM times ($p < 0.01$). All male participants and 13 % of female participants achieved the Infantry standard across all three RMTs. A greater proportion of male compared to female participants achieved the Infantry RMT standards for the SL (97 vs 15 %), Carry (99 vs. 58 %) and LM (100 vs. 83 %). **Conclusion:** Male personnel had higher RMT performance scores than females, however some women outperformed the men. The greatest gender differences in meeting Infantry RMT pass standards was for the SL. Therefore, future physical training programmes to support female personnel to meet Infantry RMT standards should focus on developing muscle strength.

378 Board #199 May 31 9:30 AM - 11:00 AM
Sex Differences in Training Load During British Army Phase One Training

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The initial weeks of British Army Phase One training are characterised by unaccustomed exercise and rapid increases in training load. Quantifying training load can aid in managing fatigue and minimising the risk of developing illness and injury whilst maximising training adaptation. Women are at increased risk of musculoskeletal injury during British Army Phase One training compared to men, however the differences in absolute external and relative internal training loads between sexes during the first few weeks of training is unknown. **PURPOSE:** Quantify the sex differences in external (distance and speed) and internal (ratings of perceived exertion [RPE] and heart rate [HR]) training loads during the first two weeks of British Army Phase One training. **METHOD:** Following completion of an initial medical assessment, 26 female (21 \pm 4 yrs, 61.8 \pm 8.4 kg, 1.64 \pm 0.05 m, 12:29 \pm 1:01 min 1.5 mile run time) and 24 male recruits (22 \pm 4 yrs, 77.6 \pm 9.7 kg, 1.78 \pm 0.08 m, 10:30 \pm 1:03 min 1.5 mile run time) were fitted with a combined HR and GPS device (Polar Team Pro, Polar Electro Oy, Finland) and monitored during waking hours (06:00 – 22:00 hrs) for the first 10 days of training. Daily self-reported RPE, muscle soreness and fatigue (all 0-10) were recorded. Independent samples t-tests were conducted to examine sex differences. **RESULTS:** Male recruits covered significantly more distance per day than female recruits (13.31 \pm 0.83 km vs. 10.85 \pm 0.70 km, $P < .001$) and at a greater mean speed (0.88 \pm 0.05 km·h⁻¹ vs. 0.74 \pm 0.03 km·h⁻¹, $P < .001$). Mean % HR reserve (%HRR) and RPE were not significantly different between men and women (%HRR: men 31 \pm 3 vs. women 32 \pm 4, RPE: men 4 \pm 1 vs. women 4 \pm 1). However, female recruits reported significantly greater physical fatigue (men: 4 \pm 1, women: 6 \pm 2, $P < .001$) and muscle soreness (men: 4 \pm 1, women: 5 \pm 2, $P < .05$). **CONCLUSION:** Despite a lower absolute external training load and similar internal training loads, women reported greater fatigue and muscle soreness, which could be linked to a higher injury risk. Future work should examine the links between fatigue and muscle soreness with injury risk during the first few weeks of initial military training.

This research has been sponsored by the UK MOD (Army).

379 Board #200 May 31 9:30 AM - 11:00 AM
Diurnal Pattern of Salivary C-Reactive Protein and Associations with Biobehavioral Correlates in Military Men

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C-reactive protein (CRP), a systemic inflammatory biomarker, is positively associated with the development of disease and inversely correlated with regular physical activity. CRP has been previously reported to have a diurnal rhythm with higher levels upon awakening and lower levels thereafter.

PURPOSE: To characterize the pattern of salivary CRP and evaluate associations with sedentary and active behaviors in U.S. Navy men. **METHODS:** Healthy, active duty men ($n = 17$; mean \pm SD age = 36.1 \pm 6.0 yr) self-collected samples in a free-living setting using oral swabs on 2 consecutive workdays at Wake, Wake + 30 min, Wake + 60 min, 1600, and 2100 for a total of 10 samples. Following our prior published study, CRP variables and summary parameters were computed. Stability across both days was evaluated via Pearson product-moment correlational analyses. Stable measures

were then correlated to self-reported percent time (%time) spent sedentary, or active, in a typical workday for the previous week. Three non-responders, defined as having an absolute reactivity (AR) > 0 , were excluded from analyses. **RESULTS:** Stability was high between both days at all time points (r value range = .75-.92, all $p \leq .001$). CRP was highest at Wake, decreased on average by 42.8 \pm 5.7% at Wake + 30, and then plateaued for the rest of the day. The stabilities of Wake mean ($r = .89$, $p < .001$) and AR [(Wake + 30) - Wake], a measure of CRP pattern ($r = .48$, $p = .053$), were determined. Mean \pm SE of Wake mean was 12,460 \pm 3968 pg/mL and AR was -8298 \pm 3123 pg/mL. Wake mean was strongly associated with %time walking ($r = -.57$, $p < .01$). Wake mean also showed an intuitive yet nonsignificant positive association with %time sitting, and a negative association with both %time standing and %time performing heavy labor. Hypothesized associations between %time and AR were not performed due to the borderline stability of AR. **CONCLUSIONS:** In a military population, the salivary CRP pattern was described as diurnal with robust stability across 2 consecutive days. The negative correlation between Wake mean and %time walking suggests that walking is a powerful modality to reduce systemic inflammation. Subsequent analyses will comprehensively characterize the CRP pattern (area under the curve and other summary parameters) and evaluate additional biobehavioral correlates.

380 Board #201 May 31 9:30 AM - 11:00 AM
The “Yin and Yang” of the Adrenal and Gonadal Systems in Elite Military Men

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We recently established daily, free-living profiles of the adrenal hormone cortisol (Cort), the (primarily adrenal) anabolic precursor dehydroepiandrosterone (DHEA), and the (primarily gonadal) anabolic hormone testosterone (Testo) in elite military men. A prevailing view is that adrenal and gonadal systems reciprocally modulate each other; however, recent paradigm shifts prompted the characterization of these systems as parallel, cooperative processes (i.e., the “positive coupling” hypothesis). **PURPOSE:** To test the positive coupling hypothesis in elite military men by evaluating associations between adrenal and gonadal biomarkers across the day. **METHODS:** Fifty-seven healthy, active duty men (mean \pm SE age = 33.4 \pm 1.0 yr) self-collected salivary hormone samples in a nondeployed, free-living setting on two consecutive midweek workdays upon waking, +30 min, +60 min, 1600, and 2100 (10 samples total). Hypotheses were tested using correlational and linear regression models. **RESULTS:** DHEA was positively coupled with Cort (r range: 0.28 - 0.30, all $p < .05$) as was Testo (r range: 0.43 - 0.59, all $p < .01$). Anabolic processes (i.e., DHEA, Testo) were also positively and reliably coupled across the day (r range: 0.31 - 0.39, all $p < .05$). In multivariate models, DHEA and Cort combined to account for 27 - 43% variance in Testo across the day, which was driven primarily by DHEA. DHEA and Testo modestly and less robustly predicted Cort concentrations; this was confined to the morning (area under the curve, ground F(3,51) = 2.9, $p < .05$), and Testo was the primary predictor ($\beta = 0.38$, $p < .05$). **CONCLUSION:** To our knowledge, this is an unprecedented test of the positive coupling hypothesis in elite military men, a group at an elevated risk for chronic stress exposure. This study showed that adrenal and gonadal systems were positively coupled. Altogether, top-down co-activation of adrenal and gonadal hormone secretion may complement bottom-up counter-regulatory functions to foster anabolic balance and neuronal survival; hence, the “yin and yang” of adrenal and gonadal systems. This may be an adaptive process that is amplified by stress, competition, and/or dominance hierarchy.

381 Board #202 May 31 9:30 AM - 11:00 AM
Vitamin D Supplementation Augments SlgA Secretion Rates in Marine Corps Basic Trainees

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BACKGROUND: Vitamin D has been implicated in modulating innate immunity and may confer protection against upper respiratory tract infections (URTIs) during periods of arduous training. **PURPOSE:** Determine whether vitamin D status in Marine Corps basic training recruits is associated with URTIs, and whether daily vitamin D supplementation decreases the incidence of URTIs as a result of augmented innate immunity. **METHODS:** A double-blind RCT was conducted with male and female recruits entering Marine Corps basic training. Subjects were randomized to

either 1000 IU vitamin D₃ d⁻¹ (n=73) or placebo (n=76) for 12-weeks. At baseline, weeks 4, 8 and 12 (post-training) subjects provided saliva samples (passive drool) to determine secretory immunoglobulin A secretion rates (SIgA-SR) by indirect ELISA. The incidence of URTIs was assessed by administering a survey at weeks 4, 8 and 12. Serum vitamin D status (25(OH)D) was measured by radioimmunoassay. Longitudinal linear models were created using a simple-effects model to estimate symptoms. To determine whether supplementation altered SIgA-SR during training, a two-way repeated measures ANOVA was used. **RESULTS:** The proportion of recruits reporting URTI symptoms at any time during training was 72%. Baseline SIgA-SR were similar between placebo (65.4 ± 52.0 μg·min⁻¹) and vitamin D groups (51.9 ± 41.9 μg·min⁻¹). The relative changes in SIgA-SR were significantly greater with vitamin D supplementation at weeks 4 (5.1 ± 29.8%) and 8 (12.3 ± 31.0%) compared to placebo at the same time points (week 4; -6.5 ± 22.9% and week 8; 1.3 ± 22.9%), *p* = 0.001. Baseline 25(OH)D was significantly lower during winter (59.2 ± 22.5 nmol·L⁻¹) compared to summer (80.4 ± 21.0 nmol·L⁻¹), *p* < 0.001. When accounting for treatment, season and sex, there was no association between 25(OH)D and reported URTIs. **CONCLUSION:** We report that a high proportion of Marine Corps recruits experience URTIs during 12-weeks of basic military training, and although daily vitamin D supplementation led to a modest increase in SIgA-SR, this did not result in a reduction in the incidence of reported URTIs. Supported by the Defense Health Program. The views expressed are those of the authors and do not reflect the official position of the Uniformed Services University, United States Army, or United States Department of Defense.

A-50 Free Communication/Poster - Muscle and Mitochondria

Wednesday, May 31, 2017, 7:30 AM - 12:30 PM

Room: Hall F

382 Board #203 May 31 11:00 AM - 12:30 PM Alterations of Mitochondrial Dynamics Proteins in Primary Human Myotubes Following Roux-en-Y Gastric Bypass Surgery

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Mitochondrial dynamics including mitochondrial fission (e.g., Dynamin-related protein 1 (Drp1) and Fission 1 (Fis1)) and fusion (e.g., Mitofusin 2) regulates mitochondrial homeostasis. Defects in mitochondrial dynamics are suggested to contribute to skeletal muscle mitochondrial dysfunction and insulin resistance associated with obesity and Type 2 Diabetes. Roux-en-Y gastric bypass (RYGB) surgery markedly improves metabolic health as indicated by enhanced substrate oxidation and insulin action in skeletal muscle. However, the underlying cellular mechanisms responsible for these improvements are not clear and could possibly be due to the improvement of mitochondrial dynamics. **PURPOSE:** The purpose of this study was to determine whether RYGB surgery improves mitochondrial dynamics proteins in primary human myotubes derived from severely obese humans. **METHODS:** Primary human skeletal muscle cells were isolated from muscle biopsies obtained from six lean subjects (BMI = 23.4 ± 0.6 kg/m²) and six RYGB patients prior to, 1-month and 7-months after surgery (BMI = 50.2 ± 2.0, 43.2 ± 2.8 and 35.7 ± 2.2 kg/m², respectively) and were differentiated to myotubes. On day 7 of differentiation, myotubes were harvested for immunoblot analysis in order to assess the expressions of mitochondrial dynamics proteins. **RESULTS:** Before surgery, Drp1 Ser⁶¹⁶ phosphorylation and Fis1 protein expression were significantly higher in primary myotubes derived from severely obese patients when compared to lean controls (41% and 26%, respectively, *P* < 0.05). While there were no significant improvements at 1-month post-surgery, Drp1 Ser⁶¹⁶ phosphorylation and Fis1 protein expression were significantly decreased in primary myotubes from severely obese humans at 7-months post-surgery (Pre vs. 7-months post: 0.046 ± 0.004 vs. 0.035 ± 0.003; 0.023 ± 0.008 vs. 0.014 ± 0.003 AU; respectively, *P* < 0.05), and not statistically different from lean controls. However, MFN2 protein expression did not change in primary myotubes derived from severely obese patients at any timepoint post-surgery in comparison to pre-surgery. **CONCLUSION:** These data suggest that RYGB surgery reduces obesity-induced rise in mitochondrial fission, but not fusion, protein expression in primary human myotubes derived from severely obese humans.

383 Board #204 May 31 11:00 AM - 12:30 PM Osteocalcin Does Not Increase Insulin Sensitivity or Mitochondrial Biogenesis in Palmitate Treated C2C12 Myotubes

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PURPOSE: Osteocalcin (OC) is a bone matrix protein that has been shown to regulate systemic glucose homeostasis and increase mitochondrial mass in mice fed a high-fat diet, however the mechanisms by which OC stimulates metabolic adaptations in lipid overloaded muscle remain underexplored. This study examined the effects of OC on regulators of insulin signaling, glucose handling, and mitochondrial biogenesis *in vitro* using palmitate treated C2C12 myotubes.

METHODS: C2C12 myotubes were treated with control media, or media containing undercarboxylated OC (100ng/ml) both with and without 2mM palmitate-BSA conjugate (PA+OC and PA, respectively) for 24 hours. Insulin signaling (IRS-1, pIRS-1, Akt, pAkt, and PTP1B), glucose handling (GLUT-4 and AS160) and mitochondrial biogenesis (PGC-1α and Citrate Synthase) were measured via western blot. One-way ANOVAs with Tukey's post-hoc tests performed to determine between treatment differences.

RESULTS: IRS phosphorylation and PTP1B protein content remained unchanged. Surprisingly, phosphorylation of Akt significantly increased (52% ± 33%) with PA+OC compared to OC. Additionally, GLUT4 content decreased significantly in all treatments (≥50%) compared to control with no differences between the treatments. GLUT4 regulator AS160 was significantly elevated (300% ± 158%) following PA+OC compared to OC. No changes in PGC-1α or Citrate Synthase protein content were observed.

CONCLUSIONS: Overall, treatment with OC was unable to improve markers of insulin signaling and mitochondrial biogenesis in palmitate-treated C2C12 myotubes. Moreover, GLUT4 content and possibly translocation may be negatively affected by OC treatment in PA-treated cells.

384 Board #205 May 31 11:00 AM - 12:30 PM MKP-5 Establishes Skeletal Muscle Metabolic Quiescence by Negatively Regulating MAPK-dependent Mitochondrial Function

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Purpose: The mitogen-activated protein kinases (MAPKs) represent a central signaling pathway in the regulation of skeletal muscle function. It is also known that MAPKs are required to promote mitochondrial biogenesis in skeletal muscles. Mitochondrial dysfunction underlies numerous diseases including those of skeletal muscle. The MAPKs are negatively regulated by MAPK phosphatases (MKPs). We have demonstrated that MKP-5 regulates regenerative myogenesis and rescues muscle degeneration by inactivating and dephosphorylating both p38 MAPK and JNK. However, the physiological and molecular roles of MKP-5 in regenerative myogenesis and progression of skeletal muscle degeneration have remained unclear. We tested the central hypothesis that MKP-5 regulates mitochondrial function and thus contributes to enhanced myogenesis and regeneration in mice lacking MKP-5. **Methods:** To test our hypothesis, we induced skeletal muscle damage by cardiotoxin (CTX) injection into both *mkp-5^{+/+}* and *mkp-5^{-/-}* mice. Mitochondrial respiratory function in permeabilized muscle fibers was assessed in regenerating skeletal muscles from *mkp-5^{+/+}* and *mkp-5^{-/-}* mice. Mitochondrial biogenesis was determined by quantitative PCR for mRNA. The amount of mitochondrial DNA (mtDNA) copy number was also quantified by qRT-PCR. **Results:** Our data show that MKP-5-deficient mice exhibited 49% enhanced ADP-stimulated mitochondrial respiratory function in regenerative skeletal muscle compared with *mkp-5^{+/+}* mice (*P* < 0.05). Furthermore, expression of genes associated with mitochondrial biogenesis such as PGC1-α, NRF-1, Tfam, and subunits of complex I were significantly increased in regenerating skeletal muscles of animals lacking MKP-5. The amount of mitochondrial DNA copy number was also significantly increased in *mkp-5^{-/-}* mice, compared with *mkp-5^{+/+}* mice (*P* < 0.001). **Conclusions:** Collectively, these results demonstrate that MKP-5 negatively regulates mitochondrial function and biogenesis in skeletal muscle during myogenesis and regeneration.

385 Board #206 May 31 11:00 AM - 12:30 PM
Mitochondria Content In Rat Ankle Extensor Muscles Following Chronic Endurance Exercise

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 (No relationships reported)

Endurance exercise studies involving animals typically measure muscle mitochondria content to verify intensity of training. Most use one of the three calf ankle extensor muscles, which vary in fiber type. The soleus is all slow twitch fibers (SO) while the plantaris and gastrocnemius are a mixture of fast twitch glycolytic (FG) and fast oxidative glycolytic (FOG) fibers. **PURPOSE:** To compare mitochondria content changes in the soleus, plantaris, and gastrocnemius in response to a widely used moderate intensity exercise program. **METHODS:** Male, 8-wk-old, Sprague-Dawley rats were divided into two groups: sedentary (S) and exercised (E) on a treadmill 5 d/wk for 6 wks. Exercise duration and intensity were progressively increased to 1 hr at 30 m/min up a 10.5% incline (75-80% VO₂max). Whole muscles plus specific FG and FOG regions of gastrocnemius were homogenized (9-10 for each muscle or fiber type) and cytochrome c oxidase activity, a marker of mitochondria content, was determined using a Clark-type oxygen electrode. **RESULTS:** E significantly increased cytochrome c oxidase compared to the same S muscle (P<0.05) and the amount of increase was similar for all muscles (P>0.05). On a relative basis (% above mean S value), the increases were 60.7 ± 13.3 (mean ± standard error) in soleus, 72.3 ± 6.8 in plantaris, and 78.7 ± 12.4 in gastrocnemius. On an absolute basis (μMol O₂ consumed/min/gram muscle), the increases were 28.5 ± 6.3 in soleus, 35.0 ± 3.3 in plantaris, and 25.7 ± 3.8 in gastrocnemius. E was also greater than S in all fiber types considered (P<0.05), but there were considerable differences in the amount of increase. On a relative basis (%), the increase in FOG fibers (115.5 ± 17.0) was significantly greater (P<0.05) than those in SO (60.7 ± 13.3) or FG (42.8 ± 12.0). On an absolute basis, all fibers differed from each other with FOG increasing the most and FG the least (P<0.05). Specifically, FOG increased by 53.4 ± 7.9, SO by 28.5 ± 6.3, and FG by only 5.1 ± 1.4. **CONCLUSION:** All three whole muscles increase by similar amounts in response to a moderate intensity (75-80% VO₂max) exercise program, thus all are appropriate for verifying training status. Caution is advised when using small portions of plantaris and gastrocnemius because of differences in responses of FOG and FG fibers. Supported by UNCG School of HHS Research Excellence Grant

386 Board #207 May 31 11:00 AM - 12:30 PM
Myokine/Cardiokine Follistatin-like Protein 1 Promotes Oxidative MyHC Expression and Mitochondrial Function in Myogenic Cells

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Myokine/Cardiokine Follistatin-like Protein 1 Promotes Oxidative MyHC Expression and Mitochondrial Function in Myogenic Cells

Follistatin-like Protein 1 (FSTL1) is a glycoprotein secreted by cardiac and skeletal muscle tissues under stressful 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 various myogenic cells. **METHODS:** 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 amplify each fiber type-associated myosin heavy chain isoforms. Oxygen consumption of intact cells were measured using a Clark-type oxygen sensor; and mitochondrial respiration was measured using Seahorse XF96 analyzer. **RESULTS:** During canine 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 MyHC7 expression (~1.5 fold) in myotubes treated with FSTL1 during differentiation compared to non-treated myotubes. Acute FSTL1 treatment (up to 500 ng/ml) had no significant effect on mitochondrial respiration in canine myoblasts. Acute FSTL1 treatments (250 ng/ml) significantly increased mitochondrial respiration in L6 myotubes (~1.5 fold) and human rhabdomyosarcoma cells. Chronic FSTL1 treatments (250 ng/ml, 64 hours) significantly increased oxygen consumption in intact canine myoblasts and myotubes. **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 of the beneficial effects of exercise in the context of skeletal muscle adaptation. Supported by NIH Grant RO1 HL133248

387 Board #208 May 31 11:00 AM - 12:30 PM
Exercise Preconditioning Improves Mitochondrial Morphology and Function in Rat Loubus Fromatis after Heavy Exercise

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Our previous work has demonstrated that exercise preconditioning can ameliorate the apoptosis in Loubus Fromatis of rats induced by one-time heavy exercise. **PURPOSE:** To investigate whether exercise preconditioning affects the morphology and function of mitochondria by influencing the expression of dynamin-related protein 1(Drp1) and mitofusin 2(Mfn2) in rat loubus fromatis following an acute heavy load exercise. **METHODS:** Thirty-six male Sprague-Dawley rats were randomly assigned into a control group (C, n=12), an exercise group (E, n=12) and an exercise preconditioning group (EP, n=12). Groups C and E received conventional feeding for four weeks, and then group E completed a one-time heavy load swimming exercise; group EP received feeding and swimming training for four weeks, 60 min/day, 6 days/week, and also completed a one-time heavy load swimming. Some indicators were detected, such as the apoptosis index (AI), the mRNA of Drp1 and Mfn2, index related to the function of mitochondrial respiratory chain (ATP, ADP/O, V3, V4, RCR, OPR). The experimental data are reported as means±SE, and P values<0.05 were considered significant. **RESULTS:** According to the TUNEL test, the apoptosis index (AI) (C:0.06±0.01; EP:0.58±0.17; E:0.89±0.16; respectively, P<0.05) were significantly elevated after heavy load exercise, mRNA of Mfn2 (C:0.25±0.09; E:0.95±0.08; EP:1.24±0.07; respectively, P<0.05) and Drp1 (C:0.34±0.08; EP:1.23±0.14; E:1.35±0.07; respectively, P<0.05) were also increased. However, the ATP content, ADP/O, RCR, V3 and OPR of the loubus fromatis were significantly lower in group E and EP than C (P<0.05), and those index in Group EP were higher than Group E (P<0.05) indicates that the function of mitochondrial respiratory chain in Group EP are better after carrying out an acute heavy load exercise. **CONCLUSIONS:** Results from this study suggest that one-time heavy load swimming can induce cell apoptosis in rat loubus fromatis by increasing the expression of Drp1. Four weeks of exercise preconditioning can ameliorate the apoptosis and the function of mitochondrion via increasing the expression of Mfn2. Supported by the SML of General Administration of Sport of China/SML of Sichuan province Foundation.

A-51 Free Communication/Poster - Nutrition and Athletes

Wednesday, May 31, 2017, 7:30 AM - 12:30 PM
 Room: Hall F

388 Board #209 May 31 11:00 AM - 12:30 PM
Energy Balance During A Self-sufficient, Multistage Ultramarathon: a Case Study

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For optimal performance, endurance athletes are recommended to ingest sufficient energy to maintain energy balance (EB) and ensure adequate energy availability (EA). **PURPOSE:** Describe and evaluate the EB of an athlete competing in a self-sufficient, multistage ultra-marathon (SSMU). **METHODS:** A male endurance athlete (Age 35 yrs; Ht 183.0 cm; Body mass 78.4 kg; VO₂max 66 ml/kg/min) volunteered to take part in this observational case study prior to competing in the Marathon des Sables 2016. The participant self-reported energy intake (EI) by reviewing his dietary plan after each of the five competitive event stages. The food diary was used to calculate energy and macronutrient intake using dietary analysis software. Basal metabolic rate (BMR) was estimated prior to the MdS based on fat free mass. Distance and moving speed were recorded using a GPS device (Garmin Forerunner 920XT) throughout the race. Exercise energy expenditure (EEE) was calculated using the GPS device algorithm. Total energy expenditure (TEE) was calculated by adding the participant's RMR to

the recorded EEE. EB was calculated by subtracting IE from TEE. EA was calculated as follows: EI - EE / fat free body mass. RESULTS: Mean daily EI was 2946 ± 358 kcal (38 ± 4.6 kcal/kgBM/day). Mean daily EEE was 3006 ± 1030 kcal (62 ± 13 kcal/kgBM/day). This resulted in a total energy deficit of 9609 kcal with a mean daily energy deficit of 1922 ± 952 kcal/day. Mean EA was -0.97 ± 15.4 kcal/kg/FFM/d. The participant did not report any subjective feelings of hunger at any point during the event. CONCLUSIONS: The athlete was unable to consume enough food/fluid to meet estimated energy requirements during all five days of the SSUM, resulting in sub optimal EA and EB throughout the event. Relying on subjective perception of hunger to modulate energy intake is not an effective strategy during a SSMU. Athletes competing in a SSUM are likely to benefit from a strategic diet plan to minimise daily energy deficit and maximise performance.

389 Board #210 May 31 11:00 AM - 12:30 PM
Nutrition Education Improves Nutrition Knowledge, Not Dietary Habits In Female Collegiate Distance Runners

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(No relationships reported)

BACKGROUND. In order to meet the physical demands of training for and competing in sports, athletes need to fuel their body adequately on a daily basis. Previous research, however, has indicated that the dietary habits of athletes are often insufficient regarding total energy and carbohydrate intake. Furthermore, athletes often do not know what or how much food they should eat in order to meet the nutritional demands of their sport. **PURPOSE.** The purpose of this study was to assess the effect that nutrition education focusing on total energy, carbohydrate, fat, and protein requirements has on the nutrition knowledge and dietary intake of female collegiate distance runners. **METHODS.** Eleven female collegiate Division II cross-country runners (age: 19.4 ± 1.1 years, mass: 56.65 ± 4.90 kg, height: 163.50 ± 5.22 cm) completed a nutrition knowledge for athletes survey consisting of 10 background information questions and 76 true/false statements and recorded a 3-day diet record prior to the start of the intervention. Participants were then presented with four 1-hour nutrition education sessions covering energy balance, carbohydrates, proteins, fats, and hydration. After the nutrition education intervention, participants completed the same nutrition knowledge survey and 3-day diet record. **RESULTS.** The nutrition education sessions increased (P<0.05) the participants' correct answers on the nutrition knowledge survey regarding dietary carbohydrate (45.5 ± 24.5% vs. 68.2 ± 29.8%), fat (57.6 ± 21.6% vs. 72.7 ± 20.1%) and protein (76.6 ± 9.6% vs. 93.5 ± 9.8%) intake (for pre vs. post, respectively). Although the participants were not meeting recommendations regarding total energy and carbohydrate intake before the nutrition education sessions, there were no changes in dietary composition following the nutrition education sessions. **CONCLUSION.** The present data are in agreement with previous findings indicating that enhanced nutrition knowledge does not always translate to enhanced dietary practices, even when improved dietary practices could result in improved sports performance.

390 Board #211 May 31 11:00 AM - 12:30 PM
In Race Nutritional Strategies Comparing Ironman Wisconsin Athletes to Ironman World Championship Athletes

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PURPOSE: The purpose of the current investigation was to compare the nutritional plans of Ironman Wisconsin athletes to elite Ironman World Championship athletes and to determine if differences exist between the two groups. **METHODS:** Athletes competing in Ironman triathlons were surveyed at Ironman Wisconsin (N=73) and the Ironman World Championships (N=79) to determine their in-race nutrition plans. Unpaired t-tests were run to examine the differences in overall finish time, calories consumed per hour on the bike, fluid consumed while biking, and caffeine consumption during the biking portion of the race. **RESULTS:** Athletes participating at the Ironman World Championships consumed significantly more (p < .01) calories per hour on the bike compared to Wisconsin Ironman athletes (299.9 kcal +/- 126.6; 239.5 kcal +/- 130.5, respectively). Ironman World Championships athletes consumed significantly (p < .01) more fluid on the bike compared to Wisconsin Ironman athletes (3827 mLs +/- 1693; 3327 mLs +/- 1874, respectively). Ironman World Championship athletes consumed significantly more (p < .01) caffeine while biking in comparison to Ironman Wisconsin athletes (110.7 mg +/- 172; 65.9 mg +/- 100.8, respectively). **CONCLUSIONS:** Ironman World Championships athletes consumed higher amounts of calories per hour, fluid, and caffeine during the bike in comparison to the Ironman

Wisconsin athletes. This suggests that elite Ironman athletes consume more calories, caffeine, and fluids during their races when compared to average Ironman athletes, and hence increased calorie and caffeine consumption may contribute to faster performances for the elite athletes.

391 Board #212 May 31 11:00 AM - 12:30 PM
Vitamin D Awareness and Intake in Collegiate Athletes

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Approximately 56% of athletes worldwide are vitamin D deficient which may negatively influence health and physical performance. Lack of knowledge about the importance of vitamin D may be contributing to the high prevalence of deficiency. **PURPOSE:** To assess vitamin D awareness in NCAA athletes and examine its association with total dietary vitamin D intake. **METHODS:** 52 women (mean ± SD: age = 20.0 ± 1.5 yr, 4 cross country, 4 golf, 8 hockey, 14 soccer, 6 softball, 8 swim and dive, 6 track and field, 2 tennis) and 29 men (age = 22.1 ± 1.9 yr, 4 baseball, 3 cross country, 9 football, 1 swim and dive, 7 track and field, 5 tennis) competing at the University of North Dakota completed an online survey between November 1, 2015 and January 30, 2016. Vitamin D awareness was assessed using five vitamin D-specific questions related to the following: 1) familiarity with vitamin; 2) concern about levels; 3) risk of deficiency; 4) importance for health; and 5) importance for physical performance. Responses were scored using a 5-point Likert Scale. Total dietary vitamin D intake was assessed using the vitamin D-specific Diet and Lifestyle Questionnaire. Spearman's rank order correlation coefficients were used to evaluate the association between Likert scores for each awareness question and total dietary vitamin D intake. **RESULTS:** Overall, 21% of athletes reported "rarely" hearing anything about vitamin D. The majority of athletes responded that vitamin D "probably" or "definitely" will play a role in their health (88.9%) and physical performance (71.6%). However, only 23.4% and 28.4% of athletes reported concern for their vitamin D levels or believed they were at risk for deficiency, respectively. The RDA for vitamin D was met by 30% of women and 62% of men. Familiarity with vitamin D in women (r = 0.33, p = 0.02) and concern about vitamin D levels in men (r = 0.45, p = 0.02) were positively associated with total dietary vitamin D intake. **CONCLUSIONS:** The majority of collegiate athletes believed vitamin D plays a role in their health and physical performance; however, most expressed low concern for their vitamin D levels. Increased familiarity with vitamin D and concern for vitamin D levels were associated with increased total intake of vitamin D, and thus, interventions addressing these factors could reduce the prevalence of vitamin D deficiency in athletes.

392 Board #213 May 31 11:00 AM - 12:30 PM
Food Servings Habitually Ingested By Mexican Varsity Athletes Depending On The Type Of Sport

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(No relationships reported)

Several studies have reported the macronutrient intake in different types of sports, however, the type and amount of food that is needed for achieve these quantities is not commonly reported. **PURPOSE:** To describe the habitual amount of food servings ingested in varsity athletes depending on the type of sport performed. **METHODS:** 365 varsity athletes were polled. They were asked about their habitual food intake by trained nutritionists using a food frequency questionnaire. This includes 75 common local foods divided in 9 food groups (Table 1). Each athlete described how many days per week he/she usually ate each food and the usual amount they consume in those days. Then the servings' amount were calculated for each food weekly and a total weekly servings per food group as a daily average was calculated. Servings' size were determined according to the Mexican System for Equivalent Foods. The sample was divided by the type of sport as team (soccer, basketball, baseball, volleyball, handball, n= 184) or individual (weightlifting, tennis, athletics, wrestling, gymnastics, karate, taekwon-do, judo, n=181). For each group, the servings' amount were analyzed as quartiles. **RESULTS:** Analyzing the 50th centile, cereals were the most consumed food group, followed by animal source foods (ASF) and fats. Legumes were the less consumed food group (50th centile: 0 servings; 75th centile: 1 serving) and wasn't included in the table. Foods had a very similar amount of servings per group per type of sport.

CONCLUSIONS: In our population, the amount of food servings commonly ingested by varsity athletes were very similar between these two types of sport classification. These data could help as a reference for comparing the habitual amount of food serving's ingested (25th to 75th centile) in different types of sports.

Table 1. Amount of food servings ingested per type of sport.

Food group	Quartile					
	25th		50th		75th	
	Team	Individual	Team	Individual	Team	Individual
Cereals	8	9	10	13	16	16
ASF	5	6	7	8	10	12
Fats	4	4	6	7	9	10
Fruits	3	3	5	5	8	8
Dairy	2	2	3	4	5	5
Veggies	2	2	3	3	4	4
Sugars	2	2	3	3	5	5
Seeds	0	0	1	1	2	2

393 Board #214 May 31 11:00 AM - 12:30 PM
Amount Of Food Servings By Food Group Commonly Ingested In Mexican Varsity Athletes

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There is huge evidence regarding the macronutrient intake in athletes, however there is little research about the food groups and amount of food servings ingested by athletes. **PURPOSE:** To describe the habitual amount of food servings by food group ingested in male and female varsity athletes.

METHODS: 365 (206 males, 159 females) varsity athletes were evaluated anthropometrically and for dietary habits. They were asked about their habitual food intake by trained nutritionists using a food frequency questionnaire, which includes 75 common local foods divided in 9 food groups (Table 1). Each athlete described how many days per week he/she usually ate each food and the usual amount they consumed on those days. The servings' amount were calculated for each food weekly as a total weekly servings per food group, finally a daily average was calculated. Servings' size were determined according to Mexican System for Equivalent Foods. The sample was divided by sex and then the servings were calculated as quartiles.

RESULTS: Subjects' age, body weight and stature were 21 ±2 and 21 ±2 years old, 76 ±15 and 61 ±11 kg, 177 ±7 and 163 ±7 cm, for males and females respectively. Considering the 50th centile, the most ingested food groups were cereals, animal source foods (ASF) and fats. The less consumed food group was legumes (its quartile analysis revealed 0 serving/day at the 50th centile and 1 servings at 75th centile). Veggies group were repetitive in centile 25th and 50th in male athletes.

CONCLUSIONS: Male and female varsity athletes had the same pattern of food intake, but in different amount. Further research is needed for assessing if these servings are enough to achieve the macronutrient daily needs.

Table 1. Amount of food servings habitually ingested by male and female varsity athletes.

Food group	Quartile					
	25		50		75	
	Males	Females	Males	Females	Males	Females
Cereals	10	7	14	9	19	12
ASF	6	5	9	6	12	9
Fats	4	4	7	6	9	10
Fruits	3	3	6	4	8	7
Dairy	2.5	2	4	3	6	4
Sugar	2	2	4	3	6	4
Veggies	2	2	2	3	4	4
Seeds	0	0	1	1	2	2

394 Board #215 May 31 11:00 AM - 12:30 PM
Dietary Characteristics In Medalist Versus No Medalist Varsity Combat Ahtletes

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Nutrition is an important factor for achieving sports success. Some dietary characteristics could lead to sporting advantage. Therefore, analyzing the dietary characteristics of successful athletes could help to better understand their nutritional practices that lead them to an advantage over their competitors.

PURPOSE: To compare the dietary characteristics between medalist and non-medalist varsity combat athletes.

METHODS: The nutritional characteristics of 58 varsity combat (wrestling, judo, karate, tae-kwon-do) athletes were evaluated one month before a national collegiate sport tournament. After the tournament, subjects were classified as medalist if they earned a medal (first four places, n=28) or non-medalist (n=30). Their dietary characteristics were evaluated with a 24-h dietary recall applied by trained nutritionists. These characteristics were daily food servings, energy and macronutrient intake (g/day and g/kg/day). All variables are expressed as median and interquartile range. Dietary characteristics were compared between groups by U Mann-Whitney test.

RESULTS: For food groups, medalist athletes ingested lower amounts of dairy and fats than non-medalist. Similarly, total fat intake (g/day) were lower in medalist. The relative macronutrient intake (g/kg/day) was significantly lower for fat (1.3 [1.0-1.7] vs 1.8 [1.4-2.0], p=0.003) but not for protein (1.8 [1.5-2.6] vs 2.0 [1.8-3.0], p=0.07) nor carbohydrates (6.0 [3.8-7.5] vs 6.6 [4.7-8.7], p=0.11) in medalist vs non-medalist, respectively. Despite didn't reached statistical significance, sugars' servings, energy intake, and relative protein intake tended to be lower in medalist group.

CONCLUSIONS: In this study, medalist athletes tended to ingest less food groups (dairy, fats, sugars), energy, fat and relative protein one month before an important competition. Perhaps because they were trying to keep their competition weight as controlled as possible in this lapse.

Table 1. Daily dietary characteristics for medalist and non-medalist varsity combat athletes.

	Medalist [Median (interquartile range)]	Non-medalist [Median (interquartile range)]	p-value
Animal source foods (servings)	8.5 (6.0-10.5)	8.5 (6.4-12.5)	0.46
Dairy (servings)	3.5 (2.5-5.0)	5.0 (3.0-6.0)	0.05
Legumes (servings)	0.5 (1.0-1.5)	1.0 (0.6-1.5)	0.71
Cereals (servings)	12.0 (8.5-16.0)	12.8 (10.8-20.0)	0.18
Veggies (servings)	3.0 (1.5-4.5)	2.0 (1.3-3.8)	0.31
Seeds (servings)	1.0 (0.5-1.5)	1.0 (0.4-2.5)	0.54
Fats (servings)	4.5 (2.5-9.5)	7.7 (5.0-12.0)	0.04
Fruits (servings)	5.0 (3.0-8.5)	5.5 (3.5-9.9)	0.36
Sugars (servings)	3.0 (1.5-6.0)	3.7 (2.7-6.3)	0.09
Energy (Kcal)	2891 (1998-3741)	3360 (2592-5050)	0.08
Protein (g)	137 (103-168)	151 (122-206)	0.12
Fat (g)	82 (62-123)	113 (92-158)	0.01
Carbohydrates (g)	396 (231-493)	389 (314-670)	0.25

395 Board #216 May 31 11:00 AM - 12:30 PM
Body Composition and Performance Capabilities Based on Level of Protein Intake in Collegiate Female Dancers

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 (No relationships reported)

The aesthetic nature of dance places pressure on dancers to have low body weight and fat, which often leads to disordered eating. Despite data showing higher protein intake improving body composition in numerous populations, a paucity of data exists on dancers. **PURPOSE:** To examine associations between protein intake, body

composition and performance among dancers. **METHODS:** Female dancers ($n = 25$; age 20.7 ± 1.8 years; mean \pm SD) were recruited to complete a 3-day food log, body composition analysis (DXA), and performance testing for muscular endurance, power and strength. Protein was expressed as g/kg/day and three equal groups were created (Low protein: LP, <1.2 g/kg/day; Moderate protein: MP, 1.2 - 1.6 g/kg/day; High protein: HP, >1.6 g/kg/day). Data were analyzed using one-way ANOVA to compare group means (SPSS v.21.0, Chicago, IL). Significance was set at $p < 0.05$. **RESULTS:** Total caloric intake was significantly greater in HP when compared to LP only (LP: $1,883.5 \pm 500.1$ kcal; HP: $2,439.8 \pm 348.5$ kcal; $p = 0.01$). Protein consumption was greater in HP compared to MP and LP, and for MP compared to LP ($p < 0.05$). Additionally, 22 participants (88% of all participants) fell below the protein recommendation (2.3 g/kg/day) for athletes to maintain lean mass during weight loss. There were no differences between LP, MP, and HP for all body composition and performance measurements. Although not significantly different, HP had lower body weight compared to LP despite consuming more calories. Additionally, although not significant, fat mass (%) was lower and lean mass (%) was greater in HP compared to both LP (fat: -8%; lean: +3%) and MP (fat: -4%; lean: +0.5%). **CONCLUSIONS:** Tertiles of protein intake in the female collegiate dancers participating in this study were not significantly associated with more desirable body composition and performance. However, trends for improved body composition observed with HP may be physiologically relevant for dancers. Further research should focus on achieving adequate protein spread between groups to determine the impact higher protein intake may have on dancers' body composition and performance.

396 Board #217 May 31 11:00 AM - 12:30 PM
Protein Intake Per Meal in Varsity Athletes with Low and High Lean Body Mass Index

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PURPOSE: To compare the protein intake per meal in varsity athletes with low and high lean body mass index (LBMI). **METHODS:** Protein intake per meal and LBMI were assessed in 94 varsity male athletes. Protein intake was evaluated with a 24-h dietary recall by trained nutritionists. The protein amount per meal was estimated for each subject and was classified as inadequate if it contained lower than 20 g of protein. Lean body mass was evaluated with bioelectrical impedance and LBMI was calculated (lean body mass [kg]/height² [m]). Then the sample was divided per LBMI tertiles, and the lower and higher tertiles defined as low (LLBM) and high (HLBM) lean body mass groups, respectively. Median intake for total (g/day), relative (g/kg/day) and per meal (g) protein as well as prevalence of inadequate protein intake (INPI) per meal were calculated for each group. We made comparisons between groups for protein intake (U Mann-Whitney test) and INPI prevalence (two samples t-test), we also analyzed within groups per meal protein intake (Friedman ANOVA, Dunns post hoc) and per meal INPI prevalence (one sample t-test). **RESULTS:** HLBM group had a higher total but not relative protein intake compared with LLBM group. The per meal protein intake analysis didn't show significant differences between groups. The INPI prevalence was similar in both groups, but one comparison reached statistical significance. LLBM group ingested the majority of their protein at lunch being higher than dinner ($p < 0.05$) and the INPI prevalence was lower at lunch ($p > 0.05$). HLBM also ingested the majority of their protein at lunch, being higher than breakfast and dinner ($p < 0.05$) and the lowest prevalence of INPI was showed in lunch compared with dinner ($p < 0.05$) but not for breakfast ($p > 0.05$). **CONCLUSIONS:** INPI per meal is common in varsity athletes, independently if they are LLBM or HLBM. Despite an adequate daily protein intake, efforts should be addressed to provide adequate amounts of protein on a per meal basis.

Table 1. Protein intake (daily and per meal) and prevalence of inadequate protein intake per meal.

	LLBM [Median (interquartile range),n=31]	HLBM [Median (interquartile range),n=31]	p-value (between groups)
Total protein intake (g/day)	105.5 (90.0-128.7)	129.7 (93.3-197.5)	0.04
Relative protein intake (g/kg/day)	1.8 (1.3-2.3)	1.5 (1.2-2.6)	0.55
Breakfast protein intake(g)	22.3 (12.0-35.3) ^{AB}	28.0 (16.4-35.9) ^A	0.28
Lunch protein intake (g)	31.8 (16.9-52.1) ^A	42.2 (27.4-66.9) ^B	0.13
Dinner protein intake (g)	21.9 (8.0-28.1) ^B	19.6 (12.6-40.5) ^A	0.29
INPI at breakfast (%)	45.2 ^a	35.5 ^{ab}	0.44
INPI at lunch (%)	25.8 ^a	12.9 ^a	0.20
INPI at dinner (%)	48.4 ^a	51.6 ^b	0.80

Different capital letters mean significant differences ($p < 0.05$) in protein intake between meals within groups.
 Different lower case letters mean significant differences ($p < 0.05$) in INPI prevalence between meals within groups.

397 Board #218 May 31 11:00 AM - 12:30 PM
Dietary Analysis and Body Composition of Male and Female Costa Rican College Soccer Players

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Soccer is a worldwide popular sport and research on several aspects related to performance are available; however, there are only a few studies reporting dietary analysis and body composition of Latin American college players. **PURPOSE:** To determine macronutrient consumption and body composition in male and female college competitive soccer players. **METHODS:** Participants were 22 male (mean age = 21.4 ± 1.9 yr.) and 19 female (mean age = 20.1 ± 1.7 yr.) varsity team soccer players who were interviewed for dietary assessment using a 7-day diet history questionnaire. Body composition was obtained by a full-body dual-energy X-ray absorptiometry (DXA) scan. Total energy and macronutrient analysis was performed following the nutritional interview, and body height, weight, lean mass, fat mass (%), and intermuscular adipose tissue-free skeletal muscle mass (IMAT-SMM) were obtained from the DXA scan. Gender differences were obtained by independent samples t-tests. **RESULTS:** Energy intake was higher in males ($19,377 \pm 5,514$ kJ) than in females ($13,066 \pm 4,610$ kJ; $p \leq 0.001$). Carbohydrate intake was higher in males (10.3 ± 3.2 g/kg) than in females (7.9 ± 3.8 g/kg; $p = 0.010$). Protein intake was higher in males (2.2 ± 0.8 g/kg) than in females (1.6 ± 0.5 ; $p = 0.031$). Fat consumption was similar between males (1.9 ± 0.8 g/kg) and females (1.7 ± 0.6 g/kg; $p = 0.117$). Body height (176.0 ± 6.1 vs. 160.4 ± 3.4 cm), weight (69.3 ± 7.7 vs. 59.2 ± 6.5 kg), lean mass (26.0 ± 2.0 vs. 16.9 ± 1.4 kg), and IMAT-SMM (31.0 ± 2.3 vs. 20.2 ± 1.6 kg) mean values were higher in males than in females ($p \leq 0.001$ for all). Fat mass was higher in females (31.4 ± 6.4 %) than in males (14.8 ± 5.2 %; $p \leq 0.001$). **CONCLUSIONS:** An excessive energy and carbohydrate intake was found in both genders. Protein and fat intake were appropriate for both genders. Body composition in males showed similar values compared to previously reported literature; however, females showed poor body composition compared to international values.

398 Board #219 May 31 11:00 AM - 12:30 PM
Weight Loss Practices Of Youth Taekwondo Athletes

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Taekwondo athletes traditionally compete at the lowest weight class possible in order to gain a competitive advantage. To be eligible in lighter weight classes, competitors use a combination of potentially harmful weight loss practices, which may adversely

affect one's physical and mental health. **PURPOSE:** The present study examined the weight loss practices of youth Taekwondo athletes. **METHODS:** Participants were 280 Taekwondo competitors aged 12 to 18 yrs (116 boys; mean age \pm SD 15.4 \pm 1.6 yr) who completed a previously validated questionnaire developed to evaluate rapid weight loss in combat sports athletes, which provides a score. The higher the score obtained by the competitor, the more aggressive his/her weight management strategies tend to be. Frequency and summary statistics were calculated on all variables. To compare the overall magnitude of weight management behaviours between boys and girls, a Mann-Whitney U Test was conducted with the scores obtained by both genders. A general linear model one-way ANOVA with Tamhane post hoc test for unequal variances was used to compare the scores obtained by the three following groups: regional-, national-, and international-level competitors. The same procedure was used to compare scores between athletes from different weight classes ($P < 0.05$). **RESULTS:** Seventy-five percent of youth Taekwondo athletes reported that have already lost weight to compete. Most of them reported reductions of up to 5% of body weight (mean \pm SD 2.2 \pm 1.9%). The reductions usually occurred within 8 \pm 4 d. Increased exercise and restricted food and/or fluids and training with plastic or rubberized suits, were cited as the most common rapid weight loss strategies. One-third of the athletes reported they took diet pills, diuretics, and/or laxatives to lose weight. No significant differences were found in the score obtained by male versus female as well as by athletes from different weight classes. International- and national-level athletes scored significantly higher in the questionnaire than regional-level athletes ($P < 0.05$). **CONCLUSION:** These results suggest that rapid weight loss is highly prevalent in youth Taekwondo athletes. The level of aggressiveness in weight management behaviors seems to be influenced by the competitive level.

399 Board #220 May 31 11:00 AM - 12:30 PM
Sources Of Nutrition Information And Knowledge In Ultra-runners (the SNIKR Study): A Qualitative Analysis

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With the recent increase in ultra-endurance competitions, the role of nutrition in performance has garnered significant attention. While the ACSM, AND, and DC have a joint position stand on nutrition for endurance performance, recent data has demonstrated that many ultra-endurance athletes do not meet the recommendations for athletic performance. **PURPOSE:** The purpose of this study was to understand common sources of nutrition information among recreational ultra-endurance athletes, and determine how this information is used in their training. **METHOD:** Recreational ultra-endurance athletes were recruited to participate in one of two focus groups (N = 8, mean age = 38.2 years), which followed pre-scripted questions to guide discussion. Participants also completed a demographic questionnaire. Focus group data was transcribed and reviewed by multiple researchers, and common themes were identified. **RESULTS:** The sample was 50% female, 100% white or non-Hispanic, 68% attained a college degree or higher, and 62.5% are married/partnered. Regarding their perception of the ideal diet for an ultra-endurance athlete, 87.5% of respondents discussed a "whole foods" diet with little processed food. Most of the participants (62.5%) were aware of the ACSM recommendations, but did not follow them. The most common reason was a belief in individual responsiveness to diet (50%) or the perception that it was too difficult to follow (50%). The most commonly used sources of nutrition information were through experienced athletes (87.5%) or personal relationships (62.5%), followed by magazines and non-academic books (50%). **CONCLUSION:** Overall, the focus group discussion revealed that recreational athletes, while aware of the dietary recommendations, do not believe they are accessible or worth their effort. As many participants look to personal relationships and successful athletes for advice, researchers and dietitians may reconsider how nutritional information is most effectively disseminated.

400 Board #221 May 31 11:00 AM - 12:30 PM
Inadequacy Of Food-Energy Supplying To The Energy Requirements Of Female Ballet Dancers

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PURPOSE: Nowadays athletes use to control strictly their body weight focusing on convenient body weight-dependent competing categories or simply for their sports performance, as commonly seen in dancers. Usually this procedure lead to eating disorders with unfavorable outcomes. To investigate the energy balance of ballet dancers in association with their food intake pattern and anthropometric profile. **METHODS:** The resting energy expenditure (Fitmate), food intake (Food Frequency and 24-h recall questionnaires) pattern and anthropometric (Bioelectrical Impedance

data of ballet dancers was crosssectionally studied in 17 girls (19.1 \pm 7.1yrs.). Statistical analysis was done by Pearson's correlation and Multiple Stepwise Regression ($p < 0.05$).

RESULTS: The availability of energy (22.48 \pm 13.1 kcal/kgFFM/d) was inadequate for 82.3% of the dancers once their energy intake (1248 \pm 385 kcal/d) achieved only 56% of the total energy expenditure. However, 24.5% showed high body fatness although 52.9% referred episodes of amenorrhea. Overall, their diet was classified as low quality (HEI score 67.9 points).

CONCLUSIONS: The existence of a presently energy-insufficient diet intake was confirmed by the energy expenditure measurements and the self reports of amenorrhea. On the other hand, the found rate of high body fatness would mean some earlier long lasting positive energy-balance in those girls. Supported by CNPq.

401 Board #222 May 31 11:00 AM - 12:30 PM
Twelve-weeks Oral Spray Vitamin D₃ Supplementation Does Not Alter Bone Turnover Markers In Collegiate Gaelic Footballers

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Reported Relationships: S.M. Madigan: Intellectual Property; none. Honoraria; none. Ownership Interest (Stocks, Bonds); none.

Vitamin D deficiency is associated with increased bone remodelling activity. Quantification of reference-standard bone turnover markers total procollagen type I N-terminal propeptide (PINP) (bone formation) and beta C-terminal telopeptide of type I collagen (β -CTX) (bone resorption) therefore enable detection of subtle perturbations in bone remodelling that may result from vitamin D inadequacy and indicate an increased risk of stress fracture in athletes. **PURPOSE:** To investigate the effect of wintertime vitamin D₃ supplementation using an oral spray on bone turnover markers in Irish athletes compared to placebo. **METHODS:** Stored samples from a randomised, double-blind, placebo-controlled trial conducted in Gaelic footballers (3000IU (75 μ g) vitamin D₃ daily versus placebo for 12-weeks, n=42) were analysed for PINP and β -CTX. Dietary vitamin D and calcium intake as well as total 25-hydroxyvitamin D (25(OH)D) data were available from the previous study. **RESULTS:** Overall, 72% of athletes presented with a 25(OH)D concentration $<$ 50nmol/L, and 5 exhibited vitamin D deficiency ($<$ 30nmol/L) at baseline. Dietary vitamin D and calcium intakes averaged 5.9 \pm 4.3 μ g/day and 1037 \pm 651mg/day respectively. Daily supplementation with 3000IU (75 μ g) vitamin D₃ significantly increased mean \pm SD 25(OH)D compared to no significant change in the placebo group (vitamin D; 47.37 \pm 13.29 to 83.68 \pm 32.98nmol/L (+79%) vs. placebo; 43.10 \pm 22.00 to 49.22 \pm 25.40 (+14%) $P=0.006$). However, ANCOVA revealed no significant difference in mean \pm SD change from baseline for PINP (-8.72 \pm 18.83 vs. -5.04 \pm 21.13 μ g/L, $P=0.413$) or β -CTX concentrations (-0.09 \pm 0.18 vs. -0.10 \pm 0.21 μ g/L, $P=0.627$) when compared to placebo. **CONCLUSION:** In this study, 12-weeks vitamin D₃ supplementation using an oral spray solution did not influence bone turnover when compared to placebo, despite increasing mean 25(OH)D concentration by 79%. Vitamin D inadequacy ($<$ 50nmol/L) is apparent in collegiate Gaelic footballers however future interventions, aiming to test change over time in bone turnover as a primary outcome, should consider a longer intervention in athletes with vitamin D deficiency ($<$ 30nmol/L).

402 Board #223 May 31 11:00 AM - 12:30 PM
Anxiety and Stress Predict Gastrointestinal Symptoms during One Month of Running

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PURPOSE: To investigate dietary, training, demographic, anthropometric, pharmacological, and psychological predictors of gastrointestinal (GI) symptoms in distance runners. **METHODS:** A total of 150 runners (74 men) completed a prospective journal recording daily running duration and intensity (Rating of Perceived Exertion [RPE]), as well as GI symptoms experienced during each run. At month's end, participants completed a survey inquiring about demographics, anthropometrics, running experience, analgesic use, antibiotic use, probiotic consumption, fluid/food intake during runs, caffeine intake before and during runs, stress, and anxiety. Stress and anxiety were measured via the Perceived Stress Scale (PSS) and Beck Anxiety Inventory (BAI). Substantial GI distress was defined as a run with at least one GI symptom ≥ 3 on a 0 to 10 scale. **RESULTS:** On average, participants reported experiencing substantial GI distress during 44.1% of runs. Age ($\rho = -0.30$, $p < 0.01$) and years of running experience ($\rho = -0.17$, $p = 0.04$) were negatively correlated

with the percentage of runs with substantial GI distress. Mean run RPE ($\rho = 0.23$, $p < 0.01$), frequency of probiotic food consumption ($\rho = 0.20$, $p = 0.02$), PSS scores ($\rho = 0.29$, $p < 0.01$), and BAI scores ($\rho = 0.27$, $p < 0.01$) were positively associated with the percentage of runs with substantial GI distress. **CONCLUSIONS:** Several factors are associated with substantial GI distress over one month of running, including perceived stress and anxiety, which have largely been neglected in previous research.

A-52 Free Communication/Poster - Occupational/Firefighter Physiology

Wednesday, May 31, 2017, 7:30 AM - 12:30 PM
Room: Hall F

403 Board #224 May 31 9:30 AM - 11:00 AM The Physiological Responses of Specialist-Role Paramedics Undertaking a Simulation Treating Casualties Exposed to Hazardous Materials

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(No relationships reported)

The National Ambulance Resilience Unit (NARU) works on behalf of each National Health Service Ambulance Trust in England to strengthen national resilience and improve patient outcome in challenging pre-hospital scenarios. Specialist ambulance responders (HART) are trained to deal with mass casualty incidents, during which they may need to wear Breathing Apparatus (BA) inside fully encapsulated Gas Tight Suits (GTS) to treat casualties in a hazardous area. **PURPOSE:** To measure the physiological strain of paramedics during a simulated task to treat casualties exposed to hazardous materials. **METHODS:** Six participants (5 male / 1 female; age 39 ± 8 y; body mass 80.1 ± 7.9 kg; VO_{2max} 38.05 ± 4.31 ml·kg⁻¹·min⁻¹) wearing BA and GTS (36.7 ± 1.3 kg) undertook a 30 min simulated task, which included walking 200 m to an incident, moving casualties and administering CPR for approximately 14 min. Participants' urine osmolality was measured before the task. Sweat losses during the task were estimated by changes in body mass, with participants unable to drink due to the BA. Participants wore a heart rate monitor, rectal thermistor, and skin thermistors (neck, hand, scapular and shin). The day before the simulation, participants completed an incremental shuttle run test to measure VO_{2max} and maximum heart rate (HR_{max}). Data are presented as the mean \pm SD; differences were compared using paired sample t-tests with significance set at $p < 0.05$. **RESULTS:** Mean urine osmolality at the start of the task was 380 ± 150 mOsm·kg⁻¹. Total estimated sweat losses during the simulation were 0.47 ± 0.39 L. Mean heart rate during the simulation was 75 ± 15 % HR_{max} . During the simulation both rectal (start and end; 37.45 ± 0.03 to 38.13 ± 0.19 °C, $p < 0.05$) and mean skin temperature (31.57 ± 0.02 to 34.04 ± 0.06 °C, $p < 0.05$) increased. The range of peak rectal temperatures were $37.8 - 38.3$ °C. **CONCLUSION:** Participants started the simulated task in a hydrated state and sweat losses were unable to be matched by fluid intake. Although cardiovascular strain during the task was 'moderate' to 'very hard' and body temperature increased, all participants successfully completed the 30 min simulation. These data can be used to inform interventions to enhance physical performance and to develop physical competency assessments for specialist ambulance responders.

404 Board #225 May 31 9:30 AM - 11:00 AM The Physiological Responses of Specialist-role Paramedics Treating Casualties in a Simulated Firearms Incident

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(No relationships reported)

The National Ambulance Resilience Unit (NARU) works on behalf of each National Health Service Ambulance Trust in England to strengthen national resilience and improve patient outcome in challenging pre-hospital scenarios. Specialist ambulance responders are trained to deal with hazardous or difficult situations, particularly incidents such as situations involving firearms and mass casualties. **PURPOSE:** To measure the physiological strain of paramedics during a scenario to treat multiple casualties in a simulated firearms incident. **METHODS:** Six participants (5 male / 1 female; age 27 ± 3 y; body mass 80.4 ± 11.8 kg; VO_{2max} 46.5 ± 1.6 ml·kg⁻¹·min⁻¹) wearing ballistic personal protective equipment (19.1 ± 1.0 kg) undertook a 120 min

scenario, which included a 400 m approach walk, casualty drags, sprints, and stretcher drags. Participants' urine osmolality was measured before the scenario. Sweat losses during the scenario were estimated by changes in body mass with ad libitum fluid intake measured. Participants wore a heart rate monitor, rectal thermistor and skin thermistors (neck, hand, scapular and shin). The day before the simulation participants completed an incremental shuttle run test to measure predicted VO_{2max} and maximum heart rate (HR_{max}). Data are presented as the mean \pm SD; and analysed with paired sample t-tests with significance set at $p < 0.05$. **RESULTS:** Urine osmolality at the start of the simulation was 450 ± 160 mOsm·kg⁻¹. Total estimated net sweat losses during the scenario were 2.23 ± 0.34 L which was not different to fluid intake of 2.43 ± 0.42 L ($P > 0.05$). Mean heart rate during the scenario was 73 ± 11 % HR_{max} . During the simulation both rectal (start to end: 37.54 ± 0.29 to 38.34 ± 0.51 °C, $P = 0.24$) and mean skin temperatures (32.04 ± 1.08 to 30.85 ± 0.68 °C, $P = 0.78$) did not change significantly. The range of peak rectal temperatures was $37.10-39.15$ °C. **CONCLUSION:** Participants started the scenario in a hydrated state and sweat losses were matched by fluid intake. Although cardiovascular strain during the simulation was 'moderate' to 'hard', body temperature did not rise significantly and all participants successfully completed the two-hour scenario. These data can be used to inform interventions to enhance physical performance and develop physical employment standards for specialist ambulance responders.

405 Board #226 May 31 9:30 AM - 11:00 AM The Physiological Response of Specialist-role Paramedics Undertaking a Casualty Decontamination Scenario.

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(No relationships reported)

The National Ambulance Resilience Unit (NARU) works on behalf of each National Health Service Ambulance Trust in England to strengthen national resilience and improve patient outcome in challenging pre-hospital scenarios. Specialist ambulance responders are trained to wear Powered Respirator Protective Suits (PRPS) to move, treat and decontaminate casualties exposed to hazardous materials. **PURPOSE:** To measure the physiological strain of paramedics during a scenario to move and decontaminate multiple casualties exposed to hazardous materials. **METHODS:** Eight participants (7 male / 1 female; age 38 ± 10 y; body mass 90.4 ± 16.2 kg; VO_{2max} 34.5 ± 5.6 ml·kg⁻¹·min⁻¹) undertook a 193 min scenario involving erecting a decontamination tent, then donning PRPS (11.9 ± 0.4 kg) to work for ~120 min to move and decontaminate multiple casualties. Urine osmolality was measured before the scenario. Sweat losses during the scenario were estimated from changes in body mass, with ad libitum fluid intake recorded. Participants wore a heart rate monitor, rectal thermistor, skin thermistors (neck, hand, scapular and shin). The day before the scenario participants completed an incremental shuttle run test to measure VO_{2max} and maximum heart rate (HR_{max}). Data are presented as the mean \pm SD; differences were compared using paired sample t-tests with significance set at $p < 0.05$. **RESULTS:** Urine osmolality at the start of the scenario was 350 ± 170 mOsm·kg⁻¹. Estimated sweat losses during the scenario were 1.40 ± 0.36 L which were less than fluid intake 2.54 ± 0.96 L ($p < 0.05$). Mean heart rate during the scenario was 64 ± 11 % HR_{max} . During the scenario rectal temperature increased (start to end: 37.51 ± 0.32 to 37.88 ± 0.19 °C, $p < 0.05$) and mean skin temperature was unchanged (31.16 ± 0.10 to 31.67 ± 1.23 °C, $p > 0.05$). The range of peak rectal temperatures was $37.95-38.60$ °C. **CONCLUSIONS:** Participants started the scenario in a hydrated state and sweat losses were lower than fluid intake. Cardiovascular strain during the scenario was 'moderate' and body temperature increased slightly. One participant was withdrawn during the scenario by the investigators due to becoming excessively fatigued. These data can be used to inform interventions to enhance physical performance and develop physical employment standards for specialist ambulance responders.

406 Board #227 May 31 9:30 AM - 11:00 AM A Case Report: The Physiological Strain Incurred by Electrical Utility Workers During Consecutive Work Days

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(No relationships reported)

Heat strain in electrical utilities workers has been assessed in a single work day and it has been shown that workers can experience high levels of thermal and cardiovascular strain. However, the impact of consecutive work shifts performed in hot conditions on the level of physiological strain remains unclear. **PURPOSE:** To examine the influence

of working consecutive shifts in hot conditions on the physiological strain experienced by electrical utility workers. **METHODS:** Four male electrical utility workers (age 38 ± 12 years) were monitored as they performed their normal work duties over two consecutive work days in hot conditions (average: 34°C , 60% relative humidity). Hydration was assessed using urine specific gravity (USG) prior to and following the participants regularly scheduled work shift. The proportion of work spent at various levels of physical effort as defined by the American Conference for Governmental and Industrial Hygienists (i.e., rest, light, moderate, and heavy effort) was determined using video analysis. Body core temperature (T_{core}) and heart rate (HR; presented as a percentage of maximal heart rate, HR_{max}) were measured continuously throughout the work shifts. **RESULTS:** Based on the ACSM guidelines, the workers were considered dehydrated (USG ≥ 1.020) prior to (Day 1: 1.025 ± 0.005 ; Day 2: 1.029 ± 0.004) and following (Day 1: 1.027 ± 0.015 ; Day 2: 1.032 ± 0.004) each work shift. On day 1, workers spent 50, 25, 21, and 4% of the work period at rest and performing tasks considered as light, moderate and heavy physical exertion, respectively; whereas, 65, 19, 11, and 5% of the work shift was spent in these physical exertion categories during the second day. The proportion of the work shift at rest was higher on the second day compared to the first ($P=0.07$). Peak T_{core} tended to be greater on the second (Day 2: $38.4 \pm 0.2^\circ\text{C}$; range: $38.2\text{--}38.7^\circ\text{C}$) relative to first work shift (Day 1: $38.1 \pm 0.2^\circ\text{C}$; range: $37.8\text{--}38.2^\circ\text{C}$; $P=0.08$), whereas the peak HR response was similar between days (Day 1: $91 \pm 7\%\text{HR}_{\text{max}}$; range: $83\text{--}100\%\text{HR}_{\text{max}}$; Day 2: $87 \pm 11\%\text{HR}_{\text{max}}$; range: $74\text{--}98\%\text{HR}_{\text{max}}$; $P=0.57$). **CONCLUSION:** Our case report findings suggest that despite the fact that work effort is decreased over consecutive work shifts, thermal strain continues to be elevated in electric utility workers. Funding support by the Electrical Power Research Institute

407 Board #228 May 31 9:30 AM - 11:00 AM

Heat Stress, Dehydration and Cardiovascular Responses in Sugar Cane Cutters in Brazil

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Current evidence demonstrates that the planet's climate is warming and that extreme heat waves are occurring more frequently. Outdoor workers are vulnerable to climate changes and are subject to risk of heat-related illness. Sugar cane cutters represent a labor force that is at high risk of heat-related illness due to high physical demands, long labor hours, and use of uniforms that dissipate heat poorly. **PURPOSE:** To investigate heat stress, dehydration and cardiovascular responses of sugar cane cutters during a typical work shift. **METHODS:** Eight male sugar cane workers (27 ± 7 years) volunteered for the study. Data collection occurred on a sugar cane plantation during the spring season. An ingestible telemetric temperature sensor and a heart rate monitor were used for measuring core temperature (T_{core}) and heart rate (HR), respectively, continuously. Oxygen consumption (VO_2) was measured using a portable metabolic cart during the first and second half of the work shift. Urine samples were collected pre- and post-work shift. Total sweat loss was calculated using body weight change and adjusting for water ingestion and urine output. A wet-bulb globe temperature (WBGT) station was used to monitor environmental heat stress. **RESULTS:** Total work shift time was $6:55 \pm 0:18$ hr with physical work duration of $5:28 \pm 0:21$ hr and rest time of $1:27 \pm 0:09$ hr. Mean and peak T_{core} during the work shift were 37.82 ± 0.31 and $38.60 \pm 0.41^\circ\text{C}$, respectively. All subjects achieved T_{core} above 38°C . Mean and peak HR during the work shift were 137 ± 18 and 165 ± 11 bpm, respectively. VO_2 was, on average, $21.2 \pm 5.4 \text{ mL}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$ and was not different ($p=0.296$) between the first ($22.6 \pm 3.4 \text{ mL}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$) and second half ($21.2 \pm 5.4 \text{ mL}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$) of the work shifts. Volunteers ingested 6.0 ± 1.0 L of fluid and experienced a total sweat loss of 7.6 ± 2.3 L. WBGT index was on average $26.8 \pm 2.3^\circ\text{C}$ and above the permissible heat exposure threshold of 25°C for 1 hour of heavy work. **CONCLUSIONS:** Sugar cane cutting is a physically demanding occupation performed in a hot environment and associated with high T_{core} and fluid loss. Preventative actions such as water ingestion, adequate rest, access to shade, and physiological monitoring should be implemented to reduce the risk of heat illness, particularly with the warming global climate. **Supported by CNPq (404201/2013-0).**

408 Board #229 May 31 9:30 AM - 11:00 AM

Thermal Exposure Limit for Mine Refuge Chambers: A Pilot Study

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(No relationships reported)

Refuge chambers (RCs) provide shelter to miners trapped during a disaster. Industry standards mandate that RCs not exceed a Steadman Apparent Temperature (AT) (also known as Heat Index) of 95°F (35°C). This limit is designed for adults performing moderate work and maintaining thermal equilibrium at a core temperature $\leq 37^\circ\text{C}$. However, occupants in a RC spend most of their time at rest, and are able to maintain thermal equilibrium at a core temperature $> 37^\circ\text{C}$. Thus, the temperature limit may be unnecessarily restrictive. **PURPOSE:** To determine the upper limit of sustainable heat stress that is protective for most individuals during long-term heat exposure at rest. **METHODS:** In Phase 1, five men (age = 23.6 ± 3.2 ; BMI = 23.6 ± 2.5) underwent five 4-hr trials in a semi-recumbent position (mean $\text{VO}_2 = 0.43$ L/min) at ATs of 39.4, 40.0, 42.8, 45.6 and 49.0°C , rh 90%. In phase 2, five men (age = 23.6 ± 3.2 ; BMI = 25.1 ± 2.2) underwent five 8-hr trials in a semi-recumbent position (mean $\text{VO}_2 = 0.44$ L/min). The starting AT for phase 2 was 3°C below the highest AT from Phase 1, and increased in a stepwise fashion (ATs = 45.6, 50.8, 51.7, 54.4 and 56.1°C ; 90% rh). In all trials, gastrointestinal temperature (T_{gi}) and heart rate (HR) were assessed every 15 min. Oxygen uptake was assessed at the midpoint of each trial. Fluids were offered ad libitum. Sweat rate (SR) was determined from pre- and post-body weights. Repeated measures ANOVA was used to assess differences between trials. T-tests were used to assess pre- to post-trial differences. Significance was set at 0.05. **RESULTS:** Maximum AT of 56.1°C had an ending HR of 76 ± 1 bpm and ending T_{gi} of $37.5 \pm 0.3^\circ\text{C}$; well below the assumption of the Steadman AT limit. There were no differences ($p>0.05$) in T_{gi} at 45.6°C at 4 hrs in Phase 1 ($T_{\text{gi}} = 37.0 \pm 0.6^\circ\text{C}$) or Phase 2 ($T_{\text{gi}} = 37.2 \pm 0.1^\circ\text{C}$) or at 8 hrs in Phase 2 ($T_{\text{gi}} = 37.1 \pm 0.3^\circ\text{C}$). As AT increased, the difference in T_{gi} from 4 to 8 hrs increased ($p<0.05$). There was no difference in HR ($p>0.05$) and no between-phase difference in SR ($p>0.05$). **CONCLUSION:** As there were no differences in T_{gi} at 4 hrs and a greater difference from 4 to 8 hrs as AT increased, 4 hrs may not be long enough to detect a change in T_{gi} . The effect of climate evidenced by increasing T_{gi} which occurred between 43.3 and 46°C -AT provides support for sustainable exposures greater than 35°C -AT with a likely ceiling below 46°C -AT.

409 Board #230 May 31 9:30 AM - 11:00 AM

The TLVs Fail to Maintain Body Core Temperature within Safe Limits in Older Adults

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Industries rely on the American Conference of Governmental Industrial Hygienists Threshold Limit Values (TLVs) to manage the health and safety of workers in hot conditions. A key shortcoming of the TLVs is the assumption that the guidelines are generalizable to broad population groups and do not consider age-related impairments in heat dissipation. **PURPOSE:** To evaluate core temperature and change in body heat storage during work in the heat using the TLVs, which are designed to ensure that a stable core temperature (and therefore heat balance) is achieved and remains below 38°C . **METHODS:** Nine older (58 ± 5 yrs) males performed three 120-min work bouts consisting of cycling at a fixed rate of heat production (360 W) under increasing ambient temperatures. Based on the TLVs, each protocol consisted of different work-to-rest (WR) ratios performed at different wet-bulb globe temperatures (WBGT). The first was 120-min of continuous (CON) cycling at 28°C WBGT while two protocols consisted of intermittent work bouts (15-min duration) adjusted for increases in WBGT: i) WR of 3:1 at 29°C (WR3:1) and ii) WR of 1:1 at 30°C (WR1:1) (equivalent exercise time of 90 and 60-min, respectively). Rectal (T_{re}) and mean skin temperatures were measured continuously and used to calculate the change in mean body temperature (ΔT_{b}). The change in body heat storage was determined via direct calorimetry and subsequently used to calculate ΔT_{b} . **RESULTS:** Heat balance was not achieved during exercise in any work conditions as the rate of change in T_{re} was greater than $0^\circ\text{C}\cdot\text{min}^{-1}$ (all $P \leq 0.05$). As a consequence, mean T_{re} exceeded 38°C ; albeit, time for T_{re} to exceed 38°C decreased as total exercise time increased (CON: 53 ± 7 ; WR3:1: 79 ± 12 ; and WR1:1: 100 ± 29 min). Moreover, a greater ΔT_{b} was observed with calorimetry relative to thermometry in all work protocols during the first 15-min of exercise [thermometry vs. calorimetry; CON: 0.21 ± 0.07 vs. $0.45 \pm 0.06^\circ\text{C}$ ($P<0.01$); WR3:1: 0.18 ± 0.05 vs. $0.51 \pm 0.06^\circ\text{C}$ ($P<0.01$); and WR1:1: 0.20 ± 0.06 vs. $0.50 \pm 0.09^\circ\text{C}$ ($P<0.01$)]. **CONCLUSION:** We show that the TLVs do not adequately protect older workers from potentially dangerous increases in core temperature during moderate work in the heat. Supported by the Ontario Ministry of Labour, Electric Power Research Institute and Natural Sciences and Engineering Research Council of Canada

410 Board #231 May 31 9:30 AM - 11:00 AM
Uncompensable Heat Stress Improves Manual Dexterity, But Does Not Affect Risk Propensity
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PURPOSE: Healthcare workers in the West African Ebola Treatment Units experienced substantial heat stress from wearing personal protective equipment (PPE) while performing light activities in a hot environment. It is unknown if uncompensable heat stress alters risk propensity or manual dexterity, which could impact the health of the worker and/or patient. We tested the hypothesis that uncompensable heat stress increases risk-taking propensity and impairs manual dexterity. **METHODS:** Fifteen healthy subjects (2 women) aged 22 ± 2 y completed a single experimental trial in 40°C and 60% relative humidity while wearing a hooded Tyvek chemical resistant coverall, an N95 respirator mask, goggles, gloves, boots, and an autopsy apron. Subjects walked on the treadmill for 30 min at 60% of their age predicted maximal heart rate, which was followed by 15 min seated rest. This cycle was repeated until participants reached 120 min, the subject terminated the test, or their physiological measures exceeded safe parameters. Subjects completed the Balloon Analogue Risk Task (BART) and two dexterity tasks (Tool Dexterity and Minnesota Manual Dexterity) pre and post the exercise while in the hot environment. **RESULTS:** Core temperature ($1.8 \pm 0.6^\circ\text{C}$; $p < 0.01$), mean skin temperature ($3.8 \pm 0.7^\circ\text{C}$; $p < 0.01$), and heart rate (55 ± 21 bpm; $p < 0.01$) increased during exercise, while body mass decreased ($1.1 \pm 0.4\%$; $p < 0.01$). Core-to-skin temperature gradient decreased from pre to post ($1.1 \pm 0.02^\circ\text{C}$ vs. $1.0 \pm 0.02^\circ\text{C}$; $p < 0.01$) During exercise, perceived exertion ($p < 0.01$), thermal sensation ($p < 0.01$), thermal comfort ($p < 0.01$), sweating sensation ($p < 0.01$), and dyspnea ($p < 0.01$) ratings increased. There was no change in the number of balloon explosions on the BART, an objective measure of risk propensity, from pre to post ($p = 0.43$). Time to complete the Tool Dexterity task did not differ between pre and post ($p = 0.49$). Time to complete the Minnesota Manual Dexterity task decreased from pre to post for both placing (270.4 ± 29.6 s vs. 252.0 ± 27.7 s; $p = 0.03$) and turning (230.2 ± 25.7 s vs. 204.9 ± 33.3 s; $p < 0.01$). **CONCLUSION:** Despite considerable thermal strain, light exertion in the heat while wearing encapsulating healthcare PPE did not alter risk propensity, but improved aspects of manual dexterity.

411 Board #232 May 31 9:30 AM - 11:00 AM
Selection into Shipbuilding Occupations when Dealing with Missing Data
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 (No relationships reported)

Building battle ships involves transforming sheets of steel into many shapes and joining the segments using welding, brazing, torquing, and other methods. **PURPOSE:** To design and validate selection tests for 30 jobs (e.g., shipfitter, joiner). One of the challenges was prevalence of missing data due to intermittent availability of the workers in the shipyard. Thus, this research used alternative methods to identify statistically the tests predictive of job performance for 30 occupations. **METHOD:** A job analysis survey completed by 629 workers identified the essential tasks for each job. Research staff identified the physical abilities required to perform essential job tasks. Researchers conducted a criterion-related validity study that included ten predictor tests and five criterion measures. The criterion measures included performance of tasks onboard a ship, along with supervisor evaluations of physical job performance. The sample included 197 men and 47 women across 24 of the 30 jobs. **RESULTS:** Validation data yielded a model ($R^2 = .59$) that consisted of lift/carry climb stairs, arm endurance, container lift, and plank. Further analysis showed the test battery was fair to protected groups (e.g., sex, age). Due to varying shift schedules, missing data occurred for the predictor tests and criterion measures for many subjects. Listwise deletion in the regression analysis resulted in a final sample of 155. Although statistical power was high for this sample, we conducted a Full Information Maximum Likelihood (FIML) analysis to determine whether the missing data affected the conclusions. FIML used a maximum likelihood approach to estimate the missing data based on all available information for a subject in an unbiased manner, rather than not replace or impute missing data. **CONCLUSIONS:** Comparison of squared multiple Rs for all ten tests for the FIML (0.61) and original (0.59) analyses found a small difference with FIML accounting for 1.3% more variance. The FIML standardized beta coefficients with the highest values were the same as the original regression analysis, thus confirming the original results. We established separate passing scores by job and test using information from the validation and job analysis results. Each job's test battery contained only tests and passing scores relevant to the job.

412 Board #233 May 31 9:30 AM - 11:00 AM
Flow-resistive Inspiratory Muscle Training Improves Running Time To Exhaustion With Thoracic Load Carriage
 Ren-Jay Shei, Robert F. Chapman, FACSM, Allison H. Gruber, Daniel P. Wilhite, Timothy D. Mickleborough, FACSM. *Indiana University, Bloomington, IN.* (Sponsor: Timothy D. Mickleborough, FACSM)
 (No relationships reported)

Exercise while carrying an external load upon the thoracic cavity imposes extra stress on the cardiopulmonary and limb locomotor systems. This in turn, negatively impacts exercise tolerance and performance, as well as pulmonary and respiratory muscle function. Thoracic load carriage exercise (LC) has been shown to induce global respiratory muscle fatigue as assessed by volitional mouth pressures, with a concomitant impairment in running time-trial performance. Inspiratory muscle training (IMT) has been shown to improve performance in a running time-trial with thoracic LC. However, in many occupational and recreational activities that require thoracic LC, the capacity to sustain prolonged exercise may be of equal or greater importance than performance in a time-trial. **PURPOSE:** To determine the efficacy of 6 weeks of flow-resistive IMT on running time to exhaustion with thoracic LC; and to determine whether 6 weeks of flow-resistive IMT moderates diaphragmatic fatigue that may occur following a thoracic LC running time to exhaustion test. **METHODS:** Twelve recreationally active males completed two runs to exhaustion (T_{lim}) at a fixed speed eliciting 70% of $\dot{V}O_{2max}$ while carrying a 10 kg backpack. Visits were completed at baseline and after 6 weeks of either IMT or placebo-IMT. Exercise metabolic and ventilatory measures were recorded and diaphragm strength was measured using bilateral phrenic nerve stimulation in conjunction with esophageal balloon-tipped catheters to measure intrathoracic pressures. Twitch transdiaphragmatic pressure amplitude was recorded pre-exercise and immediately post-exercise in both trials. Maximal volitional mouth pressures (P_{imax}) were recorded at baseline and post-IMT. **RESULTS:** 6 weeks of IMT significantly improved T_{lim} ($p = 0.029$, $\% \Delta +29.3 \pm 6.4\%$ IMT, $-8.8 \pm 11.1\%$), but did not alter the change in diaphragm strength following a run to exhaustion ($p > 0.05$). The $\% \Delta$ in P_{imax} from pre- to post-training was significantly correlated with the $\% \Delta$ in T_{lim} from pre- to post-training ($p = 0.031$, $r = 0.622$). No changes were observed in minute ventilation or breathing mechanics (all $p > 0.05$). **CONCLUSIONS:** IMT improves exercise tolerance with thoracic LC, but does not attenuate the severity of diaphragmatic fatigue following a running time to exhaustion test.

413 Board #234 May 31 9:30 AM - 11:00 AM
Assessment of the Physical Requirements Related to the Basic Training Program in Police Patrolling
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 (No relationships reported)

PURPOSE: To evaluate the demands of the basic training program in police patrolling (BTPPP) at the École Nationale de Police du Québec in order to develop a job-related physical test (JRPT). The aims were to: 1. quantify the physiological demands of the training and 2. identify and analyze the physically demanding and critical tasks of the training. **METHODS:** **AIM #1:** To determine the physiological demands, 56 cadets were recruited (27 M, 26 F). Their $\dot{V}O_{2max}$ and maximal heart rate (HR_{max}) were directly assessed ($\dot{V}O_{2max} = 48.9 \pm 6.8$ mlO₂ · kg⁻¹ · min⁻¹) using an incremental treadmill test. The physiological demands of the BTPPP were later quantified by recording the HR of participants during the physically demanding classes and then $\dot{V}O_2$ was extrapolated using a personalized regression function. Video sequences were also taken during those classes to allow further analyses. **AIM #2:** To identify the critical tasks of the BTPPP, 12 police training-experts participated in an advisory activity in which they were asked to individually rate the critical aspect of various tasks using a seven point Likert-like scale. A ranking of the most critical physically demanding tasks was established based on the scores given by the experts. The tasks scored as the most critical were later analyzed by 4 experts in kinesiology in order to identify the physical abilities needed to execute those tasks. **RESULTS:** **AIM #1:** HR analysis showed participants spent very little (Avg. = 0.62%) of their time in class at a HR > 90%, the most difficult classes required $\dot{V}O_2$ averaging only 35.2 mlO₂ · kg⁻¹ · min⁻¹ for females and 43.1 mlO₂ · kg⁻¹ · min⁻¹ for males. **AIM #2:** Critical tasks identification by police training-experts allowed the creation of a rank order list of 11 tasks of which the 7 most critical were, in order: reactive shooting, wrestling, self-defence with a baton, pursuing a suspect, force open a door, crowd control, and moving an unconscious person. Analysis of these 11 tasks by experts in kinesiology allowed the ranking of the most essential physical abilities, the first four being lower body power, coordination, upper body power and agility.

CONCLUSION: The assessment of the physical demands of the BTPPP allowed the creation of a JRPT based on the proper abilities and tuned to the energy expenditure and critical physically demanding tasks taught during the training.

414 Board #235 May 31 9:30 AM - 11:00 AM
Development of a New Job-Related Physical Test for the Basic Training Program in Police Patrolling
 Claude Lajoie¹, Sébastien Poirier¹, Annie Gendron², Louis Laurencelle¹. ¹UQTR, Trois-Rivières, QC, Canada. ²École Nationale de Police du Québec, Nicolet, QC, Canada. (Sponsor: Francois Trudeau, FACSM)
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 (No relationships reported)

Purpose: Based on previous observation and analyses of the basic training program in police patrolling, the main physical abilities required to successfully accomplish the critical and essential tasks of the program were identified. The objective of the study was then to develop and validate a new physical test for the École Nationale de Police du Québec (ENPQ) based on a job related approach sustaining the bona fide occupational requirements criteria. **Methods:** Our approach focused both on job task simulation and assessment of specific motor and physiological abilities. Seventeen tasks representing the main physical abilities elicited in the training program were evaluated throughout the test circuit, especially: lower and upper limb power, upper limb strength, global coordination and agility. To validate the test, 184 male and 56 female police students were recruited. Students executed the new ENPQ test and also a series of six 'convergent' measures (C): Edgren agility test (C1), dynamometer test for strength (C2), seated medicine ball throw for upper body power (C3), vertical (C4) and horizontal (C5) jump tests for lower limb power, and a maximal aerobic power estimation (C6). Among the experimental group, 39 male and 9 female police students did twice the ENPQ test for establishing test-retest reliability. **Results:** The new ENPQ test consists of a time circuit including various tasks in continuity, separated by 3 laps: lap 1 (8 tasks), lap 2 (7 tasks) and lap 3 (7 tasks). Mean completion time was significantly different (p<0.001) between male (210 ± 25 sec) and female participants (282 ± 52 sec). Correlation between the ENPQ test time and the six convergent tests were all significant (p<0.01) and moderately high: C1 (r=-0.43), C2 (r=-0.62), C3 (r=-0.59), C4 (r=-0.50), C5 (r=-0.71) and C6 (r=-0.49). Test-retest reliability (n=48) was r=0.81. **Conclusion:** The construction design used for the development of the new test insures *per se* its content (face) validity. On the other hand, the correlations obtained between the independent six 'convergent' ability measures and the new test's time performance confirm its multi-faceted concurrent validity. As for its predictive, or practical, usefulness for the tightening and betterment of the training standards of future police officers, this remains to be investigated.

415 Board #236 May 31 9:30 AM - 11:00 AM
DEXA Body Composition and Cardiovascular Risk Factors are Weakly Related in Police Officers
 Alison McGuire, Stephen F. Crouse, FACSM, Steven Martin, Allison Donnell, Daniel Mohnke, John S. Green, FACSM. *Texas A&M University, College Station, TX.* (Sponsor: Dr. Stephen Crouse, FACSM)
 (No relationships reported)

There is currently little research on whether fat mass and distribution are predictors for cardiovascular risk. **PURPOSE:** To determine if obesity measures, such as fat mass and distribution (e.g. android vs gynoid), could be used to predict cardiovascular risk, particularly lipid levels, systolic blood pressure (SBP) and blood glucose. **METHODS:** 182 police officers (166 males, 16 females; age 37.6±8.1 yrs; ht 1.7±0.1 m; wt 92.2±17.8 kg; BMI 28.9±4.8) were part of an annual cardiovascular risk profile testing group. We measured resting blood pressure and body composition via DEXA scan (SBP 127.16±10.33 mmHg; fat mass 26.85±9.99 kg; lean mass 62.01±9.90 kg; percent android fat 35.5±10.1; percent gynoid fat 29.7±6.9). Fasting blood samples were drawn and analyzed by a clinically certified lab to determine total blood cholesterol (TC) (192±37 mg/dL), LDL (119±35 mg/dL), HDL (46±10 mg/dL), triglycerides (129±99 mg/dL), and glucose (87±19 mg/dL). Correlations were determined by using a bivariate Pearson correlation matrix, significance was set at and p<0.01**. **RESULTS:** As fat mass increased, total cholesterol and LDL increased and HDL decreased. Triglycerides, glucose, and SBP also increased as fat mass increased. There were also significant increases in total cholesterol, LDL, triglycerides, glucose and SBP as android fat percentage increased. HDL decreased significantly as android fat percentage increased.

		Lean Tissue Mass	Fat Tissue Mass	Android Fat %	Gynoid Fat %	BMI
Cholesterol	Pearson	-.068	.193**	.242**	.196**	.211**
	R ²	.005	.037	.059	.038	.045
HDL	Pearson	-.258**	-.252**	-.262**	-.030	-.233**
	R ²	.067	.064	.069	.001	.054
LDL	Pearson	-.017	.169*	.178*	.154*	.168*
	R ²	.000	.029	.032	.024	.028
Triglycerides	Pearson	.075	.240**	.302**	.134	.215**
	R ²	.006	.058	.091	.018	.046
Glucose	Pearson	.152*	.150*	.153*	.024	.215**
	R ²	.023	.023	.023	.001	.046
Resting SBP	Pearson	.246**	.258**	.196**	.073	.299**
	R ²	.061	.067	.038	.005	.089

CONCLUSION: Fat mass and distribution are significantly, but weakly related to blood lipids/lipoproteins and blood pressure. We suggest that factors other than fat mass affect these cardiovascular disease risk markers, such as genetics, lifestyle, and diet. More research is needed to see if this correlation holds or is stronger in similar and different populations.

416 Board #237 May 31 9:30 AM - 11:00 AM
DXA Body Composition Is Weakly Related To Blood Lipids, Blood Pressure, And Glucose In Firefighters
 Kalen A. Johnson, Daniel Mohnke, Allison Donnell, Steven E. Martin, John S. Green, FACSM, Stephen F. Crouse, FACSM. *Texas A&M University, College Station, TX.* (Sponsor: Stephen F. Crouse, FACSM)
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Current published data are inconclusive regarding whether DXA body composition measures of fat, lean, and regional fat mass are predictive of other CVD risk factors. **PURPOSE:** To determine if DXA measures can be used in a cardiovascular risk-predictive manner to indicate unhealthy levels of circulating lipoproteins in firefighters. **METHODS:** 256 male firefighters (age=35±10; ht=179±6.6 cm; wt=94±16 kg; BMI=29.9±4.6; fat mass=27.5±10.4 kg; lean mass=63±7.5 kg; gynoid%fat=28.7±6.5%; android%fat=36±11.3%; glucose=85±12.9 mg/dL; SBP=128±9 mmHg) underwent an annual cardiovascular risk profile screening and DXA scan; resting BP was also measured. We collected fasted blood samples and a clinically certified lab analyzed them to determine glucose, HDL, LDL, total cholesterol, and triglycerides. Statistics included simple statistics and Pearson's correlations. **RESULTS:** Table (*=p<.01)

		Percent Fat	Lean Mass	Fat Mass	Android % Fat	Gynoid % Fat	BMI
Cholesterol	Pearson	.262*	.003	.212*	.281*	.197*	.180*
	R ²	.069	.000	.045	.079	.039	.032
HDL	Pearson	-.203*	-.228*	-.253*	-.251*	-.070	-.286*
	R ²	.041	.052	.064	.063	.005	.082
LDL	Pearson	.248*	.002	.206*	.266*	.191*	.185*
	R ²	.062	.000	.042	.07	.036	.034
TRIG	Pearson	.284*	.166*	.285*	.322*	.128	.277*
	R ²	.081	.028	.081	.104	.016	.077
Glucose	Pearson	.287*	.044	.271*	.277*	.238*	.208*
	R ²	.082	.002	.073	.077	.057	.043
Resting SBP	Pearson	.126	.201*	.178*	.130	.102	.176*
	R ²	.016	.040	.032	.017	.010	.031

CONCLUSIONS: Though the correlations were statistically significant, none of the DXA body composition measures explained a physiologically relevant portion of the variance in the CVD risk markers measured. We suggest that factors other than body fat contribute to lipid and blood pressure profiles in firefighters, a population at high risk for CVD.

417 Board #238 May 31 9:30 AM - 11:00 AM
Analysis of Dietary Intake in Volunteer Firefighters
 Kelly C. McLaughlin¹, Lauren N. Chavis¹, Rachel Dickinson¹, Emily Reeve¹, Christian K. Roberts, FACSM², Deborah L. Fearheller¹. ¹Ursinus College, Collegeville, PA. ²Occidental College, Los Angeles, CA. (Sponsor: Christian Roberts, FACSM)
 (No relationships reported)

Cardiovascular disease remains the leading cause of death in the United States. Dietary patterns can influence many risk factors for cardiovascular disease, such as blood pressure, lipid levels, body composition and glucose metabolism. Cardiac events are the leading line-of-duty deaths in firefighters. Due to the fast-paced and unpredictable

nature of the work as well as lack of proper kitchen equipment, firefighters often rely on quick, easy meals that may not be optimally nutritious. Limited research has examined firefighter's dietary intake and preferences. **PURPOSE:** To analyze the dietary intake of volunteer firefighters. **METHODS:** Seemingly healthy male volunteer firefighters (n=18, 34.1 ± 11.7 years of age) participated in a dietary workshop. Height and weight of each participant was measured. Participants were asked to collect a three-day diet recall which was analyzed using Diet Analysis Plus. **RESULTS:** The BMI of study participants was 32.4 ± 4.9 kg/m². On average, the participants consumed 1753 ± 503 kcals daily. The macronutrient breakdown was 197.8 ± 83.8 g (45.1%) carbohydrates, 71.6 ± 19.6 g (36.8%) fats and 75.6 ± 18.3 g (17.2%) protein. Types of fat intakes were: saturated fat (24.8 ± 6.7 g), monounsaturated fat (20.5 ± 7.8 g), polyunsaturated fat (11.5 ± 6.9 g), and trans-fat (2.0 ± 5.5 g) per day. In addition, 14.1 ± 6.2 g of dietary fiber, 70.9 ± 57.6 g of sugar, and 3008 ± 1231 mg sodium was consumed. Furthermore, the firefighters reported intakes of 10.0 ± 6.0 g linoleic acid, 1.0 ± 0.7 g linolenic acid, 735 ± 466 mg calcium, 170 ± 78 mg magnesium, 1775 ± 850 mg potassium, and 3 ± 2 µg vitamin D. **CONCLUSION:** Our results suggest volunteer firefighters do not consume diets in line with the 2015 Dietary Guidelines for Americans; however, additional data is needed to completely understand the dietary preferences of firefighters.

418 Board #239 May 31 9:30 AM - 11:00 AM

The Body Mass Index And Its Relationship With Cardiovascular Risk in Québec Firefighters

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Firefighting tasks in emergency conditions impose high physiological and psychological demands, which can be particularly deleterious to the health and safety of firefighters. According to the *National Fire Protection Association*, 51% of the deaths that occurred among U.S. firefighters in 2015 while on duty were sudden cardiac deaths. Therefore it is essential for firefighters to maintain a healthy body weight throughout their career in order to reduce the risk of on-duty death. Body mass index (BMI) is very likely associated to a higher cardiovascular disease (CVD) risk in firefighters. Misclassifying mesomorphic firefighters as obese by using BMI occurred infrequently in a U.S. firefighters' cohort (Poston et al. 2011, *J Occup Environ Med*, 53(3), 266-273). **PURPOSE:** To document CVD risk among Québec firefighters according to their BMI. **METHODS:** Seven hundred and seventy nine (779) male firefighters (age: 41.6 ± 10.4 years; BMI: 28.0 ± 3.6 kg/m²) answered an online questionnaire evaluating the presence of CVD risk factors and symptoms. All data collected were self-reported. Three groups were formed based on the BMI; Group 1 (G₁): 18.5 kg/m² ≤ BMI < 25 kg/m², Group 2 (G₂): 25 kg/m² ≤ BMI < 30 kg/m², Group 3 (G₃): BMI ≥ 30 kg/m². **RESULTS:** Prevalence of overweight (25 kg/m² ≤ BMI < 30 kg/m²) and obesity (BMI ≥ 30 kg/m²) is 59.9% and 23.6% respectively. The number of modifiable risk factors (diabetes, hypertension, physical inactivity, smoking and dyslipidemia) is higher among firefighters with higher BMI before adjusting for age (G₁: 0.70 ± 0.71, G₂: 0.94 ± 0.78, G₃: 1.32 ± 1.00, P ≤ 0.001) and after (G₁: 0.77 ± 0.70, G₂: 0.94 ± 0.75, G₃: 1.23 ± 0.93, P ≤ 0.001). The BMI of participants who didn't have any cardiovascular symptom (n=463) was lower than that of participants who did report at least one cardiovascular symptom (n=285) before adjusting for age (27.35 ± 2.94 vs 28.44 ± 3.97, P ≤ 0.001) and after (27.37 ± 2.85 vs 28.44 ± 3.83, P ≤ 0.001). **CONCLUSION:** These results show the important prevalence of overweight and obesity among Québec firefighters based on BMI. They also show the relationship between BMI and CVD risk factors and symptoms. These relationships suggest that the BMI is an important indicator of CVD in Québec firefighters.

P. Gendron was supported by a doctoral research scholarship from Fonds de recherche du Québec en santé.

419 Board #240 May 31 9:30 AM - 11:00 AM

Efficacy of a Goal Setting Intervention on Firefighters' Cardiorespiratory Fitness: A Pilot Randomized Controlled Trial

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PURPOSE: The purpose of this study was to assess the effectiveness of a goal setting and implementation planning intervention on cardiorespiratory fitness among firefighters. **METHODS:** Male career firefighters (N=18) from a large municipal fire department with nine or more years on the job were randomized to an intervention arm (n=10) or passive control arm (n=8) of a 14-week study involving cardiorespiratory exercise. The intervention consisted of a goal setting and implementation planning coaching toward improving cardiorespiratory fitness at baseline, as well as support

throughout the 14 weeks of the study (i.e., midpoint goal coaching, surveys on goal adherence). Cardiorespiratory fitness was assessed through a standardized physical protocol for firefighters (Candidate Physical Ability Test; CPAT) at baseline, 6 week, at 14 week time points, using the Cosmed K4b2 portable metabolic system to measure physiological variables. Using intention-to-treat principles, we employed a 2-level multilevel model to examine the effect of intervention group on intercept and change over time on primary outcomes of interest: oxygen transport and utilization (VO₂), heart rate (HR), and respiratory exchange ratio (R). **RESULTS:** The intervention and control groups both exhibited a significant increase in VO₂ (B=0.1414, SE=0.0253, p<.0001), and a decline in R (B=-0.0026, SE=0.0008, p<.01) over the course of the study. However, there were no significant effects of randomization group on intercepts or slopes of any of the three outcomes, indicating that there were no significant differences in cardiorespiratory fitness when intervention group was compared to the control group. **CONCLUSION:** Although both groups exhibited improvements on two of the three cardiorespiratory outcomes, the addition of goal setting and planning implementation intervention did not convey additional benefits over the effect of a control group. The current study was the first to directly measure cardiorespiratory demands of actual firefighter job tasks (CPAT), as measured by using a portable metabolic system. Importantly, the results of this intervention provided estimates that will be used to appropriately power a larger future trial testing the effect of goal setting and planning implementation in improving cardiorespiratory health.

420 Board #241 May 31 9:30 AM - 11:00 AM

The Effect of Age on Cardiorespiratory and Muscular Fitness Measures in Female Firefighters

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The profession of firefighting is physically demanding, requiring a high level of both cardiorespiratory and muscular fitness. However, few studies have examined these fitness components among female firefighters (FF) and it remains unclear if this population is meeting minimum standards adopted by the National Fire Protection Association (NFPA). **PURPOSE:** To describe cardiorespiratory and muscular fitness of female career FF, and to determine if ageing affected their achievement of recommended profession standards. **METHODS:** A cross-sectional analysis of age groups (25-34, 35-44, 45-54, >55 yr) was conducted on 96 female FF over a ten-year span. Outcomes included cardiorespiratory fitness (CRF) expressed as maximum METs achieved during graded exercise to volitional fatigue, and muscular fitness (push-ups, sit-ups, and Sorensen back endurance). A one-way analysis of variance (ANOVA) with Bonferroni post-hoc comparisons was used to determine mean (± SD) differences (alpha level of 0.05) between age groups. **RESULTS:** The mean maximum METs achieved was significant across age groups, decreasing from 14.0 ± 2.2 in the 25-34 age group to 12.8 ± 1.4 in the 55+ age group (p<0.0001). The mean maximum number of push-ups was significant across age groups, decreasing from 34.0 ± 13.8 in the 25-34 age group to 31.6 ± 16.1 in the 45 to 54 age group, but increased to 35.8 ± 13.2 in the 55+ age group (p=0.02). Mean differences between age groups for sit-ups and the Sorensen test were not significantly different (p>0.05). **CONCLUSION:** While the mean values for age-groups consistently met or exceeded the 12-MET minimum CRF standard of the NFPA, the percentage of FF that fell below this cut-off ranged from 13% in the 25-34 age group to 39% in the 45-54 age group. Strategies to maintain fitness among all female FF are needed to ensure safe and effective job performance.

421 Board #242 May 31 9:30 AM - 11:00 AM

Heart Rate Recovery As Part Of Firefighters' Selection Process?

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(No relationships reported)

During a fire response, firefighters must carry out interventions that can vary in time followed by pauses for recovery. Thus, the ability to assay effort recovery is essential for firefighters to perform the requested task several times. **PURPOSE:** The objective of this study was to observe the heart rate (HR) recovery after a firefighter task simulation course test and rank their performance. **METHODS:** During the session, three groups of participants were asked to pass the course test, totalling n=48. Participants had an average of 23 ± 2.6 years, body weight 82 ± 8.7 kg and height 177 ± 6.4 cm (BMI of 26.2 ± 2.2 kg / m²). The course included seven tasks: fire hose handling, obstacles course with equipment, climbing up and down a 5 stair

staircase with hose, forced entry simulations with a sledgehammer, portable ladder manipulation, exploration work with a gaff pole and transporting an unconscious victim. Each participant was equipped with a HR monitor. A performance index, using heart rate at minute two of a 4 minute recovery period sitting down immediately after the course test and time of completion, was created to determine if a participant could in theory pass to the next stage of a hiring process. **RESULTS:** The maximal heart rate was 197 ± 2.6 bpm and represented the HR reached during the course test. The percentage of HR recovery after 2 min was $30 \pm 4.1\%$ for participants who passed ($n=40$) and $20 \pm 2.6\%$ for participants who did not pass ($n=8$) ($p<0.001$). Decrease of relative recovery was significantly different for the participants who passed or did not pass ($p < 0.05$), between 8 and 10 %. The index identified the overall performance with discrimination ($p<0.001$) for the two groups (7.79 ± 0.52 and 6.14 ± 0.52 , respectively). **CONCLUSIONS:** The evaluation of firefighters reveals the high intensity of effort required during intervention situations and the need to consider the moments of pauses, duration of pauses and aerobic fitness.

422 Board #243 May 31 9:30 AM - 11:00 AM
Physical Fitness, Body Composition And Quality Of Life Among Brazilian Police Recruits

Welere G. Barbosa¹, Edgard M. K. V. K. Soares¹, Guilherme E. Molina¹, Maria Korre², Stefanos N. Kales², Keila E. Fontana¹, Luiz Guilherme G. Porto³. ¹University of Brasilia, Brasilia, Brazil. ²Harvard T. H. Chan School of Public Health, Boston, MA. ³University of Brasilia and Harvard T. H. Chan School of Public Health, Brasilia and Boston, Brazil.
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Policing is a dangerous activity with intense physical and psychological demands that might impact police officers (PO) quality of life **PURPOSE** To evaluate physical fitness (PF), body composition (BC) and the quality of life (QL) among Brazilian male military police officer recruits **METHODS** Participants were 219 male PO recruits of a northern state of Brazil engaged on a mandatory 6-month training course before admission in the Police Department. The course is a 6-month full-time activity that includes 3 sessions of physical training/week and other police tasks. During the early part of the course, cardiorespiratory fitness (CRF) and muscle strength (MS) were evaluated by means of the Cooper running test (CRF), curl up, pull up and push up tests (MS). BC was evaluated by BMI, body fat percentage (BF% - Jackson & Pollock 3 skin fold) and waist circumference (WC). In the same evaluation, QL was assessed by the WHOQOL-Bref, that ascertains the QL in four domains: physical, psychological, social, and environmental. We compared the QL by BMI categories (normal vs overweight+obese) using Mann-Whitney test. We also evaluated the correlation between PF tests and QL (Spearman test), always applying 5% level of significance **RESULTS** Mean (\pm SD) PO age and BMI were 25.5 ± 3.6 years and 24.4 ± 2.5 kg/m². PO showed high level of PF and reduced QL (Table 1). There was no association between all PF components and all QL domains ($r_s < 0.1$, $p > 0.12$). Using BMI, 33% of PO would be classified as overweight and 2.7% as obese, but all participants were in the normal range for BF% and WC ($< 20\%$ and < 94 cm, respectively) **CONCLUSION** We observed high levels of PF and a relatively impaired QL among young PO recruits. Contrarily to previous findings, QL was not correlated to PF which may be related to high demands during the course. Therefore, considering BF% and WC values, the adequacy of using BMI for BC evaluation in this population (young well fit PO recruits) needs further

Table 1 Descriptive values of physical fitness, BC and QL among 219 Brazilian male PO recruits	
	mean \pm sd
Push up (repetitions)	30.4 \pm 2.32
Curl up (repetitions)	34.4 \pm 3.58
Pull up (repetitions)	7.7 \pm 3.68
CRF (VO ₂ max-mL.kg ⁻¹ .min ⁻¹)	48.5 \pm 3.65
BF (%)	11.2 \pm 3.8
WC (cm)	80.3 \pm 5.5
QL Physical domain	66.5 \pm 15.17
QL Psychological domain	75.6 \pm 17.06
QL Social domain	69.5 \pm 18.33
QL Environmental domain	54.4 \pm 13.48

A-53 Free Communication/Poster - Perception of Effort, Pain and Fatigue

Wednesday, May 31, 2017, 7:30 AM - 12:30 PM
 Room: Hall F

423 Board #244 May 31 11:00 AM - 12:30 PM
Effect Of Bench Press Load Knowledge On Repetitions, RPE, And Attentional Focus

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The central governor theory (CGT) states that metabolites that act through sensory feedback mechanisms act on the brain and spinal cord, allowing the nervous system to decide the extent of skeletal muscle recruitment during exercise. This ensures that homeostasis is maintained throughout exercise, regardless of the conditions of the exercise. Few studies have examined the role of the CGT and teleoanticipation during resistance training. **PURPOSE:** Examine the role of the CGT and teleoanticipation during resistance training, while completing the bench press (BP) during a known and unknown load. **METHODS:** A convenience sample of 26 participants (age= 21.31 ± 1.99 yrs, ht 175.08 ± 9.15 cm; mass 81.04 kg + 13.16 kg) completed three testing sessions: 1) 1 RM BP determination; 2) Submaximal BP reps to fatigue known weight (KW); 3) Submaximal BP reps to fatigue unknown weight (UW). KW and UW sessions were randomized and completed at 70% 1RM. **RESULTS:** One-way ANOVA revealed no significant effects for testing order. Repeated measures t-tests revealed no significant differences in number of repetitions (KW 14.23 ± 2.76 v. UW 14.73 ± 2.24 ; $t = 1.18$, $df = 25$, $p = .25$), RPE (KW 13.37 ± 1.40 v. UW 13.00 ± 1.66 ; $t = 1.26$, $df = 25$, $p = .22$) or attentional focus (%associative v. %dissociative) (KW 68.46 ± 12.87 v. UW 68.85 ± 13.36 , $t = 0.15$, $df = 25$, $p = .88$). **CONCLUSIONS:** While completing the BP participants used more associative rather than dissociative attentional strategies. RPE, reps to fatigue, and attentional did not differ across KW and UW conditions. Load knowledge did not influence performance.

424 Board #245 May 31 11:00 AM - 12:30 PM
Evaluating Instructions For Use Of The Rate Of Percieved Exertion Scale: A Pilot Study

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PURPOSE: The purpose of this study was to determine if there is a difference in understanding of Rate of Perceived Exertion (RPE) with two types of instructions. **METHODS:** Older adults that lived independently at a life care community participated in this study ($N = 18$). Two interviews took place more than seven days apart from each other. One participant only attended the first interview. At the first interview, participants signed the necessary paperwork and randomly chose which script (Brief or Modified Borg) would be read. At the second interview the remaining script was read. Identical sets of description, scenario and feedback questions were asked after each script. Participants were asked to describe the feeling of RPE's 6,9,13, 17, and 20. In addition, scenarios were said and they were asked to label the situations RPE level for themselves. Scenarios included gate closing at the airport (Airport Scenario), playing with children, and a typical trip to the grocery store. Responses were rated 'Good,' 'Needs Improvement,' and 'Exact.' Situations were analyzed by script and frequency. **RESULTS:** The Modified Borg instructions had a higher number of 'Good' descriptions for 6 ($n = 13$ vs. $n = 12$), 9 ($n = 14$ vs. $n = 11$), 13 ($n = 9$ vs. $n = 4$), and 17 ($n = 12$ vs. $n = 3$). RPE of 20 had equal ($n = 10$) participants with 'Good' descriptions for both scripts; however, the Modified Borg had two more participants that 'Needed Improvement.' The Airport scenario for the Brief instructions ranged from 13 to 20 RPE and 8 to 17 RPE for the Modified Borg. The most common answers were 13 ($n = 5$) and 15 ($n = 5$) for the Brief, and the Modified Borg's were 12 ($n = 4$) and, 11, 13 and 14 ($n = 3$). Playing with children scenario resulted in 11 and 12 being the most common answer given for both scripts ($n = 3 - 6$). The children scenario ranged from 7 to 18 for the Brief Script and 6 to 13 for the Modified Borg. Most answered response was 11 ($n = 6$) to the grocery store scenario for both scripts ranging from 8 to 14 and 6 to 14 for the Brief and Modified Borg. **CONCLUSION:** Perception widely varies between the participants for the different scenarios. The longer more descriptive instructions were helpful but were possibly too long for the adults to be more accurate than the brief script.

WEDNESDAY, MAY 31, 2017

425 Board #246 May 31 11:00 AM - 12:30 PM
The Effect of an Energy Harvesting Backpack on Perceived Exertion during Locomotion

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Biomechanical energy harvesting from elastically-suspended load carriage is a promising source of power for Soldiers, who often march with heavy loads at varying speeds on various terrains. An energy harvesting backpack (EHB) has been developed which generates power from vertical oscillations during locomotion. Ideally, the EHB should not increase psycho-physiological burden compared to the standard military assault pack (AP). **PURPOSE:** To compare ratings of perceived exertion (RPE) while walking with an EHB and an AP at different speeds on different grades. **METHODS:** 16 subjects (M±SD; 28.6±4.9 years; 173.4±10.6 cm; 78.7±16.4 kg) walked on a treadmill with each pack for 5 minutes at each of three grades (+5%, 0%, and -5%) and each of two speeds (1.34 m/s and self-selected faster speed). Both the AP and EHB contained a 15.9 kg load, but the design of the EHB made it 4.4 kg heavier than the AP. A Borg RPE score was taken during the last 10 seconds of walking at each grade and speed. A within-subjects ANOVA was used to determine effects of pack, grade, and speed on log-transformed RPE. Alpha level was set a priori at p<0.05. Post-hoc comparisons were explored using Bonferroni corrections. **RESULTS:** There were main effects for pack, speed, and grade ($F_{1,152}=14.3$, $F_{1,152}=100.1$, and $F_{1,152}=346.3$, respectively; p<0.001) with no interaction effects. Subjects reported a greater sense of exertion with the EHB (11.9±2.8) than with the AP (11.2±2.6) regardless of speed and grade. Faster speeds elicited higher RPE scores than slower speeds (13.1±2.4 and 10.1±2.1, respectively), while the incline grade produced higher RPE scores (13.1±2.5) than decline and level grades (10.3±2.3 and 11.2±2.5, respectively). **CONCLUSIONS:** The EHB caused greater levels of perceived exertion that were not altered by walking speed or grade. This may be due to the extra stabilization required or the extra weight cost of the EHB. Kinematic variables (trunk lean) related to this research suggest potential non-linear effects of EHB use, which may also be related to the increased perceptions of exertion found here. This may affect trade-offs between power generation, perceived exertion, and metabolic cost that warrants further research and may ultimately affect user-acceptance of suspended-load energy harvesting systems in the field.

426 Board #247 May 31 11:00 AM - 12:30 PM
Validity And Reliability Of Borg's 6-20 RPE Scale Among Chinese Mandarin Speaking Young Healthy Adults

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The validity and reliability of the Borg's 6-20 Rating of Perceived Exertion (RPE) scale has not been tested among Chinese people from Mainland China. Leung and Wang each have published a Chinese version RPE scale but neither has been validated in Chinese speaking people from Mainland China. **PURPOSE:** This study assessed: 1. The validity of Leung Chinese version (n=22) and Wang Chinese version (n=23) of the Borg 6-20 scales; 2. The reliability of Wang Chinese version (n=11) of RPE scale; and 3. The agreement of these two Chinese versions (n=21) of the RPE scales during the Bruce treadmill protocol testing among young healthy adults from Mainland China. **METHODS:** A total of 26 subjects (11 males, and 15 females), age 22.7±3.0 yr., volunteered to participate. They performed one (n=3), two (n=14), or three trials (n=9) of the identical Bruce treadmill protocol exercises within a time span of 9.0±5.1 days (validation trials), and 30.4±27.9 days (reliability trials). The objective measures of exercise intensity (power output, heart rate, and oxygen consumption) and the subjective measure of effort (RPE) were observed during the incremental exercise. **RESULTS:** Significant (p<0.01) Pearson linear correlations coefficients (r) were found where RPE values were strongly correlated with power output (Leung version $r_{s\geq 0.75}$, Wang version $r_{s\geq 0.73}$), heart rate (Leung version $r_{s\geq 0.84}$, Wang version $r_{s\geq 0.87}$), and oxygen consumption (Leung version $r_{s\geq 0.80}$, Wang version $r_{s\geq 0.81}$). The overall test-retest interclass correlation coefficient (ICC) was 0.94. All the Bland-Altman plots for stage 1 to 3 showed that at most 1 data point was outside of the limits of agreement. Fisher z-transformation test found no significant differences in correlation (all ps>0.05) between trials for the reliability test of Wang version scale, and found no significant difference (p>0.05) in correlation with objective measures between the two Chinese versions of RPE scale. **CONCLUSIONS:** Both Leung and Wang Chinese versions Borg's 6-20 RPE scales are valid psychophysiological tools to measure perceptions

of exertion during controlled Bruce treadmill protocol exercise among young healthy Chinese adults. The Wang scale is reliable, and the Leung and Wang scales show good agreement with each other.

427 Board #248 May 31 11:00 AM - 12:30 PM
Perceptual Responses Of High Intensity Interval Training Among Overweight And Obese Individuals

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INTRODUCTION: Poor exercise adherence is resulting in a rise of chronic diseases. High intensity interval training (HIIT) may improve adherence as it takes less time and is less monotonous. Beneficial physiological effects have been measured, but perceptual responses to HIIT have not been researched in overweight and obese (OW/OB) individuals. **PURPOSE:** To analyze whether participants prefer HIIT in comparison to continuous aerobic exercise (CON). **METHODS:** OW/OB individuals (30-55 years old) completed, in a randomized order: CON) a 45 minute walk at 65% of the age predicted maximal heart rate (APMHR), HIIT60) a 20 minute exercise in which the intensity alternated between 80% AMPHR and 60% APMHR every 60 seconds, and HIIT90) a 21 minute exercise in which the intensity alternated between 80% AMPHR and 60% APMHR every 90 seconds. Heart rate (HR), ratings of perceived exertion (RPE), and exercise enjoyment were measured during the exercise. Feeling scale (FS) and physical activity enjoyment scale (PACES) was measured 5 and 35 minutes post exercise. A qualitative (QUAL) interview was conducted 35 minutes post exercise. **RESULTS:** HIIT was more preferred than CON as evidenced by a higher (p<0.05) Friedman's rank score in HIIT90 and HIIT60 compared to CON. Post exercise PACES was higher (p<0.05) in HIIT60 and HIIT90, and FS was higher with HIIT60. Higher HR during HIIT60 and HIIT90 (p<0.05) indicate higher intensities during the exercise. Perceived exertion was higher (p<0.05) in HIIT90 and HIIT60, as evidenced by Friedman's rank scores of 2.36, 2.29, and 1.36 in HIIT90, HIIT60, and CON. QUAL data showed a feeling of passive exercising among CON compared to dynamic exercising among HIIT. Inability to self-regulate and safety concerns were felt in regards to HIIT. Lack of time and energy were factors for not exercising; HIIT was seen to be an effective method for time compared to CON for lack of energy. **CONCLUSIONS:** HIIT was a more preferred exercise, both during and after the exercises, regardless of the higher intensities. Greater challenges as well as dynamic changes in intensity were referenced as positive exercise perceptions. Both exercises were seen to be utilized in different scenarios such as lack of time for HIIT and a family activity for CON. Thus, HIIT is a preferred exercise within those who are OW/OB.

428 Board #249 May 31 11:00 AM - 12:30 PM
Impact of Using Perceptually Regulated Recovery Periods During Repeated Sprint Work

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Work-to-rest ratios (W:R) are designed to allow optimal recovery in sequential exercise bouts with particular consideration of intensity and duration. Emerging evidence supports the use of perceptual measures of recovery as valuable training tools in human performance. However, the efficacy of a perceptual measure of recovery compared to pre-established W:R during bouts of repeated sprint work has not been explored. **PURPOSE:** To compare performance during identical bouts of repeated sprints using either traditional W:R methodology vs. the use of a perceptual measure to gauge recovery. **METHODS:** Eight sprint-trained individuals completed two repeated sprint trials consisting of 3 sets of 8, 30-meter sprints on a non-motorized treadmill. Between each set of sprints, participants were given either a standard 5-min recovery whereupon the next set of sprints began or they were allowed to gauge recovery using a previously tested 0-10 Perceived Recovery Status (PRS) Scale. When using the PRS, once a participant estimated a recovery level '5' they began their next set of sprints. Performance measures included power (watts), decrements in power (DEC), recovery of power between sets (REC), and acute RPE estimated per sprint, but averaged to represent RPE in a set. **RESULTS:** When using the PRS, individuals self-selected longer recovery times than the standard 5 minutes (on average 24 sec longer between sets 1 and 2 and 1 min 54 sec longer between sets 2 and 3). A 2 (trial) x 3 (sets of sprints) repeated measures ANOVA revealed no significant differences (p > 0.05) in performance measures. However, performance was improved, albeit not significantly, when participants used the PRS method vs. the traditional W:R. In general, when using

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the perceptually-regulated recovery strategy, improvements (~8-12%) were observed in power, DEC, REC, and RPE vs. a set 5-min recovery period. **CONCLUSIONS:** Results indicate that perceptually regulated recovery periods were longer but produce, at a minimum, statistically similar repeated sprint performance results. In addition to greater convenience associated with subjective markers, increased adherence to exercise associated with this form of training is plausible when using perceptual markers to set intensities during exercise.

429 Board #250 May 31 11:00 AM - 12:30 PM
Comparison Of Different Instructional Sets For Patient-Generated Indexes Of Pain Severity

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Patient-Generated Indexes (PGIs) are a form of individualized patient-reported outcome measure that request patients to self-identify a predetermined number of health concerns and then rate the severity of the concerns. PGIs have been used to measure such concerns as quality of life, physical function, disability, and pain. The instructional sets of PGIs vary, but no studies were located that have tested the impact of different PGI instructional sets on severity ratings. **PURPOSE:** This study directly compared a PGI instructional set that requested painful activities (PGI-pain) to a PGI instructional set that requested activities from which the respondent most wanted less pain (PGI-painrelief). **METHODS:** The sample consisted of cohorts of patients with knee osteoarthritis (OA) who were either non-surgically managing their OA ($n = 31$, 62 yrs old ($SD = 10.18$), 64.5% women) or scheduled for their first joint replacement/s ($n = 30$, 56 yrs old ($SD = 6.45$), 70.0% women). During a single visit, patients completed both PGIs without any activity prompts. Also, they completed a numeric pain scale for rating the highest pain in the most painful knee. **RESULTS:** Both PGIs correlated with the numeric pain ratings ($r^2 = .76 \ \& \ .80$, $p < .01$). No significant differences in the patients' pain ratings were detected between the two PGIs ($t_{60} = 0.35$, $p > .05$), but the pre-surgical patients' pain ratings were higher than the non-surgical patients using both PGIs ($t^*_{59} = -6.94 - -5.55$, $p < .01$). The importance of the activities that the patients identified for the PGI-painrelief was higher than for the PGI-pain ($t_{60} = -4.28$, $p < .01$) and the pre-surgical patients' ratings of activity importance were higher than the non-surgical patients using both PGIs ($t^*_{59} = -4.56 - -3.31$, $p < .01$). **CONCLUSIONS:** The results support the construct and concurrent validity of both PGIs. Although ratings of pain severity did not differ between the two PGIs, the importance of the self-selected activities varied between them. Thus, the instructional set of PGIs may influence the criteria respondents use for identifying their concerns. These findings contribute to previous reports from qualitative studies that people prefer to assess activities they view as important. Future studies should test the impact of PGI instructional sets on responsiveness to change across time.

430 Board #251 May 31 11:00 AM - 12:30 PM
Predicting Affective Exercise Responses from a Submaximal Exercise Test Using the Feeling Scale

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The feeling scale (FS), rated -5 to +5, where -5 is an affective state of very bad and +5 is very good, has been validated across the moderate to severe exercise domains during incremental exercise; however, little has been reported on constant-load exercise. **PURPOSE:** To examine the FS during the Mankato submaximal exercise test (MSET) and predict FS responses at intensities above and below gas exchange threshold (GET). **METHODS:** A total of 8 women and 6 men (age 21 ± 1) completed the MSET using stages of 35 and 65% of estimated maximal work capacity (W_{peak}). Participants returned for 10-minute constant-load bouts at 50 and 70 or 72% estimated W_{peak} . FS was assessed at the end of each minute of the MSET and constant-load bouts. Linear regression from the MSET was used to predict FS at 50 and 70% W_{peak} . Actual and predicted values were compared using the Wilcoxon test. **RESULTS:** Actual ratings declined in the 50% W_{peak} trial reaching the lowest FS rating of 0.63 ± 2.84 , a value not differing from the estimate of 0.64 ± 2.43 ($z = 0.11$, $p = 0.92$). Six participants failed to complete the entire 70% W_{peak} trial. Continual time-dependent decreases in FS were reported by the remaining participants. The actual end-exercise value (-1.00 ± 2.06) did not differ from the predicted (0.21 ± 2.06) ($Z = 1.40$, $p = 0.16$). **CONCLUSION:** Affective responses using the FS can be predicted for exercise below GET; however, it may be limited in predictability above GET.

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Caffeine but not Low-Carbohydrate Improves Exercise Capacity in Sedentary Adults Similar to Endurance Trained Athletes

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Caffeine (CAF) and small amounts of carbohydrate (CHO) ingested or simply exposed to the oral cavity appear to delay fatigue during prolonged exercise, possibly through central nervous system mechanisms. However, this has been primarily documented in endurance trained (ET) athletes. **PURPOSE:** To determine if: 1) CAF and/or a low dose of CHO (equivalent to CHO contained in ergogenic mouth rinse and insufficient to trigger a peripheral metabolic response) improves endurance capacity in sedentary adults (SED) similar to ET and 2) potential ergogenic mechanisms differ based on fitness status. **METHODS:** Using a double-blind crossover design, ET and SED ($n=12$ each) completed four exercise trials consisting of 30 min cycling at 90% lactate threshold followed by cycling time to fatigue (TTF) at 105% lactate threshold. The following solutions were ingested after standardized 43 g CHO breakfast: CAF (3 mg/kg), low (<1%) CHO (LCHO), combined CAF+LCHO, and placebo (PLA). **RESULTS:** ET and SED did not differ in overall mean ($\pm SD$) TTF (23.8 ± 8.1 vs. 24.1 ± 11.3 min) but TTF improved ($p < 0.05$) in CAF+LCHO versus LCHO. When averaging across both CAF treatments (CAF+LCHO and CAF), perceived exertion was lowered and TTF was increased by 21% (26.3 ± 10.4 vs. 21.7 ± 9.9 min) compared to the two no-CAF treatments (PLA and LCHO), but CAF did not alter muscle strength/activation. Blood glucose, lactate, and CHO oxidation were higher with CAF vs. no-CAF treatments. Fat oxidation was higher in ET compared to SED, but CAF did not alter fat oxidation. **CONCLUSIONS:** The ergogenic benefit and action of CAF appears to be independent of fitness status. The addition of LCHO ingestion, previously observed to act centrally, did not further augment benefits of CAF in the fed state.

432 Board #253 May 31 11:00 AM - 12:30 PM
Fatigue as a Rehabilitation Strategy to Reduce Quadriceps Inhibition Following Anterior Cruciate Ligament (ACL) Reconstruction

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Arthrogenic muscle inhibition (AMI), an inability to fully activate the quadriceps muscles, has been consistently observed in patients with anterior cruciate ligament reconstruction (ACLR) surgery. Reductions in quadriceps activation may be partly due to the flexion reflex pathway, which includes the activation of the hamstrings and reciprocal inhibition of the quadriceps. Central fatigue has been shown to reduce muscle activation, change movement strategy, and shift loading to other muscles. Therefore, we hypothesized that the fatigue of the hamstrings could be used to alleviate the quadriceps muscle inhibition by counteracting the flexion reflex. **Purpose:** To determine the effects of fatigue on reducing quadriceps muscle inhibition after ACL reconstruction. **Methods:** A total of nine adult athletes (19.9 ± 1.7 years old) with unilateral ACLr and nine control athletes (24.0 ± 2.4 years old) with no previous history of knee injury were recruited. Fatigue was induced in subjects by performing tempo squats, in which the ACLr group tended to use hamstrings for more hip flexion and trunk forward flexion than the control group. Quadriceps inhibition was assessed through the central activation ratio (CAR), measured by twitch interpolation, before and after the fatigue for each subject. A Mixed ANOVA was performed to examine the effect of fatigue on the CAR between pre- and post-fatigue, and among ACLr and control groups. **Results:** The CAR of the quadriceps was significantly greater post-fatigue than pre-fatigue for the ACLr group ($96.0 \pm 7.6\%$ vs. $81.2 \pm 15.8\%$, $p = 0.010$); whereas no significant differences were observed for the control group between post-fatigue and pre-fatigue ($96.9 \pm 9.6\%$ vs. $97.0 \pm 17.1\%$, $p = 0.969$). Additionally, in pre-fatigue trials the ACLr group had marginally significant less CAR ($81.2 \pm 15.8\%$ vs. $97.0 \pm 17.1\%$, $p = 0.067$) than the control group; after fatigue trials no significant differences of CAR were observed between the ACLr and control groups ($96.0 \pm 7.6\%$ vs. $96.9 \pm 9.6\%$, $p = 0.838$). **Conclusion:** These results suggest that fatigue training can be used as a rehabilitation strategy to restore normal quadriceps function at the knee joint following ACL reconstruction by relaxing the hamstrings and overcoming the inhibition of the quadriceps.

433 Board #254 May 31 11:00 AM - 12:30 PM
Recreationally-Trained Subjects are Unable to Attenuate VO₂ Slow Component During Severe Exercise Using RPE
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Previous research indicates that recreationally-trained subjects are able to attenuate the slow component of oxygen uptake (VO₂) during heavy intensity exercise using rating of perceived exertion (RPE). Little is known, however, about the use of RPE to attenuate the slow component when exercising in the severe exercise domain. **PURPOSE:** The present study examined the degree to which recreationally-trained subjects could attenuate the VO₂ slow component while cycling in the severe exercise domain. **METHODS:** A total of 15 volunteer subjects, 9 males, and 6 females (mean age ± SD = 22.3 ± 1.8), completed a 3-minute all-out exercise test for the determination of critical power (CP) and the curvature constant (W'). Subjects then returned and completed two separate bouts at 10% >CP. The constant bout required subjects to sustain their preferred cadence until exhaustion. The regulated bout involved subjects attempting to maintain their RPE from 2-min into the bout by adjusting power output until their power output declined to a value ≤ CP. **STATISTICAL ANALYSIS:** Paired t-tests were conducted. **RESULTS:** The constant bout evoked a VO₂ value (43.3 ± 7.3 ml·kg⁻¹·min⁻¹) that was not different from VO_{2max} (43.1 ± 7.4 ml·kg⁻¹·min⁻¹) (t = 0.17, p = 0.87), confirming that the intensity was in the severe exercise domain. In the regulation bout, there was a significant gain (~7 ml·kg⁻¹·min⁻¹) in VO₂ between 2 min and the end of exercise (t = 6.25, p < 0.01). A wide range of utilization for the work capacity above CP was observed (2.0 - 13.7 kJ). **CONCLUSION:** In contrast to exercise in the heavy domain, recreationally-trained subjects are unable to attenuate the VO₂ slow component using their RPE in the severe domain. Future research is needed on fitter subjects and/or different psychometric scales.

434 Board #255 May 31 11:00 AM - 12:30 PM
Acute Affective Responses To High-Intensity Interval Training In Trained and Untrained Men
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Although exercise has been shown to alter transiently affective variables, the impact of fitness levels on affective response to high-intensity interval training (HIT) remains unclear. **PURPOSE:** The present study was designed to compare affective responses between HIT and continuous exercise at low-intensity in trained and untrained men. **METHODS:** Twenty male subjects (21.2 ± 0.34 years) were divided into trained group [TR, n=10, maximal oxygen uptake (VO_{2max}) 55.6 ± 1.1 ml/kg/min] or untrained group (UT, n=10, VO_{2max}: 40.5 ± 1.0 ml/kg/min). All subjects completed two trials in random order, consisting of HIT (10 × 1 min pedaling at 90% of VO_{2max}) with 1 min of active rest at 30% of VO_{2max}) or 60 min of pedaling at 50% of VO_{2max} (LOW). Scores of muscle soreness, fatigue, vitality and desire for exercise were evaluated using visual analog scale before exercise and during 60 min of post-exercise period. Moreover, two-dimensional mood scale (TDMS) was conducted to assess vitality, stability, pleasure and arousal. Blood samples were also collected to determine blood lactate glucose concentrations. During exercise, heart rate (HR) and rating of perceived exertion (modified 10 scale) were recorded. **RESULTS:** Exercise-induced blood lactate elevation was significantly greater in the TR group than in the UT group (group × time, P < 0.05). The results of TDMS revealed that exercise altered significantly arousal, vitality, stability and pleasure (main effect for time, P < 0.05) after HIT and LOW. However, scores of vitality, stability and pleasure were significantly (P < 0.05) elevated 60 min after HIT in the UT group, whereas the TR group did not show similar change. **CONCLUSIONS:** These findings suggest that exercise improves acutely affective variables. However, the affective response to exercise appears to be particularly influenced by fitness levels, and HIT augments vitality, stability and pleasure during post-exercise period only in untrained men, not in trained men.

435 Board #256 May 31 11:00 AM - 12:30 PM
The Validity of Oxygen Uptake Efficiency Measures in Myalgic Encephalomyelitis/Chronic Fatigue Syndrome
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Maximum oxygen uptake is often used to evaluate cardiopulmonary function in patients with Myalgic Encephalomyelitis/Chronic Fatigue Syndrome (ME/CFS). However, many ME/CFS patients may not be capable of giving the level of effort required for a valid test. Oxygen uptake efficiency slope (OUES) has been proposed as an effort independent measure to assess aerobic fitness in populations where maximal exercise is contraindicated, but has not been assessed in ME/CFS. **PURPOSE:** To determine the validity of OUES as a measure of aerobic fitness in ME/CFS. **METHODS:** Maximal exercise testing was performed using a ramped protocol on a cycle ergometer in a clinical sample of ME/CFS patients as part of the CDC multi-site study. Oxygen consumption (VO₂), carbon dioxide production (VCO₂) and pulmonary ventilation (VE) were directly measured using a metabolic cart. Ventilatory equivalents for O₂ (VE/VO₂) and CO₂ (VE/VCO₂) were calculated. Peak effort was determined using American College of Sports Medicine criteria. Anaerobic threshold was determined using the Vslope method. OUES was determined by VO₂ = a*log VE + b, where a = OUES, b = intercept. Linear regression was used to determine the relationship between VO_{2peak} and OUES. Group comparisons were analyzed using Independent t-tests and Mann-Whitney tests with an alpha = 0.05. **RESULTS:** A total of 180 tests were evaluated including 135 (39 male) ME/CFS patients and 45 (18 male) controls (CO). Over 80% of the sample achieved peak exercise effort. Anaerobic threshold occurred at similar percentages of peak VO₂ (ME/CFS: 54%; CO: 53%, p > 0.05) and peak Watts (ME/CFS: 39%; CO: 45%, p > 0.05). Maximum VO₂ correlated with OUES in both groups (CFS: Rho = 0.695, p < 0.01; CO: Rho = 0.709, p < 0.01). OUES values were significantly lower for ME/CFS patients (ME/CFS Median 1.77, interquartile range (IQR) 0.86; CO Median 2.3, IQR 1.29, p < 0.05). Ventilatory equivalent measurements were significantly higher in ME/CFS at anaerobic threshold compared to CO (VE/VO₂: ME/CFS Median 25.8, IQR 7.8; CO Median 24.0, IQR 3.8; VE/VCO₂: ME/CFS Median 30.1, IQR 9.2; CO Median 28.5, IQR 4.1, p < 0.05). **CONCLUSION:** These data demonstrate the validity of OUES to predict aerobic capacity and might discriminate ME/CFS patients from healthy controls, thereby encouraging future research using submaximal effort tests.

A-54 Free Communication/Poster - Preparticipation and Injury Risk Assessment

Wednesday, May 31, 2017, 7:30 AM - 12:30 PM
 Room: Hall F

436 Board #257 May 31 11:00 AM - 12:30 PM
Association of Interrelated Neuromechanical Factors with Injury Occurrence among College Football Players
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PURPOSE: The purpose of this prospective cohort study was to assess the predictive value of injury risk screening methods that collectively assess aspects of environmental awareness, cognitive processing of neural input, and motor control, as well as any persisting effects of previous injuries. **METHODS:** Prior to participation, 43 NCAA Division I-FCS college football players (20.2 ± 1.2 years; 185.7 ± 5.8 cm; 105.4 ± 20.6 kg) completed the 10-item Sport Fitness Index (SFI) survey and performed both a 60-second Reactive Peripheral Response (RPR) test and a 10-second Unilateral Forefoot Squat (UFS) test of postural stability. The 0-100 SFI score quantified perceptions of persisting effects of previous injuries. The RPR represented the number of outermost target hits (rings 4 and 5 of 64 target buttons arranged in a pattern of 5 concentric rings on a 1.2 m x 1.2 m board) while simultaneously reciting text that scrolled across a centrally located screen. The UFS test utilized a smartphone accelerometer to quantify the root mean square (RMS) of instantaneous change in body mass acceleration (Jerk) on the dominant extremity. All sprains, strains, and head injuries sustained from the beginning of practice sessions to the end of the 13-game season were documented, along with the number of player appearances in games.

RESULTS: Injuries were sustained by 14 of 43 players (33%). Univariable associations of binary risk classification with injury occurrence were: SFI ≤ 86 (OR=1.77), UFS Jerk RMS ≥ 0.06 (OR=4.19), RPR ≤ 11 Hits (OR=2.95), and Games Played ≥ 8 (OR=3.16). A large SFI X UFS X RPR interaction effect was identified (OR=11.20). Logistic regression results for the combination of the 3-way interaction (Adjusted OR=21.32) with Games Played ≥ 8 (Adjusted OR=6.19) yielded a strong prediction model ($\chi^2_2 = 9.04$, $p = .011$; $R^2 = .265$). Cox regression results for a binary SFI X UFS X RPR risk classification, adjusted for the potentially confounding effect of differential game exposure among players (0-13 games), demonstrated a strong association with time to injury occurrence (HR=4.65; 90% CI: 1.74, 12.44).

CONCLUSIONS: The findings support the potential for reduction of football injury risk through targeted interventions that address modifiable deficiencies in peripheral visual awareness, reaction time, and postural stability.

437 Board #258 May 31 11:00 AM - 12:30 PM
Relationships Among Lower Extremity Range Of Motion, Postural Control, And Power Generation Asymmetries: The FPPE Project

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Lower extremity (LE) musculoskeletal (MSK) injury risk factors are often examined in isolation without regard to how their interrelationships may influence injury risk. Developing a better understanding of relationships among MSK injury risk factors may help inform future injury risk assessment models. **Purpose:** Identify relationships among LE range of motion (ROM), postural control and power generation asymmetries. **Methods:** Prior to the start of their competitive sports seasons, high school football, soccer, basketball and lacrosse athletes completed the ankle dorsiflexion weight-bearing lunge (DF), single leg anterior reach (SLAR), and anterior single leg hop for distance (SLHOP) tests as part of the Functional Pre-Participation Physical Evaluation project. These tests were used as assessments of LE ROM, postural control, and power generation, respectively. DF measurements were recorded in centimeters while SLAR and SLHOP distances were recorded in centimeters and normalized to the participants' leg lengths. Limb symmetry indices (LSI) were calculated for all tests as the minimum score of the two legs divided by the maximum score. Linear regression was used to assess direct effects of DF LSI and SLAR LSI on SLHOP LSI. A linear regression-based mediation analysis was performed to determine if DF LSI was indirectly related to SLHOP LSI through an effect on SLAR LSI. Statistical significance of the indirect effect was assessed using a 95% bias-corrected bootstrapped confidence interval (CI) with 50,000 samples. A 95%CI that did not include 0.00 was considered statistically significant. Alpha level was set *a priori* at $p < 0.05$. **Results:** 3,765 male (15.65 \pm 1.23 years, 1.77 \pm 0.09m, 74.34 \pm 16.38kg) and 1,874 female (15.51 \pm 1.17 years, 1.65 \pm 0.07m, 60.26 \pm 9.94kg) high school athletes participated in this study. DF LSI (coefficient: 0.03, 95%CI=0.02-0.04; $p < 0.001$) and SLAR LSI (coefficient: 0.21, 95%CI=0.17-0.24; $p < 0.001$) were directly related to SLHOP LSI. DF LSI was indirectly related to SLHOP LSI (coefficient: 0.005, 95% bootstrapped CI=0.003-0.007) through its effect on SLAR LSI. **Conclusions:** LE ROM, postural control, and power generation asymmetries are related through a combination of direct and indirect effects. Future research should examine how these interrelationships influence LE MSK injury risk.

438 Board #259 May 31 11:00 AM - 12:30 PM
The Comprehensive High-level Activity Mobility Predictor-Sport (CHAMP-S): A Performance-Based Outcome Measure to Quantify High-level Mobility and Assist with Return to Sport for Division I Collegiate Football Players

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The Comprehensive High-level Activity Mobility Predictor (CHAMP) is a reliable and valid outcome measure that assesses high-level mobility in Service Members (SM) with traumatic lower limb loss. The CHAMP has the potential to be used to assess current high-level mobility capabilities in healthy, athletic individuals, to determine those athletes that may be at risk for injury, can be administered throughout rehabilitation process, and can assist with return to play decision making for collegiate athletes that suffer lower limb injuries.

Purpose: To develop the reliability and validity of the Comprehensive-High-Level Activity Mobility Predictor-Sport (CHAMP-S) in Division I Collegiate Football Players. **Method:** 206 student athletes participated in the study. 97 were tested at one time by three testers (two using the paper format and one using a mobile

device application) to determine CHAMP-S interrater reliability. 115 had completed CHAMP-S, anthropometric measures, upper and lower limb power, speed, and agility measures and underwent correlation analysis. 206 underwent ANOVA followed by post hoc analysis to determine differences between CHAMP-S scores between different football positions. Twenty athletes who underwent season ending injury were administered the CHAMP-S every 4-5 weeks throughout rehabilitation to assess change in high-level mobility and determine return to sport.

Results: The ICC's for the CHAMP-S items ranged from 0.90 (95% Confidence Interval, CI: [0.85, 0.93]) to 0.98 (95% Confidence interval, CI: [0.97-0.99]) for Single Limb Stance, Four-meter side step test, L-Test, and Illinois Agility Test. The CHAMP-S was significantly correlated with BMI, % Body Fat, Vertical Jump, Broad Jump, 40-yard dash, and shuttle run. The CHAMP-S demonstrated differences between linemen and skilled position players in all planes of movement. All 20 athletes returned to play safely and have not suffered re-injury to the ipsilateral or contralateral lower extremity. The athletes achieved 103% \pm 5% (95-109%) of their baseline CHAMP-S score ($p = 0.09$). **Conclusion:** The CHAMP-S is a reliable and valid measure of high-level mobility in Division I Collegiate Football Players that can help determine differences by position and assist return to sport following lower limb injury.

439 Board #260 May 31 11:00 AM - 12:30 PM
Predicting Knee and Thigh Injury Risk Using Scaled Vertical Jump and Standing Long Jump Power

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Movement tests, such as the VJ and SLJ, are used to determine power, athlete development, and quantify training protocol effectiveness. An idea exists to compare the power outputs from a VJ and a SLJ to give a picture of lower extremity injury risk. The ability to use easy and cost-efficient common movement tests could greatly enhance the capabilities of allied health care professionals.

PURPOSE: to examine the ability to predict knee and thigh injury based upon an allometrically scaled ratio of VJ and SLJ power.

METHODS: Participants included 26 female NCAA-I athletes from soccer and volleyball teams. The study examined testing data on the athletes before an off-season training cycle. Previous thigh or knee injury was compared to scaled Avg. power ratio, scaled peak power ratio, and z-scores for Avg. power and peak power. Correlation and ROC curves analyzed the relationships. Significance was set at the .01 level.

RESULTS: There were no correlations between the variables of interest and an athlete's past injury history. The individual team variables also revealed no correlation. ROC curves indicated: VJ Avg. power (.631), VJ peak power (.663), SLJ Avg. power (.622), and the VJ/SLJ peak power ratio (.663) indicated individuals who are at risk for injury.

CONCLUSIONS: Correlation indicates that ratios of power output for VJ and SLJ are not effective for predicting injury potential. A reason for the lack of correlation could be due to the crossover in vertical and horizontal components of VJ and SLJ success. The crossover of the horizontal components in the VJ jump is not as impactful as the vertical pieces of the SLJ. Each sport has different skills involved. The ROC curves do not provide strong specificity or sensitivity for predicting injury risk. The peak power ratio does not provide a solid means to predict injury risk. The z-scores of the Avg. power ratio and the peak power ratio failed in sensitivity and specificity. However, using the individual outputs of each revealed interesting information. VJ Avg. power, VJ peak power, and SLJ Avg. power provide a degree of prediction capability. The data confirms that the two sports are different from each other in power needs. Using the performance tests of the VJ and the SLJ to determine injury risk does seem to predict the possibility of a knee or a musculoskeletal thigh injury.

440 Board #261 May 31 11:00 AM - 12:30 PM
Test-Retest Reliability of Functional Tasks in Healthy High School Athletes: The FPPE Project

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(No relationships reported)

The 4th edition of the Pre-Participation Physical Evaluation (PPE) recommends functional testing for the musculoskeletal portion of the examination. However, limitations exist concerning currently recommended functional test components and the feasibility of implementing this test battery in the secondary school setting. In particular, test-retest reliability for recommended functional tests across secondary school settings has yet to be established.

PURPOSE: Determine test-retest reliability of three functional tests utilized in the Functional Pre-Participation Physical Evaluation (FPPE) project.
METHODS: A convenience sample of four high schools currently enrolled in the FPPE project participated. Prior to the start of their competitive sports seasons, high school athletes completed a weight-bearing lunge to assess ankle dorsiflexion range of motion (DF) as well as the single leg anterior reach (SLAR) and anterior single leg hop for distance (SLHOP) tests as part of the FPPE project. Athlete testing was conducted by the head Certified Athletic Trainer (AT) at each high school and was repeated one week after the initial test date. Intraclass correlation coefficients (ICC) using a two-way mixed effects model and an absolute agreement definition were calculated for each functional test. Separate ICCs were calculated for each AT. ICC(3,1) values were interpreted as: excellent (>0.75), fair to good (0.40-0.75), and poor (<0.40).
RESULTS: 40 athletes (m/f= 23/17, 16.4±1.1 y, 1.78±0.11 m, 70.1±13.1 kg) participated in this study (10 athletes per high school). Test-retest reliability was excellent for all raters for both the DF (ICC(3,1) range: 0.817-0.975) and SLHOP tests (ICC(3,1) range: 0.832-0.963). Test-retest reliability of the SLAR was found to be excellent for two raters (ICC(3,1): 0.813, 0.876) and fair to good for two raters (ICC(3,1): 0.583, 0.693).
CONCLUSIONS: Test-retest reliability for functional tasks utilized in the FPPE project was generally excellent across a sample of high school ATs, supporting the utility of these tasks in longitudinal assessments in secondary school settings. Supported by NIH Grant 5R01-AR062578-02.

441 Board #262 May 31 11:00 AM - 12:30 PM
Injury And Illness Profiles During The 2014 South African Ironman Ultra-distance Triathlon
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PURPOSE: High physiological demands on ultra-endurance triathletes and potentially serious medical complications require scrutiny of illness and injury profiles. Accurate data are required for planning of medical services. The aims of the study were to record medical history, illness and injuries of athletes receiving medical attention during the 2014 Ironman South Africa (IMSA) triathlon, and to investigate the temporal presentation of medical encounters, to optimise deployment of medical services for IMSA events.
METHODS: A retrospective, cross-sectional study of all medical encounters and associated factors during the 2014 IMSA was conducted.
RESULTS: The incidence of medical encounters was 7.8%. A significantly higher percentage of younger participants encountered medical problems (p=0.04). The majority of patient encounters (80.1%) occurred after completion of the race, and 49.2% of patient encounters occurred during the last eight hours of the event. The median duration of treatment was 26 minutes (2-126 minutes). Medication was used by 35.1% of patients during the race, and 36.2% in the three preceding days. The most common medical encounters were exertion-related (71.2%), followed by gastro-intestinal (16.4%), dermatological (11.9%), musculoskeletal (9.6%) and cardiorespiratory conditions (2.4%).
CONCLUSION: Medical encounters occurred more frequently in later stages of the 2014 IMSA, as recorded elsewhere. The majority of medical conditions were exertion-related. Potential higher risk has been associated with medication use, recent illness, and in younger participants. Temporal stacking of medical personnel and resources, planning of resources according to expected conditions, preventative measures for high-risk behaviour, and on-going data collection are recommended.

442 Board #263 May 31 11:00 AM - 12:30 PM
Adding BMI to Electrocardiographic Criteria improves Accuracy of Predicting Left Ventricular Mass in Football Athletes
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Electrocardiographic (ECG) measurements are commonly used to diagnose left ventricular (LV) hypertrophy in men, yet the validity of this practice has seldom been appraised in American-style football (ASF) athletes. **PURPOSE:** Evaluate the accuracy of five commonly used ECG criteria for LV hypertrophy – Murphy (AJC, 1984), Sokolow (AHJ, 1949), Gruber (Arch Intern Med, 1943), Cornell (Casale, JACC, 1985), and Cornell voltage-duration product (C-VDP) (Malloy, JACC,

1992) – to predict echocardiographically (ECHO) measured LV mass (LVM) in ASF athletes. **METHODS:** Resting 12-lead ECG and ECHO procedures were performed on 62 collegiate ASF players first entering an NCAA Football Bowl Subdivision university; age=18±1 yr., ht=186±7 cm, wt=99.9±22.6 kg, BMI=28.6±5.0 kg·m⁻², and BSA=2.23±0.26 m². Regression was used to predict ECHO-derived LVM and LVM/BSA from the five ECG criteria, and from the ECG criteria with BMI (+BMI) added to the model. **RESULTS:** Table (*p<0.01 for regression)

R ² for Model ECG Criteria	LVM r ²	+BMI R ²	LVM/BSA r ²	+BMI R ²
Murphy	.001	.169*	.039	.039
Sokolow	.010	.200*	.052	.052
Gruber	.001	.164*	.030	.034
Cornell	.006	.160*	.018	.022
C-VDP	.000	.159*	.021	.026

None of the ECG criteria alone were predictive of LVM or LVM/BSA in ASF athletes. Adding BMI to the regression significantly improved the predictive accuracy for LVM but not for LVM/BSA. **CONCLUSION:** ECG criteria alone are not useful in diagnosing LVH in ASF athletes. Our results suggest that adding demographic measures to the predictive model may improve diagnostic accuracy. Thus, new algorithms for evaluating LVM and LVH in ASF athletes should be explored using demographic, body habitus, cardiovascular, and other ECG criteria.

443 Board #264 May 31 11:00 AM - 12:30 PM
Effect of Previous Injury on Functional Movement Screening Outcomes
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To improve player safety, medical professionals use questionnaires, pre-participation physicals, screening tests, biomechanical analyses, and strength testing to describe characteristics of high risk athletes. The seven-test Functional Movement Screening (FMS) is widely used in current practice, and research efforts have demonstrated the efficacy of the FMS to predict future injury. However, the effect of previous injury on FMS scores has not been defined. Because previous injury is a significant predictor of subsequent injury, an understanding of the effects of previous injury on total FMS score is critical to assess the efficacy of the screening tool to predict future injury. **PURPOSE:** Determine the efficacy of the FMS evaluation to assess prior musculoskeletal injury.
METHODS: From 2012-2015, 58 incoming football athletes completed the FMS and a medical history questionnaire. Trained sports medicine researchers performed the screens and distributed questionnaires. Descriptive statistics were calculated to assess the effectiveness of total FMS results to predict previous injury. The previously established ≤ 14 score cut-off was utilized to establish the two groups' at-risk levels. The established cut-off was reported to indicate football players at-risk for serious injury defined as out of physical participation for > 2 weeks.
RESULTS: 46 athletes reported a prior musculoskeletal injury compared to 12 that denied prior injury. The group of 46 athletes was equally split on FMS scores with 23 athletes that recorded a score of ≤ 14 and 23 athletes that recorded a score > 14. The group that denied previous injury (N=12) was also evenly split with 6 athletes that recorded of score of ≤ 14 and 6 with a score > 14. The FMS with a cut-off score of 14 recorded a sensitivity and specificity of 0.500. The positive predictive value was 0.793 with a negative predictive value of 0.207.
CONCLUSIONS: Prior history of musculoskeletal injury as reported on the incoming medical questionnaire did not affect total score on the FMS with specificity or sensitivity. Future studies should evaluate the effects of previous injury on other clinical screening tools. In addition, better screening tools could be developed that assess the incidence of previous injury and risk of future injury.

444 Board #265 May 31 11:00 AM - 12:30 PM
High School Preparticipation Evaluation Screenings: Do States Include Mental Health Recommendations?
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7.7 million high school students participate in sports annually and are required to have a physical. Given the focus on illness and injury, physicians may be more likely to focus on physical health than mental health. ACSM recommends the *Preparticipation Evaluation, 4th Edition (PPE-4)*, which is the standard assessment tool and includes

guidelines for assessing mental health. However, little is known about the inclusion of mental health recommendations in state PPE forms. Screening mental health among athletes may prevent psychological and performance-related difficulties.

PURPOSE: This study examines the inclusion of mental health in PPE forms in the US. We describe the mental health content of state PPE forms and consistency with the PPE-4. The content of the PPE-4 suggests that eating disorder symptoms be assessed using yes/no questions and other topics (e.g., mood, anxiety, stress, home safety, and substance use) be included as physician reminders (e.g., open-ended).

METHODS: PPE forms were retrieved via the National Federation of State High School Associations website (n=47; 4 states did not have forms). Two raters independently coded PPE forms to evaluate adherence to the PPE-4. PPE forms were coded as whether mental health issues were not addressed, addressed as a question, or addressed as a reminder.

RESULTS: There was acceptable agreement between coders (kappa range: 0.7-1.0; M=0.9). 55.3% of forms included a question about history of an eating disorder, 83.0% included a question pertaining to worry about weight, 83.0% included a question about presence/frequency of menstrual period, and 70.2% included a question about attempts at weight loss/gain. The physician reminders were used in less than 60.0% of forms. 46.8% of forms provided a reminder to physicians to assess substance use and safety at home. Stress was included as a reminder on 59.6% of forms. 59.6% of states included a reminder to assess for sad, hopeless, depressed, or anxious mood, with only 8.5% including a question about mood or anxiety.

CONCLUSIONS: The PPE-4 is used to ensure safe participation in high school sports, but most state forms omit questions related to mental health. Future studies should examine physician assessment of mental health during PPE, as well as the course of treatment following a positive screen for mental health issues.

445 Board #266 May 31 11:00 AM - 12:30 PM
Predicting Musculoskeletal Injuries from Psychological, Neurocognitive and Physical Factors in Collegiate Athletes Without Injury History

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Musculoskeletal injury (MSI) risk in athletes is thought to be multifactorial in nature and to include psychological, neurocognitive and physical sources. However, most researchers lack the time and resources to assess these multiple factors in large groups of athletes. Examining multiple factors at once may yield improved injury prediction.

PURPOSE: To determine if body fat percentage (high or low BF%), ImPACT reaction time (RT in sec), ImPACT visual motor speed (VMS in sec), Functional Movement Screen (FMS) scores, Beck's depression indices (BDI), and/or Beck's anxiety indices (BAI) could predict MSI in athletes without MSI history.

METHODS: Seventy-one [(males, n=35; age, 19.9±1.5 yrs; height, 1.77±0.08m; mass, 73.2±14.6kg) (females, n=36; age, 19.1±1.1 yrs; height, 1.68±0.06m; mass, 70.1±9.4kg)] NCAA Division II athletes without MSI history participated in this prospective cohort study. Data were collected during pre-participation examinations as part of standard protocol. Injuries were tracked for an academic year by each team's certified athletic trainer via computer software. Pearson Chi-square analyses were used to determine if MSI could be predicted by BF%, RT, VMS, BDI, BAI, presence of a "1" on the FMS, or presence of an asymmetry on the FMS, $p < .05$. BF% was dichotomized as high or low for males (>15%) and females (>25%).

RESULTS: Twenty-seven athletes (38.0%) sustained a total of 54 MSI. Two of the 7 independent variables were statistically significant predictors of MSI. Athletes with asymmetry on any of the FMS tests ($\chi^2=12.299$, $p < .001$) or high BF% ($\chi^2=5.820$, $p < .015$) were more likely to sustain a MSI. The relative risks for an FMS asymmetry and high BF% were 1.89 (CI: 1.22-2.94, $p = .001$) and 1.99 (1.06-3.75, $p = .015$), respectively.

CONCLUSION: Athletes without a history of MSI may be at risk of MSI if they have high BF% or an asymmetry on any of the FMS tests. The neurocognitive and psychological test components may not yield significant injury prediction value in this group. Since BF% and FMS scores are modifiable risk factors clinicians may justify their assessment during pre-participation examinations.

446 Board #267 May 31 11:00 AM - 12:30 PM
The Efficacy Of Performance On Clinical Hop Tests To Predict Previous Lower Extremity Injury

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 (No relationships reported)

Background: Clinical hop tests, such as the 6-meter timed hop (6TH) and single-leg triple crossover hop (TXH) evaluate strength and neuromuscular coordination in athletes' lower extremities. Clinicians use symmetry in performance of these tests as a return to sport criteria after an injury, such as an anterior cruciate ligament (ACL) rupture. In addition, symmetries have been identified as a risk factor for lower extremity injuries. However, the efficacy of clinical hops to identify athletes with a history of previous injury is not well defined.

Purpose: Determine the efficacy of performance on 6TH and TXH to predict previous lower extremity injury.

Methods: 51 and 52 male division I football players performed a 6TH and TXH, respectively. All athletes completed a medical history questionnaire. Players were categorized as either self-professing to have a previous lower extremity injury, or not having a previous lower extremity injury. Bilateral asymmetry was defined as a greater than 10% difference in performance on the 6TH and TXH between limbs. Sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) were calculated to evaluate the efficacy of symmetry to predict previous injury history.

Results: of the 51 players that performed the 6TH, 14 reported a previous lower extremity injury. 14 of the 52 players that performed the TXH reported previous lower extremity injury. Sensitivity, specificity, PPV, and NPV are reported for the 6TH (Figure 1a) and TXH (Figure 1b).

a.	Injury (+)	Injury (-)
Symmetry $\geq 10\%$	7	11
Symmetry $< 10\%$	7	26
Sensitivity	0.500	
Specificity	0.703	
PPV	0.389	
NPV	0.788	
b.	Injury (+)	Injury (-)
Symmetry $\geq 10\%$	2	11
Symmetry $< 10\%$	12	27
Sensitivity	0.143	
Specificity	0.711	
PPV	0.154	
NPV	0.692	

Figure 1. Analysis of previous injury history and performance on the a. 6TH and b. TXH tests.

Conclusion: Bilateral asymmetry does not predict previous injury incidence. The efficacy of additional clinical tests, such as the single-leg hop, should be evaluated.

447 Board #268 May 31 11:00 AM - 12:30 PM
Effects of Previous Lower Extremity Injury on Functional Movement Screening Results

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Background: Functional movement screening (FMS) is a seven-movement screening test frequently utilized as a component of pre-season physicals. Individual tests evaluate movement patterns to identify athletes potentially predisposed to injury and previous research has established a cut-off for football athletes at high risk for serious injury defined as out of physical participation for > 2 weeks.

Purpose: To examine the effects of previous lower extremity injury on functional movement screening scores, specifically the lower extremity FMS tests.

Methods: All incoming freshman football student-athletes for the 2012-2015 seasons completed functional movement screening performed by FMS trained sports medicine researchers. All incoming athletes completed a past medical history questionnaire to document any previous injury history. Descriptive statistics were calculated to measure the effect of lower extremity injury on the FMS scores for deep squat, hurdle step, active straight leg-raise, rotary instability and inline lunge tests. The established ≤ 8 lower extremity cut-off was utilized to establish the two groups' level of risk.

Results: 60 incoming football athletes completed both the medical questionnaire and functional movement screening from 2012-2015. 36 athletes reported a previous lower extremity injury and 17 of those athletes demonstrated scores below the lower extremity cut-off (Sensitivity: 0.472). The 24 remaining athletes reported no prior lower extremity injury and 12 scored above the cut-off (Specificity: 0.500). Previous lower extremity injury had a higher positive predictive value (0.586) than negative predictive value (0.387) on lower extremity functional movement screening scores.

Conclusion: The self-reported previous lower extremity injury history of our incoming football student-athletes was not specific or sensitive for prediction of score on the functional movement screening evaluation to identify high risk lower extremity movement patterns. Future work should continue to evaluate variables that may affect results of screening tests for athletes at high risk of injury to continue to optimize athlete safety.

448 Board #269 May 31 11:00 AM - 12:30 PM
Identifying Metabolic Syndrome Risk Factors in Division 1 and Division 3 Football Players: a Pilot Study

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Retired NFL football players are at an increased risk for Metabolic Syndrome (MetS). Cross sectional studies in high school and college football players suggest an increased risk even at this level. It is not clear when MetS risk factors (RF) develop and if certain markers can be used to assess risk for early intervention. **PURPOSE:** The purpose of this pilot study was to identify MetS risk factors using the NCEP ATP III standards and measures of abdominal obesity in freshmen football players from a Division 1-FCS and a Division 3 team. Additionally, this study sought to identify if risk differed by player position and/or by college division. **METHODS:** Fifty freshmen (Division 1, n = 18, Division 3, n = 32) football players volunteered to be tested before the start of the competitive season. Testing for MetS risk factors included fasting Triglyceride (TG), High Density Lipoprotein (HDL), blood glucose (BG), blood pressure (BP), and waist circumference (WC). Additional measures included percent body fat (%BF) and subcutaneous (SCAT) and visceral fat (VAT) depth. Descriptive statistics and comparison between schools related to MetS RF were analyzed. A Pearson Correlation was used to determine the relationship between the clinical markers. **RESULTS:** Ten players (20%) met the criteria for MetS (n = 2 with 3 RF, n = 6 with 4 RF, and n = 2 with 5 RF). Division 1 had a higher percentage of players (n = 5, 27.8%, 3 offensive linemen) meeting the criteria for MetS compared to the Division 3 players (n = 5, 15.6%, 1 offensive lineman). All NCEP ATP III risk factors except BG were positively correlated with meeting the criteria for MetS, with the WC being the highest (r = 0.766, p = 0.000). Using non NCEP ATP III risk factors positive correlations were found between the %BF (r = 0.645, p = 0.000), SCAT (r = 0.352, p = 0.013), and VAT (r = 0.489, p = 0.000). Lineman meeting the criteria for MetS had a %BF > 21. **CONCLUSIONS:** This data suggests that freshmen football players have a high incidence of MetS RF. Waist Circumference and %BF should be included in pre-season evaluation with follow up for early intervention as necessary.

449 Board #270 May 31 11:00 AM - 12:30 PM
Examination of Y-Balance Performance in Chronic Ankle Instability

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 (Sponsor: Lee Brown, FACSM)
 (No relationships reported)

Chronic ankle instability (CAI) is associated with reduced proprioception and range of motion, which often results in postural control deficits. The Y-Balance Test has been used to assess lower extremity mobility, functional performance, and risk of injury. An inability to maintain single leg stance, a component of the Y-Balance Test, is associated with CAI. The Y-Balance Test has not been examined to determine performance differences in cases of CAI. **PURPOSE:** To assess maximum reach distance (MRD) differences of the Y-Balance Test in CAI participants and healthy controls. **METHODS:** A case control study of 28 subjects (14 healthy [age: 27.57±3.23 years; height: 169.61±8.33 cm; weight: 76.98± 17.95 kg], 14 CAI [age: 24.07±4.46 years; height: 175.06±5.09 cm; weight: 82.24± 10.38 kg]); CAI participants were recruited per International Ankle Consortium guidelines using the Foot and Ankle Ability Measure (FAAM) and Cumberland Ankle Instability Tool (CAIT). Subjects performed three trials in each direction (Anterior [ANT], Postero-medial [PM], Posterolateral [PL]) of the Y-Balance Test. The trials were averaged and normalized for limb length to produce a MRD value for each direction. Independent sample t-tests were used to compare MRD differences between groups. Alpha was set at p ≤ .05; an effect size above .3 was considered clinically meaningful. **RESULTS:** Significant differences were not found for MRD in the ANT (mean difference = -1.23, p = .61, Cohen's d = 0.20, 95% CI for Cohen's d = -0.94 - 0.55), PM (mean difference = 4.03, p = .27, Cohen's d = 0.43, 95% CI for Cohen's d = -0.32 - 1.17), or PL (mean difference = 4.21, p = .26, Cohen's d = 0.43, 95% CI for Cohen's d = -0.32 - 1.18) directions. The control group exhibited higher scores in the PM (106.77 vs. 102.73) and PL (105.16 vs. 100.96) directions, while the CAI group produced a higher score (61.62 vs. 60.39) in the ANT direction. **CONCLUSION:** Statistically significant differences were not found between groups on the Y-Balance Test; however, the differences in the PM and PL directions may be clinically meaningful. Clinicians may need to consider PM and PL MRD deficiencies on the Y-Balance Test when treating CAI patients; however, further research is needed to determine the sensitivity of the Y-Balance Test for identifying CAI.

A-55 Free Communication/Poster - Resistance Training

Wednesday, May 31, 2017, 7:30 AM - 12:30 PM
 Room: Hall F

450 Board #271 May 31 9:30 AM - 11:00 AM
Effects of Rest Interval Duration on the Volume Completed During a High-Intensity Bench Press Exercise

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 (No relationships reported)

Between set rest intervals (RI) are one of the most important variables in resistance training; however, no known research has investigated the effects of RIs greater than 5-min during strength training (> 85% of 1RM). **PURPOSE:** The purpose of this research was to examine the effects of three different RIs (2, 5, and 8-minute) on training volume (TV) (kg, sets x reps x resistance) completed during a high-intensity bench press exercise (> 85% of 1RM). **METHODS:** 15 resistance trained males (mean± sd, age = 26+ 5 yr, height = 161+ 6 cm, body mass = 79+ 6 kg, bench press 1RM ratio = 1.39+ 0.1) completed 3 experimental sessions, during which 4 sets of the bench press were performed with 85% of a 1RM load. During experimental sessions, the bench press was performed with a 2, 5, or 8-minute RI in a randomly counterbalanced design. Data was analyzed using a one-way ANOVA with repeated measures. **RESULTS:** The greatest TV (p < 0.05) was attained when subjects used an 8-min RI between sets (table 1). Additionally, TV completed using the 5-min RI was significantly greater (p < 0.05) when compared to the 2-min RI (table 1). **CONCLUSIONS:** Resistance trained males, with the goal of greater volume during strength training, would benefit from longer RIs. Specifically, using an 8-min RI between 4 consecutive sets of a bench press allows for a greater TV.

	2-min	5-min	8-min
Volume(Kg)	1448 + 215**	1793 + 315*	2207 + 372

* p < 0.05, value significantly different from 8-min RI
 # p < 0.05, value significantly different from 5-min RI

451 Board #272 May 31 9:30 AM - 11:00 AM
Evaluation Of Strength And Conditioning With On-court Success In Division I Collegiate Volleyball: A Retrospective Study

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Strength, fitness, and athleticism are often emphasized in sport, but there is little evidence addressing the relationship of these variables to performance. **PURPOSE:** To assess relationships between strength and conditioning (SC) measures and game performance in Division I volleyball. **METHODS:** Five years of data, were collected from one women's Division I collegiate team, n = 76. All game and SC stats were normalized to z-scores. SC measures included: T-drill, 18.3 m sprint, squat, hang clean, sprint recovery test, vertical jump, and broad jump. ANOVA was used to assess performance differences by position, and multiple stepwise regression was used to assess relationships between game and SC stats. **RESULTS:** There was a significant difference by position for broad jump (p = .002), 18.3 m sprint (p = .036), vertical (p < .001), and total strength (p = .019). Overall, there was a significant correlation between on-court performance and SC measures (r = .439, p < .001). Significant position-specific correlations (p < .05) are as follows: defensive specialist, total strength with digs (r = .798); setters, hang cleans with assists (r = .818) and digs (r = .886), broad jump with block assists (r = .846) and total game performance (r = .801); outside hitters, vertical with digs (r = .444) and total game success (r = .529), and total strength with kills (r = .660) and errors (r = .577); middle blockers, broad jump with kills (r = .694), errors (r = .736), block assists (r = .705), block solos (r = .691), and total game success (r = .594).

CONCLUSIONS: These data indicate that some SC measures correlate well with on-court performance and are specific by position. A prudent training approach may be for SC coaches to focus on improving specific measures by position, which could then translate to improved game performance.

452 Board #273 May 31 9:30 AM - 11:00 AM
Effects Of Barbell-based, Full-body Resistance Training On Muscular Strength, Lean Body Mass, And Cardiometabolic Biomarkers.

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(No relationships reported)

Resistance training improves muscular strength and hypertrophy, as well as cardiometabolic biomarkers. However, results in the literature have been inconsistent which may relate to the heterogeneity in training protocols. **PURPOSE:** This single-group pilot study defined a standardized barbell-based linear periodization full-body resistance training program and assessed its effect on muscular strength and biomarkers. **METHODS:** Ten healthy, untrained males (26.4±7.5 y) underwent 4 weeks of a barbell-based, full-body, linear periodization program 3x/week. Exercises included the squat, standing press, bench press, and deadlift. Participants performed 3 sets of 5 repetitions on the squat, bench press, and standing press and 1 set of 5 repetitions on deadlift. Weight was incrementally added each training session. Maximum dynamic strength was assessed by 5-repetition maximum (5RM), and biomarkers (lipids, insulin, HOMA-IR, CRP, and glucose) were assessed. The study was IRB approved. **RESULTS:** 5RM increased on squat (79.4%; $p=0.005$), bench press (25.9%; $p=0.004$), standing press (45.3%; $p=0.004$), and deadlift (52.9%; $p=0.05$). The sum of four lifts also increased after 4 weeks of training (50.3%; $p=0.005$). Over the 4 weeks, lean body mass (LBM) increased (1.5%; $p=0.025$). Total and HDL cholesterol decreased significantly (-14.4% and -11.7% respectively) and LDL cholesterol trended downward (-15.8%) but the total:HDL cholesterol ratio was unaltered. **CONCLUSION:** It appears that untrained males can increase body strength on a 4-week full-body, barbell-based linear periodization training program. Changes in LBM occurred sooner than previously reported. A standardized resistance training protocol for building strength would facilitate research interpretation in this field. Randomized control trials with larger samples over longer time periods are needed to further investigate the effects of full-body barbell exercise training on changes in muscular strength, LBM, and cardiometabolic biomarkers.

453 Board #274 May 31 9:30 AM - 11:00 AM
Eccentric Resistance Training in Adults with and without Spinal Cord Injuries

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Following incomplete spinal cord injuries (iSCI), individuals lose motor control, muscle fiber cross sectional area, and contractile force capacity, ultimately resulting in compromised functional independence. An innovative exercise modality for populations with impaired functional capacity is eccentric resistance training (ERT). **PURPOSE:** The purpose of this study was to examine the effects of active lower body ERT using a seated eccentric ergometer in individuals with iSCI and controls (CON). Specifically, the study was designed to determine if those with iSCI adapt similarly to ERT as CON participants, as well as the overall safety and efficacy of ERT in this population. **METHODS:** This pilot investigation involved the recruitment of persons with iSCI ($n=3$) and age- and sex-matched able-bodied CON ($n=3$). The 8-week intervention focused on building lower extremity eccentric strength by progressively increasing the duration and intensity of the three training sessions per week. Control participants completed the same training intervention. Main outcome measures were eccentric strength (eccentric ergometer), isometric strength (hand held dynamometer), and leg muscle mass (DEXA). **RESULTS:** All participants completed all sessions of the ERT. At posttest, eccentric strength improved from pretest ($p=.044$, $\eta_p^2=.68$) with similar changes between groups ($p>.05$). The percent improvement in isometric strength for those with iSCI (41.5%) was different than CON (-2.8%) after training ($p=.044$). Neither group demonstrated a change in grams of muscle mass in the legs at posttest ($p>.05$). **CONCLUSION:** Active lower body ERT is well tolerated and effective at increasing lower extremity strength in those with iSCI. These adaptations are likely attributable to neuromuscular development rather than a hypertrophic response.

454 Board #275 May 31 9:30 AM - 11:00 AM
Bench Press Strength Changes Over 23 Years in Police Recruits with Gender Comparisons

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Strength is a vital component in the performance of police duties to ensure the safety of officers and those they serve. Therefore, the initial strength the officers brings to the training program predicts the level of strength they will maintain throughout their careers. **PURPOSE:** To evaluate bench press strength changes that occur in police recruits from 1990 to 2013 with gender comparisons. **METHODS:** During the first week of police recruit training in a large southeastern metropolitan area, bench press strength and bench press weight ratio were evaluated in 2,460 recruits. ANOVA and Bonferroni post hoc procedures were used to evaluate data. **RESULTS:** The initial ANOVA indicated significant differences in males for both variables at $p\leq 0.05$. Males tended to increase in bench press strength from 1990 to 2007 (83.7±2.0 kg to 95.9±2.1 kg, $p\leq 0.01$). Male bench press strength tended to plateau after 2007. No discernible pattern was seen in females for both variables and little change in males was observed in bench press weight ratio. **CONCLUSIONS:** Overall, males had a tendency to become stronger over time when considering their initial test scores in recruit school. However, females tended to remain at approximately the same muscular strength across the 23 years.

455 Board #276 May 31 9:30 AM - 11:00 AM
Testosterone And Cortisol Responses To Superslow And Traditional Resistance Exercise In College-aged Males

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Recent evidence suggests that Superslow resistance training (SS), involving low intensity workloads and slow repetitions, has potential to produce improvements in muscular strength similar to traditional high intensity resistance training (TR). Few studies have compared endocrine responses to SS and TR protocols. **PURPOSE:** To compare acute hormonal responses to two resistance exercise protocols that have similar exercise volumes, but differ in intensity and contraction speed. **METHODS:** Thirteen males (18-35 years) participated in this randomized crossover study. Participants performed two protocols in random order separated by 3-week washout periods. For TR, participants completed 3 sets of 8 reps at 80% 1-RM for four upper and lower body exercises with 1.5 seconds of concentric and eccentric contraction speeds. For SS, participants performed 1 set of each exercise to voluntary failure at 50% 1-RM with 10 seconds concentric and 5 seconds eccentric contraction speeds. Fasting morning blood draws were taken before (Pre), immediately post exercise (IP), and 15 min post exercise (15P). Serum samples were analyzed for testosterone (TES) and cortisol (Cor) concentrations using ELISA. Lactate and hematocrit were also measured for each condition. **RESULTS:** There were no significant differences in baseline values between the two conditions. There was a significant ($p<0.05$) time effect for raw concentrations of TES and Cor. TES significantly ($p<0.05$) decreased from IP to 15P for both conditions (SS- 8.25 ± 1.37 ng/ml to 7.38 ± 1.26 ng/ml; TR- 8.50 ± 1.25 ng/ml to 6.94 ± 0.88 ng/ml). There was a trend ($p=0.059$) for Cor to increase from Pre to IP for both conditions (SS - 166.66 ± 15.15 ng/ml to 216.08 ± 18.16 ng/ml; TR- 157.55 ± 8.77 ng/ml to 201.03 ± 19.84 ng/ml). TES % change showed a significant time effect as it increased from Pre to IP (SS- 0.95 ± 4.39%; TR- 15.39 ± 7.73%) and decreased from Pre to 15P (SS- -5.48 ± 6.70%; TR- -5.41 ± 3.79%). Cor % change was not different between the two conditions. Correcting for hemoconcentration eliminated the significant responses. **CONCLUSION:** Both protocols showed similar patterns of hormonal responses, which may have been mediated by plasma volume shifts. This finding supports that SS exercise could be a beneficial alternative for those unable to perform high-intensity resistance exercise.

456 Board #277 May 31 9:30 AM - 11:00 AM
Comparison Of Peak Power In The High Bar And Low Bar Squat Across Eight Loads
 Jacob R. Goodin, Caleb D. Bazyler, Jake R. Bernards, Joseph Walters, Satoshi Mizuguchi, Michael H. Stone. *East Tennessee State University, Johnson City, TN.*
 (No relationships reported)

PURPOSE: To examine differences in peak power output between high bar (HBS) and low bar back squats (LBS).

METHODS: Six trained males (25.0 ± 3.1 years, 1.78 ± 0.04 m, 87.6 ± 7.5 kg) with previous squatting experience (experience: 7.5 ± 4.1 years, HBS 1RM: 157.0 ± 15.3 kg, squat/bodyweight: 1.8 ± 0.18) completed the study using a crossover design. Subjects completed a 4-week familiarization phase with both conditions. Peak power data was collected over 2 sessions using dual uniplanar force plates synchronized with 2 string potentiometers on each side of the bar collecting at a sampling frequency of 1000 Hz using a BNC 2110 connector with an analog to digital converter. Subjects were randomly assigned to the HBS or LBS for 1 set of 3 repetitions at 20, 30, 40, 50, 60, 70, 80, and 90% of their most recent HBS training 1RM with 3 to 5 minutes' rest between sets and >72 hours between testing conditions. A 2x8 repeated measures analysis of variance was used to determine interactions and main effects for condition and load with post-hoc tests conducted for statistical main effects.

RESULTS: Analysis revealed significant main effects for load ($p < 0.01$) but not for condition. Peak power output was greatest at 70% of HBS 1RM for the LBS, and 80% of HBS 1RM for the HBS.

CONCLUSIONS: According to this pilot data, athletes seeking to increase power production ability should choose a squatting style in which they feel most proficient and comfortable. Furthermore, either the HBS or LBS can be used as the primary squatting movement, or as a secondary movement to provide variation and remove linearity from the training program. However, based on previous research it is likely that sport specific biomechanical parameters will influence the squatting style selection for the majority of athletes who participate in sports that involve jumping, sprinting, and change of direction. Training with loads between 70% and 80% of HBS 1RM may be optimal for increasing power production ability. Further research using a larger population of well-trained athletes is suggested in order to more precisely compare HBS and LBS power outputs.

457 Board #278 May 31 9:30 AM - 11:00 AM
Increased Performance of Upper-Body Strength Exercise: Effect of Leg Induced Increase in Blood Lactate Concentration
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Studies have shown that high systemic blood lactate concentrations led to inhibition of glycolysis and an increase of oxidative metabolism in subsequent anaerobic exercise. **PURPOSE:** The aim of this study was to examine the effect of increased blood lactate (La) concentration induced by high intensity leg exercise on net lactate production and performance in subsequent dynamic arm pull-ups. **METHODS:** Nine trained sport students (age: 25.1 ± 1.9 yr; BMI: 21.7 ± 1.4) performed arm pull-ups on a horizontal bar with legs placed on a box either with or without pre-load (PRE) in a randomized order. PRE was a 26.6±2s all out shuttle run to increase La to ~8 mmol.l⁻¹. Each testing was preceded by a 15 min standardized warm up. Time between warm-up and testing was 14 min. During testing, heart rate (HR) and respiratory gas exchange measures ($\dot{V}O_2$, $\dot{V}CO_2$, \dot{V}_E) were monitored and La levels were measured at specific time points. Respiratory gas exchange measures were compared via the area under the curve (AUC). **RESULTS:** In pull-ups without PRE, La increased from 1.24 ± 0.4 to 6.4 ± 1.4 mmol.l⁻¹, whereas in conditions with PRE, La increased from 9.28 ± 1.98 to 10.89 ± 2 mmol.l⁻¹. In PRE conditions net La accumulation was significantly reduced by 75.5%. Performance was significantly increased by 1 rep (4%) after PRE. In PRE, net oxygen uptake $\dot{V}O_2$ (50% AUC), pulmonary ventilation \dot{V}_E (34% AUC) and carbon dioxide $\dot{V}CO_2$ production (26% AUC) were significantly increased during pull-ups but net respiratory exchange ratio (RER) was significantly decreased during work and recovery. **CONCLUSION:** Increased La induced by anaerobic leg exercise, inhibits glycolysis and increases oxidative metabolism in subsequent anaerobic dynamic upper body exercise. Increased oxidative metabolism during strength endurance exercise leads to superior performance outcome. This concept may be beneficial in sports climbing, due to a shift to an increased oxidative metabolism. However, this aspect needs to be evaluated further and in greater detail.

458 Board #279 May 31 9:30 AM - 11:00 AM
Effects Of A Two-week Lower-body Resistance Training Protocol On Aerobic Capacity In Sedentary Middle-aged Females
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 (No relationships reported)

PURPOSE: The aim of this study was to examine the effect of two-weeks of lower body resistance training on cardiopulmonary capacity ($\dot{V}O_{2peak}$) as well as its impact on muscle strength/size in sedentary middle-aged females. **METHODS:** After familiarization, $\dot{V}O_{2peak}$ was assessed via maximal cardiopulmonary exercise testing (CPET), leg extensor strength via isokinetic dynamometry, and muscle size of the vastus lateralis (VL) via cross-sectional area (CSA) using a B-Mode ultrasound. **RESULTS:** $\dot{V}O_{2peak}$ significantly improved by 10.8% ($2.1 \text{ mlO}_2^{-1} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$; $p=0.002$). Leg extension peak torque (PT) significantly improved by 6.1% (5.9 Nm ; $p=0.027$), while EMG amplitude did not change (-3.69% ; $p=0.388$). Similarly, VL CSA did not increase in response to training (0.17 cm^2 ; $p=0.456$). No significant relationships were observed between changes in $\dot{V}O_{2peak}$ and selected strength variables (PT/Amplitude). **CONCLUSIONS:** These results suggest that strength training appears to have had a positive effect on $\dot{V}O_{2peak}$ and strength in middle-aged females. However, future studies including a control group are warranted to confirm or refute the results of this current study.

459 Board #280 May 31 9:30 AM - 11:00 AM
Effect of Three Different Muscle Action Training Protocols on Hamstrings-to-Quadriceps Muscle Size Ratio
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 (No relationships reported)

Hamstrings-to-quadriceps (H:Q) muscle size ratio measured by muscle thickness (MT) is a measure of muscle balance, which can identify risk of lower-extremity injuries during sports. However, the most advantageous muscle action training protocol to elicit optimal H:Q is unknown. **PURPOSE:** To compare 3 different training protocols on H:Q muscle size ratio. **METHODS:** Forty untrained males (age 22.87 ± 2.28 yrs, mass 70.66 ± 11.04 kg, ht 174.29 ± 6.9 cm) performed 6 weeks (2 sessions per week) of training of their dominant leg H and Q on a Biodex isokinetic dynamometer. They were randomly assigned to one of 4 groups; concentric Q and concentric H (CON/CON), concentric Q and eccentric H (CON/ECC), eccentric Q and eccentric H (ECC/ECC), or no training (CNTRL). Training began with 1 set of 10 maximal repetitions at 210°/s concentrically and 60°/s eccentrically. Intensity of training was increased every week by decreasing the angular velocity for concentric and increasing it for eccentric in 30°/s increments. Volume of training was increased by adding 1 set each week. MT measurements were taken 72h before and after training in the transverse plan of Q rectus femoris (RF), vastus intermedius (VI), vastus lateralis (VL) and vastus medialis (VM), and H biceps femoris long head (BF), semitendinosus (ST) and semimembranosus (SM) using a real-time portable B-mode ultrasound device. H:Q muscle size ratio was calculated as H MT/quadriceps Q MT. **RESULTS:** A 7x2x4 (muscle x time x group) ANOVA showed interactions of muscle x time and time x group. They were followed up with seven paired t-tests, one for each muscle, and two paired t-tests, one for each group. MT post was greater than pre for VL ($8.05 \pm 4.78\%$), VM ($5.71 \pm 31.79\%$), BF ($7.93 \pm 10.87\%$), ST ($8.99 \pm 15.88\%$) and SM ($6.09 \pm 7.65\%$), while there was no difference for RF ($2.98 \pm 7.43\%$) or VI ($4.23 \pm 10.95\%$). MT post was also greater than pre for CON/CON ($7.75 \pm 8.92\%$), ECC/ECC ($11.81 \pm 0.76\%$), and CON/ECC ($6.68 \pm 1.68\%$), while CNTRL (-1.38 ± 15.22) was not different. **CONCLUSIONS:** These findings suggest that all training protocols may increase MT of H and Q similarly, which may not lead to improvements in H:Q muscle balance. A greater volume of training may need to be performed for H to elicit greater H:Q muscle size balance.

460 Board #281 May 31 9:30 AM - 11:00 AM

Reliability Of Open- And Pinch-grip Weight-assisted Pull-ups

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(No relationships reported)

PURPOSE: The purpose of this study was to evaluate the reliability of open-handed and pinch-grip weight-assisted pull-ups in recreationally-trained rock climbers. **METHODS:** Recreationally-active volunteers (n = 9) completed four counterbalanced trials. Trials (two grips each test-retest) were used to determine the reliability of the grips. Each trial included one set of open-handed or pinch-grip weight-assisted pull-ups until failure. Each trial used one of two grips each repeated twice. Sets consisted of either the open-handed or pinch-grip pull-ups assisted by 50% reduction of body weight. **RESULTS:** Heart rate, ratings of perceived exertion (RPE), perceived recovery scale and session-RPE were not significantly different (p > 0.05) among trials. Intraclass Rs for test-retest of the open-handed (R = 0.99) and pinch-grip (R = 0.96) weight-assisted pull-ups evidenced reliable values. However, Bland-Altman analysis (BA) revealed large errors indicating weight-assisted pull-ups using open-handed (95% error range: upper limit 6.34, lower limit -3.90) and pinch-grip (95% error range: upper limit 5.35, lower limit -6.91) were only somewhat reliable. **CONCLUSIONS:** Based upon the ICCR's the measurement was reliable, however the BA indicated the device was only somewhat reliable.

461 Board #282 May 31 9:30 AM - 11:00 AM

Strength Training Between Science and Practice

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(No relationships reported)

Evidence-based ACSM guidelines provide a comprehensive framework for the design of strength training interventions. Yet, a variety of practice-based approaches are used in gyms, clubs and sport federations based on empirical evidence, fashion and tradition while their scientific validation remains elusive. **PURPOSE:** We developed a practice-based strength training (*pST*) and tested its performance against an evidence-based (*eST*) intervention. **METHODS:** 18 young healthy males with minimal ST experience were randomly assigned to *eST* (#6), *pST* (#6) or *Control* (C, #6) group. *eST* and *pST* trained for 4 weeks (three, one-hour sessions per week composed of a warm-up, three main exercises -squat, chest press and deadlift- and two complementary exercises -pull-ups and push press- and a cool-down). Interventions differed in: 1) periodization strategy (linear vs. daily undulating); 2) intensity target (Repetition Maximum (RM) vs. % of maximum load) and volume (repetition range vs. exact number of repetitions); 3) amount of within-session and between-sessions variation of intensity and volume (small vs. large). *Pre* and *post* training, we measured 1RM tests (squat and deadlift) and maximal isometric force (IF_{peak}) and maximal rate of force development (IRFD_{peak}) through a whole-body isometric-strength test (mid-tight pull test) on a force platform. Groups were compared by a 2-way ANOVA. **RESULTS:** Groups were not different *pre* training. The ability to produce force significantly increased in the *post* condition (15±5% for 1RM squat and deadlift, 14±5% in IF_{peak}, 33±14% in IRFD_{peak}) in *pST* group while *eST* showed a significant improvement only in the 1RM Squat (10±5%) that was significantly smaller than that observed for *pST*. No changes occurred in C. **CONCLUSIONS:** In young healthy subjects who trained three times per week for 4 weeks with the same type of exercises, *pST* improved the ability to produce force to a larger extent compared to *eST*. Although further studies are warranted to investigate the amount and time course differences between the two interventions, it seems that the periodization strategy, intensity and volume prescription and the large within-session and between-sessions modulation of training volume and intensity that characterize *pST* may offer an advantage in strength outcome compared to *eST*.

462 Board #283 May 31 9:30 AM - 11:00 AM

Effects Of Full-body Barbell-based Linear Progression Resistance Training Program On Healthy Untrained Participants

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(No relationships reported)

Resistance training (RT) has been shown to have numerous health and performance benefits across varied populations; however the majority of the research conducted on the general population has focused on machine-based RT protocols. **PURPOSE:** To evaluate the chronic effects of a standardized whole body barbell training program on healthy participants. **METHODS:** 51 subjects (age 21.4 ± 4.7 yrs, ht. 170.3 ± 10.6 cm, body mass 69.6 ± 15.2 kg, waist 73.6 ± 9.3 cm, and hip 96.1 ± 8.0 cm, 22 ♂) were familiarized and a five repetition training load was titrated to the point the subject reached a load that they could lift safely 5 times without any degradation of form. Subjects performed the barbell squat (BS) (50.5 ± 28.8 kg), standing shoulder press (P) (26.2 ± 10.1 kg), barbell deadlift (DL) (60.2 ± 31.3 kg), and the barbell bench press (BP) (56.1 ± 29.5 kg). Following warm-up, all exercises were performed for 3 sets of 5 repetitions except DL was performed for a single set of 5 repetitions. Subjects were asked to perform a full-body resistance training protocol two or three times per week. BS was performed at each session, the P and BP alternated at each session, and the DL was performed a minimum of once per week. The training load was increased at each session that followed the attainment of 5 repetitions for each set. The progression continued until the subject was unable to make linear progress on the BS exercise. **RESULTS:** The mean duration of the intervention was 11.1 ± 3.46 weeks. Statistical analysis by t-test (P<.05) was applied to both the anthropometric and RT data. Despite no significant difference between anthropometric measurements, strength showed dramatic improvement across all lifts. Final BS (80.9 ± 33.6 kg) improved an average of 60.2%, P (38.2 ± 17.1 kg) improved an average of 45.8%, DL (87.4 ± 40.6 kg) improved an average of 45.2%, and BP (56.2 ± 29.5 kg) improved an average of 32.2%. No subjects suffered an acute injury throughout the duration of the intervention. **CONCLUSION:** A barbell-based, full-body RT protocol utilizing a linear approach to loading can be a safe and effective means of rapidly improving strength in a novice population.

463 Board #284 May 31 9:30 AM - 11:00 AM

The Effect of Knee Sleeves on Muscle Function During the Squat Exercise

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(No relationships reported)

Knee sleeves (KS); made of neoprene; provide compression around the knee without restricting flexibility. KS are commonly used by weightlifters, powerlifters, and fitness competition athletes, who report attenuated knee discomfort and increased performance. Purportedly the use of KS helps to stabilize the knee, improve strength performance, and reduce the risk of injury during lower body resistance training. **PURPOSE:** To assess the impact of KS use on muscle activity and power output during the performance of the squat exercise, 19 subjects (age 26.0 ± 2 yr, ht 172.9 ± 3.6 cm, body mass 74.8 ± 3.7 kg, 13 ♂), with a minimum of six months training with squat exercise were randomly assigned to KS or no KS (NKS) trials with a repeated-measures design. **METHODS:** EMG data were obtained on the vastus lateralis (VL), semitendinosus (S) and gluteus maximus (G) muscles with a baseline obtained by two isometric maximal voluntary contractions (MVC) for five seconds, using an immovable and secure barbell at mid-range of the squat position. A warm-up of 10 reps of unloaded barbell and 5 reps @ 65% of self-reported 1RM preceded (5 min) the trial (KS or NKS) of 5 reps @ 85% 1RM (94.1 kg). Following an 8 minute rest, subjects completed the cross over trial. EMG normalized to MVC was recorded for each trial. Peak power (PP) and average power (AP) were determined by measuring the bar speed with a micro-computer system. Statistical analysis by ANOVA (p<.05) was applied to the data. **RESULTS:** VL: 65.0 ± 44.7 & 64.5 ± 46.0, S: 71.6 ± 35.0 & 69.9 ± 37.9, and G: 48.4 ± 25.3 & 49.7 ± 24.2 for K and NKS, respectively, revealed no significant difference between conditions. In addition, %MVC for VL: 171.9 ± 126 & 180.9 ± 111, S: 215.1 ± 160 & 230.2 ± 166, and G: 145.6 ± 96 & 147.8 ± 111 for K and NKS, respectively were not significantly different. PP(watts): 624.1 ± 216 and 638.5 ± 229 and AP: 349.3 ± 100 and 345.7 ± 113 for KS and NKS trials, respectively were not significantly different. **CONCLUSION:** The use of KS during the squat exercise required almost identical motor unit recruitment and provided comparable power output, thus the use of KS is a subjective decision.

464 Board #285 May 31 9:30 AM - 11:00 AM
Comparison of 4 Weeks of Circuit Training Versus Resistance Training in Middle-Aged Adults
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Despite significant progress, cardiovascular (CV) disease remains the leading killer in the US, with lack of physical activity being a primary risk factor. Research suggests that 4 weeks of exercise training reduces blood pressure (BP) and fat mass, as well as improves fitness; yet it is unclear whether circuit training (CT) or resistance training (RT) yields better short-term improvements. **PURPOSE:** To compare changes in CV and fitness measures after a 4-week CT or RT program. **METHODS:** Eighteen middle-aged adults (CT: N = 9, 49.7±8.4 yrs; RT: N = 9, 49.3±11.7 yrs) completed 4 weeks of either CT or RT exercise. Pre- and post-intervention, CV health measures, including fasting glucose, blood lipids, carotid artery intima media thickness (IMT), body composition by bioelectrical impedance analysis (BIA) and central and brachial BP were determined. Fitness testing involved measurement of maximum oxygen consumption ($\dot{V}O_{2max}$), and indices of balance and strength. **RESULTS:** Between group analyses revealed no differences between groups with exercise training, although several variables tended to improve in both groups. In the CT group, we noted improvements in central BP (SBP: 108.9±11.6 to 104.9±7.8; DBP: 76.1±8.2± to 72.3±5.6 mmHg, p<0.05). No changes in body weight, lean mass or fat mass occurred in the CT group; however, body weight (84.5±20.7 to 83.8±20.7 kg), lean mass (57.5±15.8 to 59.5±15.8 kg), and body fat (31.9±8.6 to 29.0±7.9 %) all changed in the RT group (p<0.05). For fitness measures, the CT group improved balance (right leg: 78.3±70.4 to 152.2±122.1; left leg: 41.2±39 to 167.9±206.6 sec) and 2-min stair climb (266.1±37.8 to 314.1±46.7 stairs), while the RT group improved 12-step sprint (3.3±0.5 to 2.7±0.4 sec) and maximum strength measures (leg press: 164.3±91.0 to 178.9±92.9 kg; bench press: 29.1±43.3 to 32.9±43.9 kg) (all p<0.05). Both groups improved wall sit (CT: 44.5±18.2 to 96.4±56.9; RT: 69.6±42.5 to 100.1±65.7 sec, p<0.05). No changes in lipids or glucose were found in either group. **CONCLUSION:** Our results suggest that 4 weeks of CT or RT improves CV health and fitness measures, with no differences between these two types of training.

465 Board #286 May 31 9:30 AM - 11:00 AM
Acute Effects of the Power Snatch on Vertical Jump Performance
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 (No relationships reported)

Postactivation potentiation can increase a muscle's ability to generate force. In practical terms, this may mean that acute weight lifting could improve vertical jump performance. **PURPOSE:** To examine vertical jump performance after performing prior power snatch exercises. **METHODS:** Following a standardized warm up, ten trained Olympic-style weight lifters performed power snatch exercises at increasing intensities (40% 1 repetition max [RM], 60% 1RM, and 80% 1RM) followed by vertical jump performance. Their vertical jump was measured using a Vertec in a control condition and following each power snatch intensity. Each condition was counterbalanced and separated by at least 48 hours. Two-way repeated measures ANOVA analyzed each lift intensity using vertical jump height as the dependent variable. Also, vertical jump performance in every post-power snatch condition was compared to control using a Student's t-test. **RESULTS:** There was no statistical difference in jump height in the repeated measures ANOVA or the t-test. However, there were small improvements across group means (0.3 to 0.6 inches) in the power snatch conditions. Power analysis for that effect size showed that 58 subjects would be needed to demonstrate significance. **CONCLUSION:** Power snatch exercise may be either inappropriate for eliciting postactivation potentiation or the effect was not large enough to demonstrate improvement in vertical jump performance. Future studies could examine this effect using different exercises, a single gender, or more experienced weight lifters.

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Hip, Knee and Ankle Joint Power in Three Weighted Squat Jump Techniques
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INTRODUCTION: The vertical jump is one movement used to train and assess power output of the legs. Specifically, loaded vertical jumps have been proven to increase vertical jump performance in a training environment. **PURPOSE:** The purpose of this study is to evaluate three loaded vertical jump training methods: the barbell back squat jump (BB), the goblet squat jump (GB) and the dumbbell squat jump (DB) on lower limb, peak joint powers. **METHODS:** Nine male volunteers (age: 22.1 ± 1.2 yrs; Ht: 1.75 ± 0.05 m; Wght: 76.0 ± 10.0 Kg) with at least 2 yrs experience in weight lifting performed 5 trials in each condition of the goblet, back and dumbbell squat jumps (randomized order) utilizing 10% of their 1-RM back squat as the experimental weight. Ten infrared cameras (200Hz) and an AMTI force plate (1,000Hz) collected a full body, 3-marker per segment model and ground reaction force data. All data were smoothed using a 4th order Butterworth filter of 20Hz. GRF data were interpolated down to 200Hz to temporally align camera and force data. Commercial software was used to calculate 3D lower limb joint angles, moments and powers via inverse dynamics. Differences in peak ankle, knee and hip power values during the jump were compared with RMANOVA (alpha ≤ 0.05) with Bonferroni post hoc tests. **RESULTS:** DB resulted in greater COM maximal jump height compared to BB (p < .0001) and GB (p = .005). No differences were noted for peak hip joint power (p = .23). Peak knee power was larger for DB compared to BB (p = .01) but not GB (p = .06). At the ankle, DB produced greater power than BB (p = .01) and GB (p < .001); but no differences were noted between GB and BB (p = .40). **CONCLUSION:** DB produced a greater COM maximal jump height, and greater knee and ankle powers. DB may be a superior training tool to produce increased knee and ankle joint powers.

467 Board #288 May 31 9:30 AM - 11:00 AM
Assessment of Sprint Performance Following the Use of Resistance Training Masks During Dynamic Warm-Up
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A proposed method of increasing warm-up intensity without inducing muscular fatigue is using a respiratory training mask to provide breathing resistance. Despite the lack of research-based evidence and equivocal anecdotal evidence, this particular warm-up strategy does appear to be of increasing popularity among both athletes and active individuals. **PURPOSE:** The purpose of this study was to investigate sprint performance following the use of training masks during dynamic warm-up in Division I American football athletes. **METHODS:** Seventeen male (mean±SD: age = 17.94±.75 years, weight = 104.43±23.02 kg, height 184.93±7.06 cm) NCAA Division I, American football athletes from a Midwestern university were recruited to participate in this study. Athletes were informed of risks, and completed 3 testing sessions separated by 7 days each. All testing sessions took place at the same time of day on artificial turf in the university's indoor training facility. Testing sessions began with a warm-up (WU) under the instruction of a member of the university's Strength and Conditioning staff. The WU consisted of dynamic exercises targeting the lower body musculature. During the initial visit, participants completed the dynamic WU and tested on 5x10-meter sprints without a respiratory training mask and all data collected during the initial visit were used to establish baseline measurements. During the second and third visits, participants were randomly selected to complete the WU with the respiratory training mask set to simulate an altitude 3,657.6 (EXP) m or 914.4 m (SHAM). Upon completion of the WU, participants removed the mask and performed 5 × 10-meter sprints. A one-way repeated measures analysis of variance (ANOVA) design was used to assess differences between control and experimental results. All statistical analyses were performed using SPSS (Version 21.0 for Windows; SPSS, Chicago, Illinois) with statistical significance set at p < .05. **RESULTS:** No significant differences were found between control, sham, and experimental measures (P = 0.7-0.874). **CONCLUSION:** These findings suggest that the use of respiratory training masks during WU does not improve sprint times in Division I football athletes.

WEDNESDAY, MAY 31, 2017

468 Board #289 May 31 9:30 AM - 11:00 AM
Decrease of Muscle Performance After Two Different Load Protocols in Well-Trained Men: a Pilot Study

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To study muscle damage recovery, firstly muscle damage has to be induced by an exercise. A specific drop jumps protocol has been largely used in previous studies. However, all participants studied were untrained.

PURPOSE: To assess muscle strength, muscle power and muscle swelling after two different load drop jump protocols in well-trained athletes.

METHODS: Eighteen strength and/or power-trained male athletes (4.31±2.75 years of training experience) were randomly assigned into one of two groups. DJ100 consisted in 5 sets of 20 drop jumps from a 60-cm box with 2-minute rest interval (n=9, 23.00±2.74 years). DJ140 consisted in seven sets of 20 drop jumps also (n=9, 22.89±3.37 years). Volunteers performed a maximally explosive vertical jump. Both groups performed the assessment of indirectly markers of muscle damage before and immediately after exercise protocol. Muscle thickness of knee extensors was measured using B-mode ultrasound. Maximal isometric muscle strength (PT) was measured by 2 sets of 4 seconds maximal isometric knee extension at 60°. For vertical jump, the athletes performed three countermovement jumps as high as possible, with one-minute rest between jumps. After normal distribution confirmed by Shapiro-Wilk tests, independent samples T-tests were used to compare the magnitude of changes of muscle thickness, isometric strength and vertical jump between groups. A p-value of ≤ 0.05 was adopted.

RESULTS: There was no significant difference (p>0.05) in sample's baseline characteristics between groups. There was no significant difference in the increase of muscle thickness (DJ100: 6.47 ± 1.67 (16.50%) vs. DJ140: 7.51 ± 2.31 mm (17.82%); p = 0.286). The decrease of isometric strength was significantly greater in DJ140 than DJ100 (DJ100: 34.24 ± 22.30 (11.20%) vs. DJ140: 67.06 ± 38.79 N.m (22.41%); p = 0.043; ES = 1.037). The decrease of vertical jump was also significantly greater in DJ140 than in DJ100 (DJ100: 0.48 ± 2.88 (0.95%) vs. DJ140: 7.72 ± 7.44 cm (17.42%); p = 0.015; ES = 1.283).

CONCLUSIONS: The main finding of this study was that an exercise protocol composed by 100 drop jumps did not decrease lower limb muscle power in well-trained athletes. Furthermore, 140 drop jumps induced a decrease in muscle performance greater than 100 drop jumps in well-trained athletes.

469 Board #290 May 31 9:30 AM - 11:00 AM
Heavy And Light Training Days Attenuates Decline In Force Output During 3-weeks High-volume Resistance Training

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High volume resistance training is employed by coaches during training emphasizing enhanced body composition, hypertrophy, and work capacity. However, high volume training may cause levels of fatigue that impact strength and power performances. It is not well known if using fatigue-management strategies such as heavy and light days affect these performances.

PURPOSE: To compare changes in kinetic variables following high volume resistance training employing heavy and light days. **METHODS:** Eight strength trained males (age = 27.4 ± 4.2 years, body mass = 90.8 ± 11.8 kg, isometric peak force = 4397.1 ± 636.9) participated in the study. Pre-and post-training each subject was evaluated for isometric peak force (IPF), allometrically-scaled isometric peak force (IPFa), and rate of force development at 90 ms (RFD90) during an isometric mid-thigh pull test on a dual force platform sampling at 1000Hz. The training protocol consisted of resistance training 3 days/wk with each week progressing in intensity. Each 3rd training day was a light day (10% lighter than day 1). Paired-samples t-tests were calculated pre-post the 3 weeks to assess changes associated with training. Magnitudes of change were examined using percent change and effect size using Cohen's *d*. **RESULTS:** The change in body mass (BM) was significantly higher (90.8 ± 11.8 kg to 92.5 ± 11.7 kg) (p = 0.03) while no statistical differences were observed in IPF (4397.1 ± 636.9 N to 4380.4 ± 432.9 N), IPFa (218.0 ± 25.5 N/kg^{0.67} to 215.5 ± 23.2 N/kg^{0.67}), or RFD90 (10155.6 ± 5511.3 N·s⁻¹ to 9208.3 ± 4547.3 N·s⁻¹) (p > 0.05). Percent change for BM, IPF, IPFa, and RFD90 were as follows: 1.9%, -0.4%, -1.2%, -9.3%, respectively. Effect sizes for BM (*d* = 0.15), IPF (*d* = 0.03), IPFa (*d* = 0.10), and RFD90 (*d* = 0.19) indicated trivial effects pre-post high volume training. **CONCLUSIONS:** High volume resistance training is often concomitant with reductions in strength performance. The results of the study indicate that force outputs were spared following 3-wks high volume training when employing heavy and light days. Although not significant, a

reduction in RFD90 of 9.3% is practically significant for athletes. It seems that while strength variables were largely unaffected, explosiveness (i.e. RFD90) may be more sensitive to high training volumes regardless the fatigue management strategies used.

470 Board #291 May 31 9:30 AM - 11:00 AM
Differences In Power And Velocity During The Back Squat In Resistance-trained Men And Women.

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Muscular power is vital to success across sport and competitive level. Determination of the load that optimizes power varies by exercise, gender, and training status. For example, the load that maximized peak power for the power clean in men has been proposed to occur at 80% one-repetition maximum (1RM); whereas the ideal load for the squat is equivocal. Further, one study reported differences between men and women in peak power at differing loads during ballistic exercise. However, few data exist on the differences in men and women relative to power and velocity, and no study has examined the differences in men and women relative to power and velocity, and no study has examined the differences in men and women relative to power and velocity development. **PURPOSE:** To determine whether differences exist between resistance-trained (RT) men and women in regard to the loads that maximize average power (AP), peak power (PP), average velocity (AV), and peak velocity (PV) in the back squat (BS). **METHODS:** Forty-one RT (n = 41) men (m = 20; 21 ± 1 y; 183.0 ± 7.8 cm; 82.5 ± 8.0 kg) and women (w = 21; 20 ± 1 y; 166.5 ± 6.9 cm; 63.1 ± 7.7 kg) had their 1RM determined (m: 147.0 ± 28.0 kg; f: 89.1 ± 12.3 kg). On a second day, they performed two repetitions at BS loads corresponding to 30%, 40%, 50%, 60%, 70%, 80%, and 90% 1RM as explosively as possible for determination of AV, PV, AP and PP. The repetition with the highest value was used for comparison. Repeated measures analysis of variance for AV, PV, AP, and PP were run. **RESULTS:** Men were older (p = 0.022), taller (p < 0.001), heavier (p < 0.001), stronger (p < 0.001), and had a greater 1RM to body weight ratio (m: 1.8 ± 0.3; w: 1.4 ± 0.1; p < 0.001). Men also produced higher velocities (PV, AV) and power (PP, AP) across all loads. The highest PP occurred at 90%1RM for both, though no difference was noted between 80%1RM and 90%1RM in either sex. The highest AP occurred at 70%1RM in men, though AP at 60% and 80%1RM were not different. The highest AP in women was observed at 80%1RM, though no difference was noted between that intensity and 50% - 70%1RM. AV and PV occurred at the lowest intensity (30%1RM) in both sexes. **CONCLUSION:** These data suggest that load for PP, PV, and AV does not differ. However, differences did exist in the load that resulted in the highest AP. Whether this would be observed across all sports is unknown. Further study is required to determine if sex differences exist in load among different sports and training status.

471 Board #292 May 31 9:30 AM - 11:00 AM
Effect of Different Types of Circuit Resistance Training on Total and Regional Muscle Mass

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PURPOSE: The purpose of this study was to compare the training effects on total and regional muscle mass with different types of circuit resistance training among sedentary healthy adults.

METHODS: 36 participants (18 female; 28.19 ± 5.30 yr; 168.50 ± 8.93 cm; 66.33 ± 14.17 kg) were randomly assigned to three groups: machine circuit training group (MCT, n = 12), dumbbell circuit training group (DCT, n = 12), and control group (n = 12). MCT and DCT performed 3 sessions per week for 8 weeks resistance-type circuit training (10 exercise x 30 sec x 3 set; 25-30 min). Muscle mass of trunk and limbs were measured pre and post intervention for all subjects using bio-electric analyzer. One-way ANCOVA and least significant difference (LSD) were used for the analysis. Significant level was set at α = .05.

RESULTS: There were no significant difference in body mass (MCT: -2.19%; DCT: -1.55%; CON: -0.43%) before and after 8-wk intervention in any group. Changes in total skeletal muscle mass (MCT: + 3.44%; DCT: +4.67%; CON: -1.18%) was not different between MCT and DCT. Both training groups demonstrated significant difference with control group (p<.05). Significant changes in arms and legs muscle mass were found after training in MCT and DCT. Upper limb showed higher rate of increase in both group. For trunk muscle mass (MCT: + 0.88%; DCT: +1.83%; CON: -0.53%), both training group were significant difference with control group after intervention (p<.05). DCT showed better training effect on trunk muscle mass than MCT (p<.05).

CONCLUSIONS: The findings of present study verify the effectiveness of 8-week circuit resistance training on body composition and muscle mass for sedentary healthy

adults. Training effects was equivalent using machine or dumbbell as equipment for limb muscle mass. Circuit training with dumbbell required core stability lead to more hypertrophy of trunk muscle than training with machine.

472 Board #293 May 31 9:30 AM - 11:00 AM
Effects of Different Resistance Training Protocols on Performance, Metabolic and Perceptual Responses in Trained Men

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(No relationships reported)

Monitoring the intensity of resistance training (RT) is essential for the effectiveness of training periodization. Athletes have been using power, hypertrophic and strength trainings protocols to improve performance. However, the effects these protocols on physiological stress are still unknown. **PURPOSE:** To compare the effects of three different protocols of RT on total volume (TV), session rate perceived exertion (SRPE) and lactate concentration (LAC). **METHODS:** Nine resistance trained men (22 ± 3.87 years, 79.53 ± 13.28 kg and 176.59 ± 7.53 cm) performed three training sessions on different days separated by at least 72 hours in a counterbalance fashion. After determining one maximum repetition (1-RM) on a squat (SQ) and bench press (BP) exercises, each volunteer performed three different training protocols: 1) power training session (PTS, performed 6 sets of 6 reps on SQ and 6 sets of 6 reps on BP at 50% of 1-RM), 2) hypertrophy training session (HTS, performed 5 sets of maximum repetitions on SQ and 5 sets on BP at 75% of 1-RM) and 3) strength training session (STS, performed 5 sets of maximum repetitions on SQ and 5 sets on BP at 90% of 1-RM). The three sessions were performed with 2-min rest interval between sets and 5-min between the two exercises. The SRPE was measured 15-min after each training session by the CR-10 RPE scale. Statistical analysis was done by means of repeated measures ANOVA. The probability level of statistical significance was set at $p < 0.05$ in all comparisons. **RESULTS:** The STS showed lower TV (2493.00 \pm 948.79 kg) in comparison with HTS and PTS (5169.75 \pm 1340.20 and 4428.00 \pm 701.94 kg, respectively). However, the STS and HTS showed higher SRPE (6.33 \pm 1.87 and 7.89 \pm 1.17, respectively) when compared to PTS (4.33 \pm 1.66). In all protocols volunteers showed higher LAC at the end of the sessions ($p < 0.05$). Moreover, in the HTS the LAC was higher (1.15 \pm 0.36 to 11.77 \pm 2.07 mM) when compared to STS (1.02 \pm 0.36 to 6.53 \pm 2.87 mM) and PTS (1.10 \pm 0.40 to 4.00 \pm 2.47 mM). **CONCLUSION:** Our data suggest that the magnitude of physiological stress resulting from the exercise (internal load) is more dependent on the magnitude of the effort (maximum or submaximal repetitions) than the TV or load lifted (external load) in different protocols of RT. Further studies are needed to investigate the effects of other RT protocols.

473 Board #294 May 31 9:30 AM - 11:00 AM
Intra- And Inter-set Velocity Characteristics During High- And Low-load Resistance Training To Failure

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(No relationships reported)

INTRODUCTION: Recent investigations have examined the effects of high- and low-load resistance training on skeletal muscle hypertrophy and strength. However, few investigations have examined the velocity parameters between these two conditions. **PURPOSE:** The purpose of this study was to examine the velocity characteristics during high- and low-load barbell back squatting to failure. **METHODS:** Eleven resistance-trained males (Age: 22 ± 3 years, Body Mass: 83.7 ± 10.5 kg, Squat 1RM: 157.1 ± 25.8 kg) were recruited to participate in this study. During the initial visit participants completed a one-repetition maximum (1RM) testing session to assess lower extremity muscular strength. Following 1RM testing, participants were asked to return for two additional sessions scheduled no more than eight days apart. Following a designated warm-up, subjects were randomly assigned to squat either 80% (high-load) or 30% (low-load) of their squat 1RM for three sets to failure with 3 minutes' rest between sets. Mean velocity (MV) was recorded during each set using a linear position transducer (GymAware, Canberra, Australia). **RESULTS:** Independent samples t-tests were conducted to assess differences between conditions. Initial analysis displayed a significantly higher MV for the low-load condition (0.66 ± 0.08 m/s) when compared to the high-load condition (0.40 ± 0.12 m/s; $p < 0.001$) across all time points. Follow-up analysis revealed a significant decrease in MV during each set during both conditions ($p = 0.000 - 0.008$), with no significant differences between groups ($p > 0.05$ for each set). No significant differences ($p > 0.05$) in percent decline of intra-set MV (Low-load: 30.3-34.8%; High-load: 30.4-37.4%) were observed between the conditions at each time point. Additionally, there were no significant differences in MV

between the first and last reps of each set in either condition ($p > 0.05$ for each time point). **CONCLUSION:** Although high-load resistance training leads to significantly higher MV's than low-load resistance training, percent decline during and between sets was similar in both conditions, indicating similar levels of fatigue were accumulated during the bouts. Given the vast difference in MV between conditions, future research into the mechanisms of fatigue during each condition may be warranted.

474 Board #295 May 31 9:30 AM - 11:00 AM
Percentage-based and Autoregulated-based Resistance Training Loading Produce Similar Lower Body Hypertrophy Outcomes

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Researchers and practitioners have used the resistance training-specific rating of perceived exertion (RPE) scale to individualize load prescription. **PURPOSE:** To compare changes in muscle thickness (MT) of the vastus lateralis at 50% (VL50) and 70% (VL70) and vastus medialis at 70% (VM70) femur length between percentage-based training (PBT) and autoregulated-based training (ABT) via RPE. **METHODS:** Eleven males (age: 23 ± 4 yrs, body mass: 77.4 ± 7.7 kg, body fat: 9.5 ± 3.8 %) with at least two yrs. of training experience and a minimum one-repetition maximum (1RM) of 1.5 and 1.25x bodyweight on the squat and bench press respectively, were assigned to one of two groups: PBT (n=6) or ABT (n=5) for 8 weeks. Forty eight hours following pre-testing MT via ultrasound, both groups performed the squat and bench press 3x/wk. on non-consecutive days (i.e. Mon., Wed., Fri.) using the same number of sets and repetitions following an undulating resistance training program, which linearly increased load and decreased repetitions throughout. Weeks 1-3 consisted of 8, 6, and 4 repetitions on Mon., Wed., and Fri., while weeks 4-5 consisted of 7, 5, and 3 repetitions, with 6, 4, and 2 repetitions being performed during weeks 6-7. Week 8 served as a taper with 4 and 3 repetition days on Mon. and Wed. and post-testing on Fri. Load increased during each week in PBT from 65, 70 and 75% in week 1 to 82.5-92.5% of 1RM in week 7. In ABT there was no prescribed load but subjects were instructed to select a load in which the set ended with a 5-7 RPE in week 1 and progressed to an 8-10 RPE in week 7. A 2x2 repeated measures ANOVA was used with significance set at $p \leq 0.05$. **RESULTS:** There was a significant time effect for VL50 (25.4 ± 3.28 to 28.1 ± 4.64 mm; $p = 0.04$; +10.42%) in PBT but not in ABT (26.72 ± 3.75 to 28.45 ± 3.42 mm; $p = 0.16$; +6.47%). The time effect for VL70 in PBT approached significance (23.69 ± 3.42 to 26.81 ± 2.89 mm; $p = 0.06$; +13.17%), and there was no significant change for VL70 in ABT (24.61 ± 3.59 to 26.31 ± 4.06 mm; $p = 0.33$; +6.91%). There was a significant time effect for VM70 in PBT (17.93 ± 3.25 to 19.25 ± 3.36 mm; $p = 0.05$; +7.36%), but not in ABT (19.63 ± 4.30 to 20.50 ± 4.00 mm; $p = 0.17$; +4.43%). Additionally, there were no group differences (VL50: $p = 0.72$; VL70: $p = 0.92$; VM70: $p = 0.54$). **CONCLUSION:** Our findings indicate that PBT and ABT strategies produce similar lower body hypertrophy.

A-56 Free Communication/Poster - Running

Wednesday, May 31, 2017, 7:30 AM - 12:30 PM
 Room: Hall F

475 Board #296 May 31 9:30 AM - 11:00 AM
Inter-limb Differences When Using A Passive-dynamic Ankle-foot Orthosis For Running

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 (No relationships reported)

Recent advancements in surgical care have improved the ability to salvage, versus amputate, severely injured limbs but many patients are still left with severe functional impairments. Passive-dynamic ankle-foot orthoses (PD-AFO) have enabled some injured individuals to regain many of their functional abilities, including a return to running. The PD-AFO's semi-rigid structure provides the external support that is essential for many of these activities, but it limits motion and affects movement mechanics. There is a paucity of information on running with PD-AFOs and how their use impacts the unaffected limb. **Purpose:** To identify limb loading and footstrike patterns during running in PD-AFO users. **Methods:** Fifteen male Service Members (29 ± 5 years, 1.8 ± 0.1 m, 84.3 ± 7.6 kg) who had undergone unilateral lower limb salvage and who were prescribed custom PD-AFOs (Intrepid Dynamic Exoskeletal Orthosis)

participated. Kinematic and kinetic data were recorded as subjects ran through a 17m data capture area at a self-selected speed (3.4±0.7 m/s). Between limb differences in footstrike patterns and loading rates were assessed between the PD-AFO and unaffected limbs via paired t-tests. **Results:** Mean loading rates were 43% greater on the unaffected limb than on the PD-AFO limb (60.4±25.6 vs. 34.6±11.8 BW/sec, p<0.001). These differences were largely due to distinct footstrike asymmetries. Eleven patients used a heel strike on the unaffected limb and a forefoot contact on the PD-AFO limb. One subject attempted to run with a heel strike on both limbs and 3/15 subjects were able to run with mid-forefoot footstrike classification on each limb. **Conclusion:** Participants were able to run with the PD-AFO following traumatic lower limb salvage, but distinct asymmetries were observed. Loading the forefoot of the PD-AFO creates a larger lever for patients to utilize its energy storage and return properties and is viewed as desirable. Heel strike and higher loading rates on the unaffected limb could contribute to overuse-type injuries if these running mechanics are maintained long term. Thus, training interventions that focus on achieving a forefoot strike pattern on both limbs may promote the desired changes in running mechanics for this patient cohort.

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476 Board #297 May 31 9:30 AM - 11:00 AM
Sport-specific Comparisons of Lower Extremity Joint Work during Running

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Running involves unique contributions of joint work in order to absorb forces and subsequently propel the body forward. When compared to the hip and knee, the ankle contributes the greatest negative (W^-) and positive (W^+) work during running. Changes in work have been linked to increases in velocity (sprinting) and intensity (incline). The mechanics of running has been examined primarily in athletes who are runners. However, other athletes utilize running during their practice and competition. The specific movements of these sports may result in different mechanical demands on the lower extremities and therefore different running mechanics. **PURPOSE:** To compare differences in individual joint work and total work (W^0) during steady state running in a group of female athletes from 3 different sports (running=RN, lacrosse=LX, basketball=BB). **METHODS:** Forty-eight female athletes volunteered (RN: n=12, ht=1.68±0.1m, mass=62.1±9.8kg; LX: n=24, ht=1.64±0.1m, mass=64.1±6.6kg; BB: n=12, ht=1.76±0.1m, mass=72.3±13.4kg). Sagittal plane kinematics and kinetics were assessed while running on an instrumented treadmill (Treadmetrix, Park City, Utah) at a constant speed using a 5 camera motion analysis system (Qualysis, Goteborg, Sweden). Joint powers and joint work for the hip, knee and ankle were calculated using Visual 3D (C-Motion Inc., Bethesda, MD). W^0 was defined the absolute value of $W^+ + W^-$. Independent variables included W^+ , W^- , W^0 at the hip, knee and ankle. Two-factor analyses of variance (ANOVA) were employed using SPSS 24.0 for W^+ , W^- and W^0 . Post-hoc analyses (Tukey HSD) were performed as appropriate. All significance levels were set at $\alpha < 0.05$. **RESULTS:** A significant interaction between sport and joint existed with W^+ (p<0.01) and with W^0 (p=0.01) at the ankle. Specifically, RN had more W^+ (0.71±0.29) than LX (0.50±0.12, p=0.02) at the ankle. W^0 at the ankle was greater in RN (1.31±0.05) compared to both LX (0.96±0.21, p<0.01) and BB (0.97±0.23, p=0.02). **CONCLUSION:** Overall, W^+ and W^0 at the ankle is greater in RN compared to LX and BB. The contribution of the ankle to the lower extremity is 60% in RN compared to 54% in LX and 45% in BB. These differences in work may result in possible inefficient gait patterns. Implications of altered mechanics are possible increases in energy demand or neuromuscular fatigue.

477 Board #298 May 31 9:30 AM - 11:00 AM
Changes in Joint Work across Consecutive Seasons in Collegiate Cross Country Runners

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Running mechanics are known to change with age and years of experience, however the extent to which mechanics may change more acutely from one year to the next is uncertain. In particular, refinements of running mechanics may occur which benefit an individual's performance or reduce injury risk. **PURPOSE:** To assess changes in lower extremity joint work during running across two consecutive seasons among healthy collegiate runners.

METHODS: Pre-season data from the 2015 and 2016 cross country seasons were reviewed for 14 NCAA Division I runners (men, 7; age: 20.1±1.1 yr; height: 1.7±0.1 m; mass: 61.6±8.8 kg). Athletes were healthy at both testing sessions. Ground reaction forces and kinematic data were recorded during treadmill running (4.47m/s). Sagittal

plane positive (PW) and negative work (NW) were calculated for the hip, knee, and ankle during stance phase and averaged across gait cycles. PW and NW at each joint were then compared across seasons using paired t-tests. Training programs and injuries occurring between testing sessions were also reviewed.

RESULTS: No differences between limbs were observed (p > 0.13); analyses are reported for the right limb. At the start of the 2015 season, PW at the hip, knee, and ankle was 0.26±0.10, 0.33±0.08 and 1.31±0.21 J/kg, respectively, and NW was -0.04±0.04, -0.45±0.11, and -0.83±0.29 J/kg, respectively. At the start of the 2016 season, PW at the hip, knee, and ankle was 0.38±0.14, 0.25±0.25 and 1.30±0.23 J/kg, respectively, and NW was -0.05±0.05, -0.39±0.09, and -0.86±0.31 J/kg, respectively. Hip PW increased significantly and both knee PW and NW decreased significantly (p < 0.006) across seasons. No significant differences between seasons were observed in ankle PW or NW (p > 0.42) or in hip NW (p = 0.43). Results remained consistent when comparing those who did and did not sustain an injury between 2015 and 2016, and no changes in training programs were noted. **CONCLUSIONS:** Hip PW and knee PW and NW changed significantly between seasons, indicating an alteration in running mechanics that may affect performance. In the absence of injury and training-related modifications, the mechanism responsible for these changes requires further exploration.

478 Board #299 May 31 9:30 AM - 11:00 AM
The Effect of Small Perturbations in Running Velocity on Measures of Coordination Variability

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Running research aims to replicate movement that occurs outside the laboratory and may represent daily life. One factor commonly manipulated and constrained within the laboratory is running velocity. Outside the laboratory, velocity is often varied within a runner's training regimen. Though running velocity is regularly altered in both settings, little is known about how these small changes may affect the organization of movement. **PURPOSE:** This study aimed to determine whether small deviations from preferred velocity led to changes in coordination variability (CV). **METHODS:** Nine healthy runners (age 22 ± 2 years) were recruited from the Las Vegas community. Kinematic and kinetic analyses were performed while participants ran at 85%, 90%, 95%, 100%, 105%, 110%, and 115% of their preferred velocity. Movement CV was calculated for the segment couples of thigh-shank and shank-foot during early, mid, and late stance using a modified vector coding technique. The joint couples analyzed included: thigh flexion-shank rotation, thigh flexion-shank flexion, shank rotation-foot eversion, and shank flexion-foot flexion. CV values were averaged across trials and compared between conditions using repeated measures ANOVA ($\alpha < 0.05$). **RESULTS:** No statistically significant differences in CV were found between velocity conditions for any couplings of interest during any phase of stance (Table 1). **CONCLUSION:** Small perturbations in running velocity from preferred do not influence CV of thigh-shank and shank-foot couplings during stance phase. It is possible that larger deviations from preferred velocity would result in changes, and this effect has been shown in previous research. However, the goal of this project was to assess how slight changes, such as what would be seen in day-to-day training or from constraints in the laboratory, would influence CV.

Table 1: Mean movement coordination variability of segment couples during early, mid and late stance

	Early Stance (0-20%)				Mid Stance (21-60%)				Late Stance (61-100%)			
	Thigh-Shank		Shank-Foot		Thigh-Shank		Shank-Foot		Thigh-Shank		Shank-Foot	
	XX	XZ	XX	ZY	XX	XZ	XX	ZY	XX	XZ	XX	ZY
Sig	0.40	0.66	0.95	0.96	0.86	0.44	0.39	0.97	0.10	0.08	0.48	0.72
85%	3.41	19.8	2.73	14.9	2.06	5.25	2.67	17.0	3.79	5.58	1.56	9.65
90%	3.07	19.0	2.43	15.3	2.25	5.23	2.46	19.5	3.01	4.65	1.54	8.78
95%	3.09	17.7	2.62	15.2	2.40	5.49	2.71	18.0	3.32	4.74	1.59	8.90
100%	3.19	17.1	2.68	16.0	2.12	5.64	5.25	19.1	3.61	5.10	1.86	9.27
105%	3.33	20.1	2.91	14.2	2.18	5.08	3.22	18.9	3.13	4.32	1.70	7.78
110%	3.46	19.9	2.91	15.1	2.18	4.94	2.86	18.9	2.49	4.27	1.45	8.82
115%	4.20	17.4	2.98	16.3	2.13	4.23	3.40	18.0	2.56	3.95	1.44	8.49

479 Board #300 May 31 9:30 AM - 11:00 AM
Maximalist Shoes Do Not Reduce Impact Loading During Level And Downhill Running

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A new running shoe design called ‘maximalists’, which claims to provide maximal cushioning with its oversized midsole and thus lower the impact loading, becomes more popular among trail runners. Downhill running is an essential component of trail races but it may lead to a greater loading than level running. However, the effects of maximalists on the running biomechanics, especially during downhill running, remain unexamined.

Purpose: To compare vertical loading rates, stride length and footstrike angle in runners with traditional running shoes (TRS) and maximalists (MAX) during level and downhill running. **Methods:** Twelve regular shod runners (9 males, 32.5±8.9 years) were asked to run on a self-paced instrumented treadmill at 0% and 10%-declination with TRS (Adizero boost, Adidas) and MAX (Clifton 3, Hoka) in a randomized sequence for 5 minutes. Kinematics and force data were sampled at 200 and 1,000 Hz respectively. The average (AVILR) and instantaneous vertical loading rates (VILR), along with the stride length and footstrike angle, were extracted and averaged over the last minute in each condition. **Results:** VALR, VILR, stride length, and footstrike angle were similar between TRS and MAX during both level and downhill running ($p>0.372$, Table 1). **Conclusion:** These findings suggest that additional cushioning of maximalist running shoes do not lower impact loading. In addition, maximalists do not change the stride length and footstrike pattern in shod runners.

	Level running				Downhill running			
	MAX Mean (SD)	TRS Mean (SD)	Cohen's d	P-value	MAX Mean (SD)	TRS Mean (SD)	Cohen's d	P-value
VALR (BW/s)	57.5 (16.5)	56.3 (18.3)	0.07	0.827	84.5 (21.6)	79.4 (18.8)	0.25	0.563
VILR (BW/s)	71.6 (18.5)	69.3 (19.2)	0.13	0.684	102.3 (23.2)	95.0 (19.3)	0.34	0.372
Stride length (m)	1.72 (0.14)	1.72 (0.14)	0.02	0.672	1.78 (0.13)	1.78 (0.13)	0.04	0.626
Foot-strike angle (degree)	7.7 (7.0)	7.6 (7.3)	0.02	0.949	14.6 (6.4)	14.0 (11.1)	0.07	0.819

480 Board #301 May 31 9:30 AM - 11:00 AM
Is Variability Of Stride Frequency A Factor That Determines Preferred Stride Frequency During Running?

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 (No relationships reported)

Purpose: The purposes of this study were 1) to quantify and describe variability of stride frequency during running, and 2) to determine if the variability of stride frequency is minimized at the preferred stride frequency. **Methods:** The participants (n=8; 24.88±4.16 years; 173.19±9.33 cm; 72.81±14.27 kg) performed seven 5-minute run conditions on an instrumented treadmill (Bertec FIT, USA). The seven runs were a function of their preferred stride frequency (PSF, PSF±5%, PSF±10%, PSF±15%). Participants matched each foot fall with a metronome set to the stride frequency for each condition. Data were collected during four 30-second trials per condition. Variability of stride frequency was determined using coefficient of variation ($CV_{SF} = \text{standard deviation}/\text{mean} \times 100$). CV_{SF} were each compared between conditions using a repeated measures ANOVA. **Results:** CV_{SF} was different across SF conditions ($F=14.672$, $p<0.001$). Using pairwise comparisons, it was determined that CV_{SF} at PSF (0.991) was significantly less than during PSF+10% (1.262; $p=0.016$), PSF+15% (1.454; $p<0.001$), PSF-10% (1.362; $p=0.028$), and PSF-15% (1.652; $p<0.001$). The CV_{SF} during PSF+5% (1.025) was different from all other SF perturbations ($p<0.05$). CV_{SF} during PSF+10% (1.262) was less than during PSF-15% (1.652; $p=0.025$). CV_{SF} during PSF+15% (1.454) was greater than PSF-5% (1.209; $p=0.016$). CV_{SF} during PSF-5% (1.209) and PSF-10% (1.362) were less than PSF-15% (1.652; $p=0.001$,

$p=0.028$, respectively). **Conclusion:** CV_{SF} was influenced by large changes in SF. Stride frequency variability increased as stride frequency increased further from the preferred stride frequency. It may be that decreased variability of SF is a factor determining the preferred stride frequency during running.

481 Board #302 May 31 9:30 AM - 11:00 AM
Influence Of Stride Frequency Manipulation On Muscle Activity During Running At Reduced Body Weight

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 (No relationships reported)

Running with body weight support (BWS) (e.g., running on a lower positive pressure treadmill) has been used for physical fitness enhancement. Nevertheless, gait mechanics of running with BWS is not fully understood. **PURPOSE:** To investigate influence of stride frequency (SF) manipulation on muscle activity during running at different BWS conditions. **METHODS:** Nineteen subjects (23.8±4.1 years) ran on a lower body positive pressure treadmill at their preferred running speed (PS) for different BWS conditions (i.e., 0%, 50%, and 80% of BWS conditions). The SF conditions consist of running at preferred SF (PSF), PSF+10%, and PSF-10%. Muscle activity from the rectus femoris (RF), biceps femoris (BF), tibialis anterior (TA), and gastrocnemius (GA) were measured. In addition, rating of perceived exertion (RPE) and SF were measured. Muscle activity, RPE, and SF were analyzed using a 3 (mode) x 3 (BWS) repeated measures analysis of variance (ANOVA) ($\alpha = 0.05$). PS was analyzed using a one-way repeated measures ANOVA ($\alpha = 0.05$). **RESULTS:** Muscle activity (RF, BF, TA, and GA), RPE, and SF were not influenced by the interaction of BW support and SF ($P>0.05$). Muscle activity from the RF, TA, and GA were different between BWS conditions ($P<0.001$). Specifically, muscle activity from the RF, TA, and GA were lower with increasing BWS (e.g., a decrease of 26%~46% between 80%BWS and 0%BWS conditions). Muscle activity from the RF, BF, and TA were different between SF conditions ($P<0.05$). For example, RF muscle activity during running at PSF was 11%~18% lower than when running at PSF+10%. Additionally, BF muscle activity during running was higher with increasing SF (e.g., a 20% increase in SF resulted in 12%~27% increase in the BF muscle activity). RPE was not different between BWS conditions ($P>0.05$) and between SF conditions ($P>0.05$). SF was different between BWS conditions ($P<0.001$) and between SF conditions ($P<0.001$). For example, SF was lower with increasing BWS (e.g., a decrease of 15% between 80%BWS and 0%BWS conditions). PS was higher with increasing BWS (9.8±2.1 km/h, 11.0±2.6 km/h, and 11.8±2.8 km/h for 0%, 50%, and 80% of BWS conditions, respectively; $P<0.001$). **CONCLUSION:** These observations suggest that a change in SF may influence muscle activity (i.e., RF and TA) during running, regardless of BWS.

482 Board #303 May 31 9:30 AM - 11:00 AM
Smaller Compressive and Anteroposterior Joint Reaction Forces in Older Compared to Young Runners

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Age-related changes in bone structure and mechanics may increase the risk of injury when performing exercise such as running. Joint-related injury such as osteoarthritis is a primary concern for older runners. A contributing factor to bony injury is joint loading. However, it is not known whether increased loading exists in older runners. **PURPOSE:** To compare anteroposterior and compressive joint reaction forces (JRFs) in the lower extremities during running in healthy young and older runners. **METHODS:** Nine healthy young runners (YA) and 10 healthy older adult runners (OA) performed fifteen over ground running trials at a fixed velocity (3.35 m/s). Running velocity was maintained (+ 5%) using an infrared timing gate. Three-dimensional kinematics and ground reaction forces were recorded simultaneously using an 8-camera motion capture system (240 Hz, Qualisys, Inc.) and force platform (960 Hz, AMTI, Inc.), respectively. Visual 3D was used to calculate ankle, knee and hip JRFs (compressive and anterior/posterior) during the stance phase of the gait cycle. Independent samples t-tests were used to compare mean JRFs in both directions. **RESULTS:** YA exhibited significantly larger mean JRFs at the ankle ($p=0.04$; YA: -13.2±1.0 BW; OA: -12.6±0.7 BW) and knee ($p=0.04$; YA: -13.0±0.9 BW; OA: -12.3±0.9 BW) while no differences were observed at the hip ($p=0.08$; YA: -12.0±1.0 BW; OA: -11.1±1.4 BW). In the anterior/posterior direction, older adults had significantly smaller ankle JRFs compared to young adults ($p=0.01$; YA: 5.1±0.7 BW; OA: 4.5±0.4 BW) while no differences were observed at the knee ($p=0.20$; YA: -3.0±1.2 BW; OA: -2.7±0.8 BW) or hip ($p=0.37$; YA: 2.4±2.0 BW; OA: 2.2±1.9 BW). **CONCLUSIONS:** These data demonstrate that OA have smaller compressive JRFs and anteroposterior shear forces than YA. Therefore, it can be suggested that the greater incidence of bony and cartilage injuries experienced by older runners is not due to greater forces applied to the lower extremity joints during running.

483 Board #304 May 31 9:30 AM - 11:00 AM

Sagittal Plane Peak Knee Angle Variability During Distance Running Training And Race Speeds

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PURPOSE: To analyze peak knee angle variability during distance running to determine if significant differences exist between the stance and swing phases at training and race paces. **METHODS:** Twenty-six highly-trained (30-80 miles per week) adult runners participated in the study (9 females, 17 males, 36.1±10.8 years). For gait analysis, 9mm spherical retro-reflective markers were applied according to Pohl et al., (2010). Data were collected at 200 Hz for 25 seconds using 6 Vicon Bonita cameras. Ten strides were analyzed and normalized to 100 points for the both the stance and swing phases. To assess variability, standard deviation (SD) was calculated across the 10 strides for each of the 100 data points. Peak variability was identified by taking the maximum value of the 100 SDs. The occurrence of peak variability in each phase was extracted as a percentage of each normalized phase. A 2 by 2 repeated measures factorial ANOVA was used to test for main effects and interaction (phase x velocity) at $p=0.05$ for both variables. **RESULTS:** There were significant phase main effects ($p<0.001$) for both variables. Peak knee angle variability was significantly greater in the swing phase compared to the stance phase (7.88° vs 4.22° , respectively). Peak knee angle variability occurred at 74% of the swing phase compared to 19% of the stance phase. **CONCLUSION:** Peak knee angle variability is greater throughout the swing phase compared to the stance phase and this peak occurs at specific, but different, percentages of each phase regardless of running speed. Peak knee angle variability occurs just before and after foot contact so it is likely relevant to consistency of landing mechanics during running and therefore may be an important factor in the occurrence and/or prevention of running injuries.

484 Board #305 May 31 9:30 AM - 11:00 AM

Use Of Inertial Magnetic Sensors To Implement Kinematic Methods To Detect Foot Contact During Running

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Biomechanics of the stance phase of running is of interest in relation to injury development. Studying the stance phase requires proper detection of foot contact (FC). The onset of vertical ground reaction force (GRF) is considered the gold standard in a laboratory setting to detect FC. In the absence of GRF data, motion analysis can be used to measure peak downward velocity of the pelvis (PDVP) with a 15ms offset which showed good relation with FC during treadmill running at one speed (1). Inertial sensors can measure kinematic parameters like PDVP outside the laboratory setting. Peak tibial acceleration (PTA) is a parameter of interest in running injury development which can be measured with inertial sensors and may also be used to detect FC outside the laboratory.

PURPOSE: To assess the effectiveness of these kinematic methods using inertial measurement units (IMUs) to detect FC during running at different speeds. **METHODS:** 3 male runners (28 ± 8.5 yrs) ran on an instrumented treadmill at 6 speeds (10-15 km/h) for 1 minute each, wearing a suit equipped with IMUs at the tibia and sacrum. FC was determined based on GRF data of the treadmill (1000 Hz; threshold of 20N) and IMU data (240Hz). PDVP was obtained from a single integration of pelvic acceleration in the global frame. PTA was determined from the acceleration data measured in the local tibia frame. The 95% limits of agreement were used to compare each method to the gold standard (i.e., GRF).

RESULTS:**Table 1: The offset and 95% limits of agreement for the two kinematic methods with respect to the gold standard for 6 running speeds.**

Running Speed	Kinematic method	Offset		95% limit of agreement			
				Lower		Upper	
10 km/h	PDVP	5 frames	(21.0 ms)	1 frame	(4.2 ms)	6 frames	(25.2 ms)
	PTA	5 frames	(21.0 ms)	2 frames	(8.4 ms)	9 frames	(37.8 ms)
11 km/h	PDVP	6 frames	(25.2 ms)	1 frame	(4.2 ms)	8 frames	(33.6 ms)
	PTA	6 frames	(25.2 ms)	2 frames	(8.4 ms)	10 frames	(42.0 ms)
12 km/h	PDVP	7 frames	(29.4 ms)	1 frame	(4.2 ms)	7 frames	(29.4 ms)
	PTA	7 frames	(29.4 ms)	0 frames	(0 ms)	13 frames	(54.6 ms)
13 km/h	PDVP	8 frames	(33.6 ms)	1 frame	(4.2 ms)	8 frames	(33.6 ms)
	PTA	8 frames	(33.6 ms)	2 frames	(8.4 ms)	13 frames	(54.6 ms)
14 km/h	PDVP	6 frames	(25.2 ms)	1 frame	(4.2 ms)	7 frames	(29.4 ms)
	PTA	6 frames	(25.2 ms)	2 frames	(8.4 ms)	11 frames	(46.2 ms)
15 km/h	PDVP	6 frames	(25.2 ms)	2 frames	(8.4 ms)	6 frames	(25.2 ms)
	PTA	6 frames	(25.2 ms)	3 frames	(12.6 ms)	9 frames	(37.8 ms)

CONCLUSION: This study showed that a novel IMU-based method of detecting FC using PTA and PDVP showed good similarity with FC detection based on GRF at all running speeds. The different time offsets among running speeds should be considered when implementing these kinematic methods to detect FC. This opens up new possibilities for studying running mechanics outside the laboratory.

REFERENCES: 1. Milner CE, Paquette MR. A kinematic method to detect foot contact during running for all foot strike patterns. *J Biomech.* 2015. 18; 48(12): 3502-5

485 Board #306 May 31 9:30 AM - 11:00 AM

Superficial Sensory Feedback Is Not Responsible For Gait Alterations Associated With Barefoot Running

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 (No relationships reported)

Of the many sensory modalities, cutaneous sensory feedback is thought to play a primary role in locomotor patterns. It has long been proposed that gait alterations, when changing from shod to barefoot, are mediated by alterations in sensory feedback. While the theory of sensory mediated gait adaptations associated with barefoot running is plausible, there has been no data to support this claim. **PURPOSE:** To examine the role of superficial plantar cutaneous feedback in barefoot and shod running in order to substantiate the claim that sensory feedback triggers the gait alterations associated with barefoot running. **METHODS:** 10 healthy active subjects (6 male, 4 female); mass: 65.2±9.7 kg; age: 27±7.1 years participated in this study. 10 over-ground running trials were completed in each of the following conditions: barefoot (BF), shod (SHOD), anesthetized barefoot (ANEST BF) and anesthetized shod (ANEST SHOD). For the anesthetized conditions 0.1-0.3 mL of 1% lidocaine was injected into the dermal layer of skin on the plantar foot below the metatarsal heads, lateral column and heel. 3-dimensional motion analysis and ground reaction force (GRF) data were captured as subjects ran over a 20m run way with a force plate at 12m. Kinematic and kinetic differences were analyzed via two-way repeated measures ANOVAs. **RESULTS:** The differences in gait between the BF and SHOD conditions were consistent with previous research with subjects exhibiting decreased stride length (BF: 2.07±0.24m, SHOD: 2.21±0.24m, $p<0.001$) and changing from rear footstrike when SHOD to fore/mid footstrike when BF (BF: -5.5±5.1°, SHOD: 7.5±3.8°, $p<0.001$). Similarly, BF running was associated with decreased peak vertical GRFs and impact peak magnitudes (vGRF BF: 2.19±0.24 BW, SHOD: 2.32±0.19 BW, $p=0.02$; impact peak BF: 1.65±0.22 BW, SHOD: 1.89±0.25 BW, $p<0.001$). Despite anesthetizing the plantar surface, there was no difference between the BF and ANEST BF conditions in terms of stride length (BF: 2.07±0.24m, ANEST BF: 2.01±0.27m, $p>0.05$), footstrike (BF: -5.5±5.1°, ANEST BF: -3.8±3.2°, $p>0.05$) or GRFs (vGRF BF: 2.19±0.24 BW, ANEST BF: 2.15±0.28 BW, $p>0.05$; impact peak BF: 1.65±0.22 BW, ANEST BF: 1.59±0.25 BW, $p>0.05$). **CONCLUSION:** Superficial cutaneous sensory receptors are not primarily responsible for the gait changes associated with barefoot running.

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The Ability of Sagittal Plane Kinematic Variables to Predict Loading in Different Populations of RunnersKathryn Harrison, Bhushan Thakkar, Gregory Crosswell, Jacqueline Morgan. *Virginia Commonwealth University, Richmond, VA.* (Sponsor: D. S. Blaise Williams III, FACSM)
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It is known that sagittal plane kinematics are able to predict loading in runners. This may be of use to clinicians who don't have access to force measurement devices. However, running biomechanics differ between genders and age groups. Thus it may be that models used to predict loading in demographically distinct groups of runners need to be specific to age and gender. **PURPOSE:** To determine if kinematic predictors of kinetic variables during running apply across genders and age groups. **METHODS:** Sagittal plane kinematics and kinetics were assessed in young male (YM: n=13, age=23.1 ± 2.3 yrs, mass=77.0 ± 12.1 kg, height=1.79 ± 0.08 m, velocity=3.32 ± 0.48 m/s) and middle-aged female runners (MF: n=28, age=47.3 ± 7.0 yrs, mass=63.7 ± 7.8 kg, height=1.66 ± .07 m, velocity=2.55 ± 0.37 m/s) using a 5 camera motion analysis system (Qualysis, Goteborg, Sweden) running on an instrumented treadmill (Treadmetrix, Park City, Utah) at their preferred running pace. Kinematics (knee flexion at initial contact, foot angle at initial contact, step position, peak knee flexion and COM excursion) were the independent variables; kinetics (average vertical loading rate, braking impulse, knee power absorption and peak knee extension moment and peak vertical ground reaction force) were the dependent variables. Linear regression models were developed to predict loading in both groups ($\alpha=0.05$). **RESULTS:** In both YM and MF, sagittal plane kinematics were useful in predicting peak knee moment (YM: $R^2=0.56$, $p=.002$; MF: $R^2=0.47$, $p=.0002$), knee power absorption (YM: $R^2=0.78$, $p=.0002$; MF: $R^2=0.55$, $p<.0001$), braking impulse (YM: $R^2=0.66$, $p=0.01$; MF: $R^2=0.67$, $p<.0001$), and peak vertical ground reaction force (YM: $R^2=0.31$, $p=0.03$; MF: $R^2=0.23$, $p=0.02$). Peak knee flexion appeared in the most models (peak knee moment, knee power absorption and braking impulse for both men and women), and thus may be the most useful single kinematic variable to assess loading across age groups and genders. In all models, greater knee flexion was associated with increased magnitude of loading. Average vertical loading rate could not be predicted using the chosen kinematics in either group. **CONCLUSIONS:** When equipment for kinetic assessment is not available, sagittal plane gait analysis may be a useful tool for clinicians to estimate loading in runners.

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The Differential Effects of Footwear on Sample Entropy of Ground Reaction Force during RunningShuqi Zhang¹, Yumeng Li², Li Li, FACSM³. ¹Northern Illinois University, Dekalb, IL. ²California State University Chico, Chico, CA. ³Georgia Southern University, Statesboro, GA.
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Maximum cushioned shoes could reduce the peak vertical Ground Reaction Force (GRF) during running, but it may increase the foot instability in horizontal directions, especially at the initial foot contact. Sample entropy (SampEn) has been adopted to define the irregularity to quantify levels of complexity of movement and examine the fluctuations in GRF within a time series. The foot instability would be better represented by the index of SampEn within a stance phase instead of variation among different stance phases viewing instability as errors. **PURPOSE:** this study was aimed at examining the complexity of GRF while running on the treadmill with different types of footwear through SampEn.

METHODS: 19 experienced runners were recruited and ran on the treadmill at 7.8 mph wearing different types of running shoes: max cushioned shoe, minimalist shoe, and regular shoe. GRF of 10 consecutive steps were collected by the instrumented Tandem treadmill. GRF data were further analyzed to calculate sample entropy for both the first 20% stance phase and entire stance phase. Two-way MANOVA was used to examine the effects of independent variables (shoe, step) on sample entropy measures at first 20% stance phase (SampEn_{20%-MI}, SampEn_{20%-AP}, SampEn_{20%-VT}) and entire stance phase (SampEn_{MI}, SampEn_{AP}, SampEn_{VT}). Post hoc Tukey test was applied as needed.

RESULTS: a significant shoe effect was observed on the association among dependent variables listed above ($P < .05$). Cushioned shoes displayed a higher SampEn_{AP} (.1162 ± .01558) than regular shoes (.1094 ± .0258) and a greater SampEn_{20%-AP} (.1953 ± .1556) than minimalist shoes (.1546 ± .0932). Minimalist shoe exhibited greater SampEn_{VT} (.0614 ± .01310) and SampEn_{20%-VT} (.0636 ± .0688) than cushioned shoes (.0577 ± .1002; .0448 ± .0305) respectively. No other significant difference was observed.

CONCLUSIONS: in general, cushioned shoes displayed more fluctuations of GRF in the anterior-posterior (AP) direction compared to minimalist and regular shoes, which indicates cushioned shoes may increase the foot instability in AP direction

during running. Greater fluctuations of vertical GRF when wearing minimalist shoes may indicate a reduced foot stability that could affect the impact absorption at foot touchdown and force generation in push-off.

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Is Muscle Activity a Factor that Determines Preferred Stride Frequency During Running Outdoors?Krizzel Galvez, Jared Joerger, Kendell Galor, John A. Mercer, FACSM. *University of Nevada, Las Vegas, Las Vegas, NV.**(No relationships reported)*

Purpose: The purpose of this study was to determine if muscle activity is affected by different stride frequencies (SF) at preferred running velocity while running outdoors. **Methods:** Participants (n=10, 26.4±8.7 years, 72.6±18.3 kg, 170±8.7 cm) were given a self-selected warm-up after signing an informed consent. Wireless electromyography sensors (sample rate = 1926 Hz) were attached to four muscles on the right side: the rectus femoris (RF), biceps femoris (BF), tibialis anterior (TA), and gastrocnemius (GA). Maximum voluntary contractions were performed for five seconds prior to moving outside for data collection. Preferred running velocity and preferred stride frequency (PSF) were determined outdoors. Participants performed seven randomized conditions, each at their preferred running velocity, consisting of a specific SF. The conditions were 115%, 110%, 105%, 100%, 95%, 90%, and 85% of their PSF. SF was controlled by having participants match a metronome. Absolute value of EMG were averaged across a 5-second window for each SF for each muscle. A repeated measures analysis of variance was used to compare muscle activity between SF conditions.

Results: There was no significant difference in BF between SF conditions ($p=0.352$). There was no significant difference in RF between SF conditions ($p=0.229$). There was no significant difference in TA between SF conditions ($p=0.342$). There was no significant difference in GA between SF conditions ($p=0.758$). **Discussion:** Despite large changes in SF, average muscle activity was not different for any of the muscles tested when running a set speed outdoors. It does not seem that average muscle activity is a factor determining preferred stride frequency.

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489 Board #310 May 31 9:30 AM - 11:00 AM

Comparison Of Intrinsic Foot Muscle Size And Strength Between Gymnasts And Shod RunnersSarah Ridge, Mark Olsen, Kelsey Garner, J William Myrer, Dustin Bruening, A Wayne Johnson. *Brigham Young University, Provo, UT.* (Sponsor: J Ty Hopkins, FACSM)
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Purpose: Wearing supportive footwear during athletic activity may decrease the activity of the intrinsic foot muscles (IFM), leading to weaker muscles and suboptimal foot function. The purpose of this study was to compare the IFM size and strength of two athletic populations - gymnasts who train barefoot and runners who wear cushioned running shoes during training.

Methods: IFM size and toe flexor strength were measured from 13 female gymnasts (age: 19.8 ± 9 years; height: 158.9 ± 4.98 cm; weight: 56.9 ± 4.27 kg) and 21 female runners (age: 22.1 ± 2.95 years; height: 167.4 ± 8.88 cm; weight: 63.0 ± 9.38 kg). Strength was assessed from the big toe individually, and the 2nd, 3rd, and 4th toes together. During testing, the subject was seated with the knee flexed at 90° and the foot on the floor. The toes were aligned with a customized dynamometer. The subject gripped an S-beaner (great toe flexion) or a bar (lateral toe flexion) with their toe(s) and flexed to a maximal contraction for 3 seconds. The average of 3 trials was used for analysis. . Ultrasound images (10 MHz GE LogiqP6) were recorded of the abductor hallucis (ABDH), quadratus plantae (QP), flexor digitorum brevis (FDB) and flexor hallucis brevis (FHB). Measurements included the cross-sectional areas of the ABDH, QP, FDB and thickness of the FHB. ANCOVAs (with height and weight as covariates) were run to compare the IFM size and flexor strength between the groups of subjects. **Results:** Gymnasts had larger FDB and FHB, as well as stronger great toe flexion than runners (see table).

Conclusion: The IFM responsible for toe flexion and great toe flexion strength were greater in gymnasts than runners. Based on these data, training without cushioned footwear, in a task that requires finer control of the foot, has resulted in increased great toe flexion strength. Though it's difficult to separate training task from footwear in this study, these findings lend support to the idea that training in cushioned footwear may hinder optimal IFM function.

Group	Muscle Size				Muscle Strength	
	ABDH (cm ²)	QP (cm ²)	FDB (cm ²)	FHB (cm)	Great Toe (kg)	Lateral Toes (kg)
Gymnasts	2.16 ± .57	1.73 ± .26	1.87 ± .27	1.57 ± .07	5.44 ± 3.68	3.76 ± 1.41
Runners	1.82 ± .50	1.52 ± .35	1.62 ± .27	1.38 ± .17	4.34 ± 1.37	4.28 ± 2.05
p-value	.321	.061	.043*	.006*	.012*	.969

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Relationship of Footstrike Pattern and Landing Impacts During a Marathon Race

Matthew Ruder¹, Steve T. Jamison¹, Adam Tenforde¹, Marian Hannan², Irene Davis, FACSM¹. ¹Spaulding National Running Center, Cambridge, MA. ²Institute for Aging Research, Hebrew SeniorLife, Boston, MA. (Sponsor: Irene Davis, FACSM)
 (No relationships reported)

Landing impacts during running are influenced by footstrike pattern (FSP) in rearfoot strikers (RFS) in laboratory studies. These impacts have been linked with running injuries. Landing impacts are highest in RFS, lower in midfoot strikers (MFS) and lowest in forefoot strikers (FFS). In RFS, impacts are positively correlated with speed. However, these relationships have only been examined in a laboratory setting, limiting the ecologic validity of the data.

PURPOSE: 1. To compare landing impacts between FSP during a marathon. 2. To assess the interaction effect of FSP and speed on landing impacts during a marathon.

METHODS: 226 runners (118 M, 108 F; 44.3±11.1 yrs) running a marathon were recruited for this study. Subjects were initially filmed running on a treadmill to determine their habitual FSP (169 RFS, 32 MFS, 23 FFS). During the marathon, an accelerometer, secured to the distal medial tibia, recorded continuous data. Average peak tibial shock (TS) was calculated for the first 10km of the marathon. An ANOVA (p<0.05) was used to determine FSP differences. The interaction effect of FSP and speed on TS was determined using an ANCOVA (p<0.05).

RESULTS: Peak TS was significantly higher in the RFS compared with the FFS runners. TS in the MFS group was 20% higher than in FFS group. While not significant, this difference was associated with a large effect size, suggesting it is clinically meaningful. TS was positively correlated to speed for RFS and MFS groups (p<0.05), but not for the FFS group (p>0.05).

CONCLUSION: When running in their natural environment, FFS runners have the lowest impacts of all FSPs. In addition, unlike the RFS and MFS groups, FFS runners appear to have the ability to maintain lower impacts at faster speeds.

Supported by Vibram USA.

Table 1: Means and Standard Deviations for subject groups and intra-group comparisons

	FFS	MFS	RFS
Mean Peak Tibial Shock (g)	10.03	12.13	12.23
Standard Deviation	2.47	3.01	3.95
Number of Subjects	23	32	169
Standard Error	0.52	0.53	0.30
	FFS-MFS	MFS-RFS	FFS-RFS
Absolute Value of Average Difference	2.10	0.10	2.20
Pooled Standard Deviation	2.80	3.82	3.81
Effect Size	0.75	0.03	0.58
P-Value	0.095	0.99	0.021

491 Board #312 May 31 9:30 AM - 11:00 AM
Ground Reaction Forces During Running in Extreme Cushioning Running Shoes

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 (No relationships reported)

The extreme cushioning running shoe has recently emerged on the market and it is unclear whether this unique shoe design affects the way people move compared to a regular running shoe. **PURPOSE:** To compare ground reaction forces (GRF) while running in extreme cushioning shoes (ES) vs. normal cushioning shoes (NS) at different speeds. **METHODS:** Subjects (n=5, 1 Female and 4 Males; 74.11kg±11.8kg, BMI: 23.45±1.76 kg/m², 1.69m±0.050m) completed a 1 day testing session consisting of establishing the subject's preferred running speed (PRS) and running at three speed conditions: PRS, PRS+5%, PRS+10%. Subjects were instructed to run over a force platform embedded in the middle of a 5-m runway while wearing ES (Hoka, Bondi 4) or their self-selected shoes (SS) with three speeds (PRS, PRS+5%, PRS+10%)

per shoe condition. Running velocity was measured using infrared timing gates with velocity controlled within ±5% target velocity with three trials completed per condition. Discrete vertical GRF parameters of impact peak (F1), maximum peak (F2), and average (Favg) were recorded and averaged across the three trials per condition. A 2 (shoe) x 3 (velocity) repeated measures analysis of variance (α=0.05) was used for analysis. **RESULTS:** Neither F1, Favg, nor F2 were influenced by the interaction of shoe and velocity (p>0.05) and none had a main effect of shoe (F1: ES 1.78±0.4 BW, SS 1.85±0.3 BW; Favg: ES 1.57±0.1 BW, SS 1.55±0.1 BW; F2: ES 2.68±0.2 BW, SS 2.67±0.2 BW; p>0.05). Favg did increase with velocity (p<0.05) but F1 and F2 did not (p>0.05). **CONCLUSION:** F1 was observed less than 30% of the ES trials for two subjects. Nevertheless, as a group, there were no differences in GRF parameters analyzed between shoe conditions.

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The Effect Of Speed, Incline, And Distance On Impacts During A Marathon Road Race

Steve T. Jamison¹, Matthew C. Ruder¹, Adam S. Tenforde¹, Marian T. Hannan², Irene S. Davis, FACSM¹. ¹Spaulding National Running Center, Cambridge, MA. ²Harvard University, Cambridge, MA. (Sponsor: Irene Davis, PhD, PT, FACSM, FACSM)
 (No relationships reported)

The majority of running studies are conducted in controlled laboratory settings. The advent of mobile technology has allowed the study of running impacts outside in a more natural environment enhancing the ecologic validity of these investigations. A marathon provides an excellent opportunity to examine the effect of a variety of naturally occurring, race-related factors on running impacts which have been related to injury.

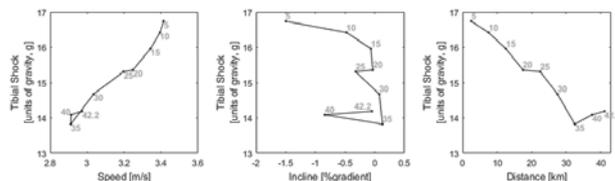
PURPOSE: To determine the association between course incline, speed, and race progression (an indication of fatigue) on running impacts (tibial shock) during a marathon.

METHODS: 226 individuals (118 males, 108 females; 44.3±11.1 yrs) running the same marathon (42.2km) were included. They each wore a triaxial accelerometer, recording at 1,000Hz, secured on their distal, medial tibia throughout the race. Peak resultant acceleration, tibial shock (TS), for each step was determined. Run times for each 5km, and the last 2.2 km, were provided by the race organizers. TS and course incline were averaged over matching race intervals. A linear mixed effects model was used to determine the relationship between tibial shock and the independent variables of course incline, speed, and race progression.

RESULTS: Mean resultant tibial shock was 15.2±1.1g. Course incline, speed, and distance were significantly related to TS (p<0.05). TS association between course incline was negative, while speed and distance were both positive.

CONCLUSIONS: Our results suggest that higher resultant tibial shock is associated with decreases in incline, increases in speed, and race progression (increased fatigue). Supported by Vibram USA.

Figure Caption: Population average resultant tibial shock [in units of gravity, g] relative to each independent variable (speed, incline, and distance). Grey numbers represent the total distance traveled after each race interval used [in km].



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The Influence of Footwear on Running Mechanics, Impact, and Plantar Loading in Habitual Rearfoot Strikers

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 (No relationships reported)

Running overuse injuries are related to the magnitude of impact forces and shocks, loading rates, and the distribution of forces underfoot. Minimalist shoes and barefoot running might reduce or eliminate running impacts by encouraging softer landings. However, reduced cushioning could increase plantar loading and some runners may not alter their habitual running mechanics to account for less cushioning.

PURPOSE: To examine the acute effects of a cushioned neutral shoe (CN), minimal shoes (MN), and neoprene socks (BF) on running mechanics, impact, and plantar pressure.

METHODS Forty habitual rearfoot strikers ran on an instrumented treadmill while 3D kinematics, ground reactions forces (GRF), tibial accelerations (TA), and plantar pressure were recorded. Variables examined included: foot and knee angle at contact, vertical GRF loading rate (VLR), the isolated impact component of vertical GRF (IP), and the magnitude of peak positive to negative TA. Peak plantar pressure was compared for the forefoot (FFP), midfoot (MFP), and rearfoot (RFP). Differences were compared with a RMANOVA and post hoc t-tests ($\alpha=0.05$).

RESULTS With less cushioning the foot was less dorsiflexed at contact BF $8.6\pm 5.3^\circ < MN 11.30\pm 5.0^\circ < CN 16.0\pm 4.4^\circ$ ($p<0.01$). The knee was more extended at contact in CN $13.3\pm 6.6^\circ$ than MN $14.8\pm 5.9^\circ$ and BF $15.2\pm 5.8^\circ$ ($p<0.001$). VLR was less in CN 670 ± 212 N/kg/s compared to MN 980 ± 268 N/kg/s and BF 975 ± 371 N/kg/s ($p<0.001$) as was IP 4.1 ± 16 N/kg vs 6.8 ± 2.6 N/kg & 6.7 ± 3.2 N/kg ($p<0.001$). TA was lower in CN 9.4 ± 4.2 g than BF 12.6 ± 6.7 g and MN 11.4 ± 5.5 g ($p<0.01$). FFP increased with less cushioning: CN 330 ± 70 kPa $< MN 430\pm 87$ kPa $< BF 561\pm 76$ kPa ($p<0.001$). MFP was less in CN 144 ± 35 kPa compared to MN 212 ± 58 kPa and BF 224 ± 108 kPa ($p<0.05$). RFP was lower in CN 253 ± 52 kPa vs MN 272 ± 81 kPa and BF 396 ± 170 kPa ($p<0.001$).

CONCLUSION Less cushioning resulted in a more compliant configuration of the limb at ground contact, which agrees with previous research. However, the CN shoe reduced VLR, IP, and TA compared to MN and BF despite a more extended knee and dorsiflexed foot. Lower peak plantar pressures in CN suggest that cushioning better distributes plantar forces of a less compliant limb particularly in the rearfoot. These results highlight the importance of both cushioning and mechanics on injury related variables.

494 Board #315 May 31 9:30 AM - 11:00 AM
Six Week MFS Drill Training with Proprioceptive Resistance Device Influences Conversion of RFS to MFS

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Recent literature suggests a transition from rear-foot striking (RFS) to mid-foot striking (MFS) may lower injury potential; but transition is difficult. Using a resistive proprioceptive device may facilitate the change. No study has quantified the impact of such a device on foot-strike conversion. **PURPOSE:** To examine the effectiveness of a 6-week MFS drill training program in converting recreational RFS to MFS with and without the use of a proprioceptive resistive device (EZ Run Belt) using changes in cardiovascular, biomechanical, and neuromuscular assessments. **METHODS:** 19 FFS runners were randomly assigned to control (C: M4, F1), drills only (DO: M3, F4), or drills plus belt (DB: M6, F1) groups. Both DO and DB received drill sessions using MFS training over 6 weeks with DB using a resistive belt (EZRB) during training runs. Physiological (VO₂max, anaerobic threshold, heart rate, running economy, timed performance), biomechanical (knee flexion and dorsiflexion angles at initial contact (KFA, DFA), cadence (CAD), stride length) and electromyographic (EMG) measures of 5 right-leg muscles (rectus femoris (RF), vastus lateralis, biceps femoris (BF), semitendinosus (ST), and lateral gastrocnemius (LG), were recorded as subjects ran under 3 conditions: submaximal (85% lactate threshold heart rate) on a treadmill (TM85) and overground for 400m (OUT85), maximal overground (OUTMAX), before and after training. **RESULTS:** In all 3 conditions, outcomes reflected significant within-group increases for DO and DB in CAD and EMG and decreases in KFA, DFA consistent with an RFS to MFS conversion, but no significance was detected between DO and DB, except for the RF EMG during TM85 increasing for DO and decreasing for DB (-0.014 ± 0.005 μ V, $p<0.05$). Greatest changes in DO were observed at OUT85: RF (+66%, $p=0.045$), BF (+70%, $p=0.008$), LG (+49.6%, $p=0.05$), KFA (-3.9%, $p=0.001$) and DFA (-34.3%, $p<0.001$). Greatest changes in DB were observed at OUTMAX: BF (+84.4%, $p=0.003$), ST (+85.5%, $p=0.015$), CAD (+5.3%, $p<0.001$), KFA (-4.9%, $p<0.001$). **CONCLUSIONS:** Changes in biomechanics and muscle activation observed in DO and DB indicate a significant shift from RFS to MFS after 6 weeks of MFS drill instruction, unique effectiveness of the proprioceptive device could not be established, but differences warrant further investigation.

495 Board #316 May 31 9:30 AM - 11:00 AM
A Comparison Of The Effects Of Forefoot Striking And Cadence On Vertical Load Rates

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High vertical load rates have been linked to common running injuries. Interventions to reduce load rates have developed to reduce impact related injuries. Two popular approaches are increasing cadence (CAD) and using a forefoot strike (FFS) pattern. However, the effects of these interventions have not been compared in the same study. **Purpose:** To compare the effects of increasing CAD and transitioning to a FFS pattern to reduce impact loading in healthy recreational runners.

Methods: 35 habitual rearfoot strike runners, ages 19-42 yrs, running 5-15 mi/wk, with a CAD of < 170 steps/min were randomized to a FFS group ($n=16$, 5M) or increased CAD group ($n=19$, 5M). All subjects performed 4 wks of strengthening exercises. This was followed by 8 sessions of gait retraining (GR) over 3 wks using auditory feedback specific to each group. Run time was increased from 10-30 min over the 8 sessions, and feedback time was faded over the last 4 sessions. An instrumented treadmill assessment was done at baseline, at 1wk post GR, and at 1 mo follow-up. Variables of interest were vertical average and instantaneous load rates (VALR, VILR) measured in bodyweights (BW)/s.

Results: Groups were similar in all variables at baseline (Figure 1). FFS group reduced VALR by 58% and VILR by 44%. CAD group reduced VALR by 26% and VILR by 24%. At 1 mo, load rates for both groups were significantly lower than baseline, but FFS maintained reductions to a greater extent. A 5.6% increase in cadence occurred in both groups following GR. At 1 mo follow-up cadence remained higher in both groups, but to a greater extent in FFS group.

Conclusion: These data suggest that transitioning to a FFS results in greater reduction of vertical load rates and greater persistence of these changes over time.

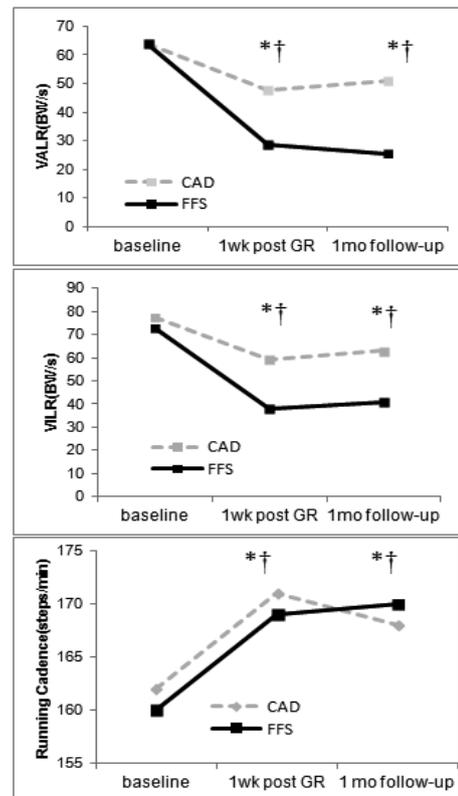


Fig 1. Comparison of results between groups across time from baseline. * significant difference for CAD group; † significant difference for FFS group

496 Board #317 May 31 9:30 AM - 11:00 AM
Perturbing Stride Frequency Has No Effect On Average Muscle Activity

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(No relationships reported)

Running is a popular and widely used mode of exercise in the world today. Preferred stride frequency (PSF) is the stride frequency (SF) a runner selects for a given speed. Changes in SF may influence metabolic costs while running (Meardon & Derrick, 2009, MSSE, 41, 512-513), but it is not clear if muscle activity is minimized at PSF compared to running with other SFs. **PURPOSE:** To determine if muscle activity is minimized while running at PSF. **METHODS:** 10 healthy participants (24.7±3.8 years; M=7, F=3) ran on a treadmill at PSF-15%, PSF-10%, PSF-5%, PSF, PSF+5%, PSF+10%, PSF+15%. Conditions were randomized for each subject to account for task adaptation. Treadmill running speed was determined initially by each participant instructing the tester to increase or decrease the speed until felt like a speed representative of a 30-minute run. During preferred running condition, PSF was calculated by visually identifying the time to complete 20 strides. Target SFs were then calculated for all other conditions. Participants ran for 5-minutes at each condition with 1-minute rest between conditions. SF was controlled by having the participants match foot strikes to the beat of a metronome set to each desired SF for 15 sec of every minute. Data were collected 4 times throughout each trial for 30s every minute of the condition. The first collection was used for this analysis. EMG sample rate was 2000Hz from the Rectus Femoris (RF), Biceps Femoris (BF), Tibialis Anterior (TA), and Gastrocnemius (GA). Average and root mean squared (RMS) EMG data were analyzed via repeated-measures ANOVA ($\alpha=0.05$). Data were normalized to %PSF to assess minimization. **RESULTS:** PSF RMS EMG were not minimized in any muscle across all SF conditions. Average EMG for BF ($F(1.24, 11.19) = 7.32, p>0.05, \eta_p^2 = 0.45$) and GA ($F(1.49, 1.71) = 21.38, p>0.05, \eta_p^2 = 0.70$) were both influenced by SF, but PSF EMG were not minimized for either of those muscles. Normalized EMG for BF were 103.90±27.02%, 90.83±26.02%, 98.37±16.19%, 104.20±29.61%, 103.42±42.59%, 109.48±48.37% and for GA were 112.73±25.02%, 90.77±24.90%, 95.33±27.33%, 108.35±36.24%, 90.89±19.40%, 106.68±20.33% for PSF -15%, -10%, -5%, +5%, +10%, +15% respectively. **CONCLUSION:** Muscle activity was not minimized while running at PSF compared across all conditions.
 Supported by NIH INBRE P20 GM103440 Grant

497 Board #318 May 31 9:30 AM - 11:00 AM
Does Preferred Running Velocity Vary with Variations in Running Condition?

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Running form is often studied within the laboratory. During these studies, researchers must make the difficult decision to capture runners at a set velocity, which allows for straight forward comparisons between participants, or at their preferred velocity (PRV). Although theoretically we are capturing natural movement when we ask runners to move at a PRV, it is unknown how a laboratory PRV over-ground or on a treadmill may differ from each other or from running on a longer course outdoors. **PURPOSE:** The purpose of this study was to determine a PRV for two groups of runners (recreational and competitive) over-ground in the laboratory, on a laboratory treadmill, and outside on a track. **METHODS:** Healthy competitive (n=10) and recreational (n=9) runners completed running trials in each of three conditions: (1) over-ground, where PRV was determined as the average of five trials; (2) on the treadmill, where PRV was determined over five trials where participants were blinded to the velocity but asked to alter the velocity until they were comfortable; and (3) around a track where the split times of two laps were taken as two separate trials. **RESULTS:** There was not a significant interaction between group and condition ($p=0.468$) but there were significant main effects for both group ($p<0.001$) and condition ($p<0.001$). The competitive runners had a faster PRV (3.1 m/s) than recreational runners (2.7 m/s). Treadmill PRV was significantly slower (2.5 m/s) than over-ground PRV (3.1 m/s; $p<0.001$) and track PRV (3.1 m/s; $p<0.001$), which were similar to each other ($p=0.618$). **CONCLUSIONS:** Environment can change a runner's perception of preferred velocity, which was demonstrated in this study with a significantly slower preferred velocity while running on a treadmill. Therefore, one should take caution when interpreting or collecting running data that utilizes a preferred running velocity, and the environment in which the data were collected should be considered.

498 Board #319 May 31 9:30 AM - 11:00 AM
Decreased Metabolic Running Efficiency After One Week Of Practicing Improved Running Mechanics

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(No relationships reported)

PURPOSE: A more efficient runner is a more comfortable, prolific, and competitive runner. At the same work rate, more efficient running technique should lead to decreased respiratory exchange ratio (RER), oxygen consumption (VO₂), exercise intensity (MET), and rating of perceived exertion (RPE). Such physiological changes should lead to performance improvements such as delayed onset of fatigue and decreased recovery time. We analyzed how improving arm movement and cadence could increase running efficiency. **METHODS:** Seven novice runners, aged 18-50, participated in the study (5 males, 2 females). Thirty-nine 3D-reflective motion sensors were placed on the upper body of each subject. Movement was analyzed by Coaches Eye. Trial 1 consisted of an uncoached 5-minute running bout at a pre-determined heart rate (calculated using the Karvonen formula) that corresponded to 50% of VO₂max. Exercise intensity, VO₂, RER, and HR were measured. After the first trial, subjects were coached on proper running mechanics and were encouraged to practice employing their enhanced technique for one week. Trial 2 was similar to trial 1 except that participants ran with proper mechanics. Paired t-tests were performed for each set of values to compare trial 1 with trial 2. **RESULTS:** Exercise intensity, VO₂, RER, and HR were all significantly greater in trial 2 than trial 1. Shoulder movement decreased in all axes. **CONCLUSIONS:** While subjects reduced their upper body movement and reported working less intensely to run at the same rate with improved mechanics, greater VO₂, RER, HR, and MET indicated that, after only one week of familiarization with new mechanics, they were actually running less efficiently. This could be the case because runners didn't practice the new mechanics sufficiently, or because with any change in running technique, even improvements, temporary lack of coordination due to under-developed neural and muscular control, leads to temporarily-decreased running efficiency. Further research with longer study duration would likely show that increased cadence and decreased upper-body movement result in more efficient running.

499 Board #320 May 31 9:30 AM - 11:00 AM
Abstract Withdrawn

500 Board #321 May 31 9:30 AM - 11:00 AM
Effect of Running Speed on Achilles Tendon Injury Potential: Use of a Weighted Impulse Measure

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ABSTRACT
 Previous literature has suggested that increasing running speed is associated with a reduction in cumulative load per distance traveled and thereby a decrease in injury risk. However, the tissue damage incurred by a bout of loading is a function of its stress-life (S-N) behavior which describes the exponential relationship between loading magnitude and cycles to failure. Current cumulative loading measures do not consider the S-N relationship which may in fact lead to erroneous conclusions about tissue damage and injury risk. **PURPOSE:** The purpose of this study was to examine the influence of running speed on an S-N weighted impulse measure at the Achilles tendon. **METHODS:** Ten participants ran overground at 2.5, 3.5, and 4.5 m/s while force and motion capture data were recorded. An inverse dynamics analysis was used to calculate joint moments and AT force was calculated from the ankle joint moment and the AT moment arm which was a function of ankle joint angle. AT impulse per step was calculated as the time integral of the AT force curve. A weighted impulse measure was quantified where AT force was raised to the power of 9. This value was derived from *in vitro* tendon testing and describes the slope of the S-N tendon curve. Impulse and weighted impulse per km were calculated as the respective impulse per step measures multiplied by the number of steps necessary to run 1km. A Friedman test examined the main effect of speed followed by Bonferroni adjusted pair-wise comparisons. **RESULTS:** A significant main effect of speed was observed for impulse per step ($p=0.003$), impulse per km ($p<0.001$) and weighted impulse per km ($p<0.001$). In general, the impulse per step and impulse per km decreased with running speed ($p\leq 0.013$); however, no significant differences were observed between 3.5 and 2.5 m/s ($p\geq 0.047$). On the other hand, the weighted impulse per km increased with running speed ($p=0.005$). **CONCLUSION:** Using a traditional measure of cumulative impulse suggests that running faster may decrease the risk of Achilles tendon injury. This counterintuitive conclusion is not reached when using a weighted impulse measure that considers the S-N behavior of the tendon.

501 Board #322 May 31 9:30 AM - 11:00 AM
Risk Factors Associated With Foot Pain In Runners
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Purpose: Repetitive stresses of running can contribute to the onset of musculoskeletal pains, such as those in the foot. The presence of foot pain in one site along the kinematic chain may alter running motion and cause pain to develop in other areas but this is not well-studied. The purpose of this study was to determine the differences in key running motion parameters in runners with and without foot pain, and identify significant contributors to the onset of foot pain.

Methods: This was a cross-sectional study of runners with foot pain (n=24) and age-sex matched runners without foot pain (n=20). Runner characteristics were: 173cm±9 cm; 70kg±14.5 kg; 77.3% long-distance trained. Running experience, history of joint pain and recent changes in training and shoe wear were collected. Foot pain was reported as presence of pain of any severity. A 12 optical camera 3-dimensional motion capture system with a force-plated treadmill were used to collect running motions and forces. Key variables included cadence, stride length, stance time and ground reaction force, rate of development of impact forces.

Results: Foot pain was classified as 33% plantar fasciitis, 8% metatarsal stress fracture, 17% other and 42% had undiagnosed foot pain. In runners with foot pain, 62.5% started running in a new shoe type within the past 6 months (p<0.001). Compared to runners without foot pain, those with pain reported additional musculoskeletal pain at sites along the kinematic chain in the knee, hip, low back and shoulder pain (62.5% versus 15%; p<0.001). 46% of runners with reported foot pain attempted to run with a new foot strike, compared to 25% of runners without pain (p= 0.10). Logistic regression revealed that the strongest contributor to onset of foot pain was the use of a new running shoe type within the previous six months (β coefficient=-2.265; p=0.003) Temporal spatial measures were not different in runners with without foot pain.

Conclusion: For injury prevention, proper adaptation to new shoes should be a priority. Running with a chronic foot pain can ultimately become a more systemic problem with the onset of other musculoskeletal pains. If a runner wishes to change shoe type, a slow proper introduction and progression of these changes over a period of time is recommended.

502 Board #323 May 31 9:30 AM - 11:00 AM
Preliminary Analysis: Variability Between Healthy and Injured Individuals during Running
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Reduced motor variability has been associated with increased risk of lower extremity running-related injuries, such as patellofemoral pain syndrome. Further investigation of lower extremity variability in populations with current lower extremity injury (LEI) is needed to determine the relationship between variability and running-related injuries.

PURPOSE: To compare lower extremity kinematic variability between healthy individuals (HE) and individuals currently experiencing LEI (knee, hip, pelvis, and thigh) during a running task.

METHODS: Thirty-four individuals (17 HE, 17 LEI) volunteered for this study. 3D kinematic data during running was captured at 200Hz using reflective markers placed on lower body. A single 25-second trial was collected. Variables of interest included knee flexion/extension angle, knee abduction/adduction angle, hip flexion/extension angle, and hip abduction/adduction angle; all were measured in degrees. Linear measures of variability including standard deviation (SD) and coefficient of variation (CV) were calculated for each dependent variable during the stance phase. A multivariate analysis of variance (MANOVA) was used to assess differences in SD and CV between the healthy and LEI groups.

RESULTS: The average running speed was 2.52±.24 m/s. There were no statistically significant differences between groups (injured and non-injured) when assessing linear measures of variability (F_{1,32}=.624, p>.05). Means and SD for each DV are as follows: knee FLEX SD (HE=6.48±13.07, LEI=1.83±.67), knee FLEX CV (HE=23.33±46.48, LEI=6.97±3.42), knee ABD SD (HE=1.06±1.52, LEI=.53±.18), knee ABD CV (HE=25.81±36.74, LEI=12.08±5.80), hip FLEX SD (HE=6.01±13.08, LEI= 1.39±.45), hip FLEX CV (HE=46.67±96.56, LEI=7.88±3.32), hip ABD SD (HE=1.37±1.60, LEI=.91±.34), hip ABD CV (HE=69.23±61.53, LEI=205.46±454.20)

CONCLUSIONS: Overall, no differences in lower extremity kinematic variability were found between groups. It is plausible that LEI is not manifested by significant changes in the amplitude of lower extremity kinematic variability demonstrated in the sagittal and frontal planes. Future studies should incorporate measures that capture the time-dependent nature in movement variability, rather than restrict analysis to simply assessing magnitude changes.

503 Board #324 May 31 9:30 AM - 11:00 AM
Is There a Predictable Value of the Drop Vertical Jump Test for Running Gait Injury Risk?
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Purpose: A three-dimensional (3D) motion analysis of running gait is often used to identify modifiable lower extremity biomechanical risk factors, but can be time consuming and costly. The Drop Vertical Jump (DVJ) test when combined with the Landing Error Scoring System (LESS) can easily be done in the field to assess lower extremity coordination and injury risk. The purpose of this study was to determine if correlations existed between biomechanical variables of the DVJ and a 3D gait analysis. Positive findings would indicate that the DVJ may serve as a simple surrogate for the running analysis to quickly screen for lower extremity injury risk.

Methods: 24 runners (26.1 ± 8.6 yrs; 27.7 ± 11.3 miles/wk; 16 Male, 8 Female) participated. During one testing session, a 3D motion analysis and an instrumented treadmill were used to capture and determine lower extremity kinematics, ground reaction forces (GRF) and knee moments during the gait cycle. Subjects completed five DVJs and a gait analysis at a self-selected running speed (6.7 ± 0.9 mph). Data were gathered on the dominant leg for both the DVJ and the gait analysis (1 left dominant). LESS scores were calculated through frontal and sagittal plane views of the DVJ using a score from 22 items. Individual LESS items were selected based on similar measures that could be captured in the 3D gait analysis: asymmetric motion of feet and knees in the sagittal and frontal planes, foot contact patterns and overall impression.

Results: Significant associations existed between maximal knee flexion angle (sagittal plane 3D running) and overall LESS score (r=-.791; p<0001). There were no other significant associations between lower extremity kinematics, GRFs and knee moments and LESS items and overall score. There were also no significant associations between DVJ biomechanical variables and the 3D gait measures.

Conclusion: Contrary to our expectation, associations between 3D gait, DVJ and LESS were minimal. A possible explanation could be that the dual-leg DVJ test may not be able to account for factors of balance and stability that are critical for the single-leg nature of running. A single-leg DVJ may be a more accurate field test when predicting running-related injuries.

504 Board #325 May 31 9:30 AM - 11:00 AM
Trunk Kinematics Displayed During Running By Individuals with Adolescent Idiopathic Scoliosis: A Pilot Study
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Decreased spinal motions in walking have been reported for Adolescent idiopathic scoliosis (AIS) individuals but how AIS produce the spinal rotations needed during high-effort running and thus compensate for the loss of spinal flexibility is not known.

PURPOSE: To compare trunk kinematics displayed by AIS and matched controls (CON) during a perceived maximal effort treadmill running.

METHODS: Five skeletally mature AIS individuals (thoracolumbar structural curve with neutral pelvis; primary Cobb angle = 35.3°±13.6°) and 5 CON (respectively: age: 21.3±1.3 yrs, 20.6±1.1 yrs; height 1.7±0.1m, 1.59±0.1m; mass 52.7±9.4 kg, 57.0±10.8 kg; level of physical activity (IPAQ SF): 7.3±2.6 hrs/wk, 6.67±3.06 hrs/wk) were recruited. Spatial locations of the 24 reflective markers on the trunk and pelvis were captured (Vicon®, 120 Hz) during self-selected maximal running speed for 15 sec on treadmill (BORG RPE > 13). Angular displacements (AngDisp) of the 3 trunk segments (upper trunk [UT: C7-T8], middle trunk [MT: T9-T12] and lower trunk [LT: L1-L5]) for each rotation plane were compared between the groups via Analysis of covariance (running speed = covariate, p<.05).

RESULTS: Running speeds were not different between the 2 groups (p=0.63). LT lateral flexion AngDisp relative to pelvis was significantly lower (p=.049) for AIS (7.7°±2.7°) compared to CON (14.0°±3.4°). AIS group (14.7°±5.0°) showed a tendency for clinical significance (p=.065) for greater sagittal plane AngDisp compared to CON (8.9°±2.8°) but no other significant differences were observed (p= .194-.814).

CONCLUSION: Minimal differences were observed between the groups contrary to those reported in literature for walking. One clinical explanation could be the presence of compensatory secondary spinal curve leading to a neutral pelvis. Magnitudes of the group differences observed were very low, and thus may not be clinically relevant when compared to the total available trunk ranges of motion. These could be a result of high inter-participant variability in running technique and low statistical power, and

not necessarily as an effect of scoliotic spine. Physically active AIS individuals have the potential to demonstrate typical trunk mechanics to achieve performance goals of high intensity physical activities like running.

505 Board #326 May 31 9:30 AM - 11:00 AM
A Prospective Study on Medial Tibial Stress Syndrome in Runners

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(No relationships reported)

Medial tibial stress syndrome (MTSS) is one of the most common overuse injuries in runners. Previous studies have indicated hip muscle strength, passive range of motion (ROM), and running kinematics as possible contributing factors. However, to date, no studies have combined measurements of all these areas into a single prospective study. **PURPOSE:** To prospectively examine differences in muscle strength, ROM, and kinematics between runners who do and do not develop MTSS. **METHODS:** 24 runners (sex: 13 male, 11 female; age: 20.1 ± 1.2 years; weekly mileage: 53.2 ± 20.8 miles) participated in this study. Participants underwent a clinical exam documenting lower limb alignment and ROM; were evaluated for hip abductor, external and internal rotator, and extensor strength using a hand held dynamometer; and completed a 3D running gait analysis during which a 12-camera motion capture system was used to record kinematics while they ran on a treadmill. Participants were followed for two years during which time any injuries were diagnosed and recorded by the teams' athletic trainer. Independent *t*-tests were used to compare differences between runners who did (INJ) and did not (CON) develop MTSS. Logistic regression was used to evaluate which variables were best predictors of group membership. **RESULTS:** After two seasons 8 of the 24 athletes developed MTSS. There were no differences in ROM measures between INJ and CON groups, however, the INJ group demonstrated weaker hip abductors than the CON group (16.0 ± 3.6 vs 21.9 ± 6.0 % body weight, *p* = 0.01, ES = 1.4). Compared to the CON group, the INJ group had higher contralateral pelvic drop (6.4 ± 1.4 vs. 4.5 ± 2.0°, *p* = .02, ES = 1.1), higher peak rearfoot eversion (8.2 ± 4.3 vs. 4.6 ± 1.9°, *p* = .02, ES = 1.1), and longer durations of rearfoot eversion (79.4 ± 8.5 vs. 55.5 ± 10.3 % stance, *p* < .001, ES = 2.5) during stance phase. The logistic regression ($\chi^2 = 18.1$, *p* < .001) revealed every 1% stance increase in duration of rearfoot eversion increased odds of being in the INJ group by 1.26 (*p* = .015, 95% CI 1.04 - 1.54). **CONCLUSION:** Both proximal and distal biomechanics appear to contribute to MTSS development. Thus, screening for individuals at risk of developing this common overuse injury should include evaluation of both regions, with particular attention to the duration of rearfoot eversion.

506 Board #327 May 31 9:30 AM - 11:00 AM
Do Female Runners with Large Peak Hip Adduction Angles Lack Hip Strength and Control?

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Large peak hip adduction angles in women are prospectively linked to patellofemoral pain and iliotibial band syndromes. Deficits in hip abductor eccentric strength and lower extremity neuromuscular control (NMC) may contribute to the large peak hip adduction angles in female runners. **PURPOSE:** To compare hip abductor eccentric strength and NMC between female runners with large and small peak hip adduction angles. **METHODS:** We recruited 11 female runners for this study (26 ± 4 years; 1.65 ± 0.06 m; 58.9 ± 4.0 kg; 19 ± 9 miles per week). Three-dimensional position data were collected during running. Hip abductor eccentric strength was measured using a hand held dynamometer during a break test. NMC was measured using the hip control test, based on Fitts law. A higher score on the hip control test indicated better NMC. Runners were separated into "large" and "small hip adduction" groups based on their peak hip adduction angle. Hip abductor eccentric strength and NMC were compared between groups and interpreted according to minimal detectable differences (MDD). Effect sizes (ES) were used to interpret the magnitude of differences. **RESULTS:** The large and small hip adduction groups were separated by more than the MDD in peak hip adduction angle (MDD = 2.7°), indicating a true difference (17.0° ± 0.9° and 12.6° ± 1.5°; ES = 3.7). The large hip adduction group had slightly less hip abductor eccentric strength (11.9 ± 1.7 (Nm/Bw*ht)*100⁻¹) than the small hip adduction group (12.4 ± 2.6(Nm/Bw*ht)*100⁻¹; ES = 0.2). Similarly, the large hip adduction group had less NMC (21 ± 2 taps) than the small hip adduction group (22 ± 4 taps; ES = 0.3). However, group differences did not exceed MDD for hip abductor eccentric strength (MDD = 2.5(Nm/Bw*ht)*100⁻¹) and NMC tests (MDD = 5 taps). **CONCLUSION:** Our findings suggest that female runners with large and small peak hip adduction angles have similar hip abductor eccentric strength and NMC. Thus, differences in peak hip adduction angle in female runners are not due to underlying hip abductor eccentric strength or NMC deficits.

Study funded by the American Society of Biomechanics Graduate Student Grant-In-Aid

A-57 Free Communication/Poster - Running and Swimming

Wednesday, May 31, 2017, 7:30 AM - 12:30 PM
Room: Hall F

507 Board #328 May 31 11:00 AM - 12:30 PM
Association of Body Composition with the Performance Level and Running Mileage among Long Distance Runners

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PURPOSE: To assess the association between leanness and running performance and training volume among highly trained Japanese long distance runners. **METHODS:** Body composition was measured by dual energy X-ray absorptiometry in 54 Japanese male long distance runners who belonged to a university track and field team (19.8 ± 1.3 yrs). The training volume was assessed by the average running mileage (km/month) during 5 months prior to the measurement. The runners were routinely divided into 4 categories by the coach of the team according to their performance level and the category of the period was used as the performance level of the runners; team A (n=15), B (n=17), C (n=11), and D (n=11) in the order of the level. Team D included runners who had injuries and restricted their training. Questionnaire survey was performed regarding weight control practices and complaints of fatigue. Written informed consent was obtained from each runner. **RESULTS:** The mean running mileage of the 54 runners was 606 km/month. Height, body mass, BMI, percent body fat, bone mineral density (BMD), z-score of BMD, and lean soft tissue mass were 172.0 ± 5.2 cm, 57.3 ± 4.4 kg, 19.4 ± 1.0 kg/m², 6.1 ± 1.3%, 1.175 ± 0.057 g/cm², -0.524 ± 0.677, and 51.1 ± 4.0 kg, respectively. The mean running mileage was not significantly correlated with any of those variables (*p* > 0.05). The mean running mileage of each category (A, B, C, & D) were 709, 600, 606, and 475 km/month, respectively (*p* < 0.01). Percent body fat were lowest in A (5.7%) and highest in D (6.4%) whereas z-score of BMD were -0.447 and -0.664, respectively. However, ANOVA showed no significant differences in those variables among the categories. Fisher's exact tests of questionnaire survey revealed significant between-categories differences in percentages of runners attempting weight reduction practices (8.3, 13.3, 53.8, and 38.5%, respectively, *p* < 0.05) and those complained of frequent fatigue (25.0, 53.3, 53.8, and 69.2%, respectively, *p* < 0.05). **CONCLUSIONS:** The runners had exclusively lean bodies regardless of their performance level and running mileage. The runners with the lowest performance level and the least training volume likely attempted weight reduction practice and complained of fatigue. It was concerned that they might pursue the lower level of percent body fat by restricting energy intake.

508 Board #329 May 31 11:00 AM - 12:30 PM
Ischemic Preconditioning Improves Marathon Trail Running Performance in Endurance-Trained Men

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PURPOSE: Muscle ischemia and reperfusion induced by ischemic preconditioning (IPC) has recently been demonstrated to improve performance across various physical activities; however, its effectiveness in real-world athletic settings is less understood. Therefore, the purpose of this study was to examine the effects of IPC on lactate and overall time during the Moab Trail Marathon. **METHODS:** Six (all men) well-trained and experienced trail runners (age = 22.4 ± 6.3 yr, ht = 173.4 ± 8.4 cm, body mass = 64.2 ± 7.4 kg, VO₂max = 56.5 ± 7.1 mL·kg⁻¹·min⁻¹) participated in this study. Participants were matched based on VO₂max and in randomized, single-blind fashion received either an IPC or sham treatment protocol 48 hours prior to a 26.2 mile trail marathon race in Moab, UT. Experimental procedures were performed bilaterally on the lower limbs with a treatment protocol of 4×5-min compression/5-min reperfusion cycles at 220 mmHg for IPC or the same procedure at 20 mmHg for the sham protocol. Blood lactate measurements were obtained at mile 9.7 and at the marathon finish. Probabilistic magnitude-based inferences were determined to assess the likelihood that the true value of the effect represents substantial change. **RESULTS:** Relative to the sham treatment, IPC produced likely beneficial effects for marathon run time (mean ± 90% confidence limits (CL): 1.7 ± 1.5%). Mean marathon times for IPC and sham treatment groups were 3hr 57min 34sec and 4hr 37min 7sec, respectively. Blood lactate values were significantly lower (*p* < 0.05) in the IPC vs. sham group at 9.7 miles (2.4 ± 1.7 vs. 3.3 ± 1.3 mmol·L⁻¹) and finish (2.2 ± 0.6 vs. 3.8 ± 1.6 mmol·L⁻¹).

CONCLUSION: IPC treatment elicited improvements in marathon trail running performance in experienced men trail runners. Moreover, we found that IPC was associated with an attenuated rise in blood lactate concentration. Therefore, utilizing IPC may allow for higher work rates and improved performance in trail marathon running.

509 Board #330 May 31 11:00 AM - 12:30 PM
Performance and Energy Balance during a 439 Mile Endurance Run

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Running for extreme distances or time has become increasingly popular, however, energy balance and its effect on performance is of great concern. **PURPOSE:** This case study examined the physical performance and energy balance in a 51 year old firefighter completing an 11-day, 439 mile solo run across Texas. **METHODS:** All food and drink consumed during the 11 day run were recorded to assess energy intake during the run. Energy expenditure and exercise data were recorded via a heart rate/GPS monitor during each run. Nude body weight was recorded each morning. **RESULTS:** Daily, the subject completed 39.98±2.61 miles (range 33.26-42.98 mi) in 11.2±1.2 hrs (range 9.74-12.97 hrs) at a 16.8±1.3 min/mi pace (range 15.17-18.45 min/mi). Subject consumed 4398±811 kcals per day (range 3280-5617 kcals/day) and expended 3804±271 kcals per run (range 3280-5617 kcals/run). Over the 11 days, the subject lost 2.6 kg of body weight. Total energy expenditure (5397 ± 271 kcal) was greater than energy intake (4398 ± 812 kcal; p=0.005). Over the 11 days, there was a trend towards a slower mile pace (r=0.832, p=0.001). Heart rate was also lower across the 11 days (range: 95 - 137 bpm; p=0.045). There was no change in core body temperature throughout each run (p=0.125 Time x Day interaction) or across the 11 days (p=0.078). On average, capillary lactate levels increased from 2.3 ± 1.3 mmol/L to 6.5 ± 2.3 mmol/L pre to post run (p=0.005). **CONCLUSION:** Energy balance is important for sustaining the high training and performance levels required for ultra-endurance events. However, the athlete was not able to consume enough calories to remain in energy balance. Nutritional needs assessments during training and competition should be an integral part of the preparation for participation in an ultra-endurance event. Supported by Valdosta State University Faculty Research Seed Grant

510 Board #331 May 31 11:00 AM - 12:30 PM
Assessment of Oxygen Deficit in Collegiate Runner during Steady State Exercise

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Oxygen deficit (OD) for the same absolute workload intensity decreases with aerobic training through improved aerobic metabolism and likewise increases with detraining. It is unclear if the amount of increase in OD with detraining is the same in middle distance (MD) and long distance (LD) runners and what training related OD changes occur in these groups with subsequent retraining.

PURPOSE: To compare and contrast the changes in OD values of collegiate MD and LD runners which accompany a post-competitive season cessation of training and subsequent endurance retraining. **METHODS:** Fourteen members of the collegiate track team (7 MD and 7 LD) runners completed a steady-state treadmill test (SS) at their gender-specific mean 5k velocity (15.3 kph for females and 18.5 kph for males) at the conclusion of their track season followed by 3 additional SS tests at 2-week intervals. Participants did not train between SS1 and SS2 and performed identical prescribed training programs between SS2 and SS4. VO₂ steady state was identified as the breakpoint of the second phase of the OD curve. OD area under the curve comparisons were made using a 2x4 repeated measures ANOVA. **RESULTS:** MD demonstrated a significant decrease in VO₂ at SS pace over the 6-week study resulting in a reduction in their mean OD (6.4%) versus LD (-0.5%) (P<.01). Mean anaerobic contributions to reach SS were greater in LD than MD (36.9% vs. 32.2%) at the end of 4-weeks of retraining (P<.01). **CONCLUSION:** There are differences in OD patterns that accompany both detraining and endurance retraining in collegiate MD and LD runners. LD runners were more aerobically challenged than MD to maintain SS velocity after detraining and may require a greater volume of anaerobic training than MD runners during the early retraining phase in order to retain a faster training pace.

511 Board #332 May 31 11:00 AM - 12:30 PM
Is There an Oxygen Pulse Threshold During Treadmill Running?

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It has been suggested there are two separate breakpoints in the oxygen pulse (O₂ pulse = VO₂/heart rate) versus workload relationship during incremental cycle ergometry, corresponding to the first and second turn points in the blood lactate response. It is still unclear if these O₂ pulse breakpoints can be detected during treadmill running, and if detected, where these thresholds may be located relative to the gas exchange threshold (GET) and respiratory compensation point (RCP). **PURPOSE:** This study examined the relationship between O₂ pulse and exercise intensity to determine if O₂ pulse thresholds could be detected during treadmill running, and, if detected, to compare these O₂ pulse thresholds to the GET and RCP. **METHODS:** Twelve, moderately trained runners (6 men and 6 women; age = 23 ± 3 years; height = 175 ± 8 cm; weight = 71 ± 12 kg) completed an incremental treadmill test to exhaustion for the measurement of gas exchange, ventilation, and heart rate parameters, as well as the determination of VO₂ peak. The GET and RCP were determined from the breakpoint in the VCO₂ versus VO₂ and V_E versus VCO₂ relationships, respectively. The O₂ pulse was plotted against VO₂ for each subject and the relationship between these two variables was examined using polynomial regression models (linear and quadratic) at an alpha level of p ≤ 0.05. **RESULTS:** The mean (± SD) VO₂ peak was 3.475 ± 0.959 L·min⁻¹ (48.33 ± 7.30 mL·kg⁻¹·min⁻¹). The GET (2.289 ± 0.617 L·min⁻¹) and RCP (3.029 ± 0.867 L·min⁻¹) occurred at 67 ± 5% and 88 ± 4 % of VO₂ peak, respectively. The O₂ pulse versus VO₂ relationship was best explained by a linear fit (r² = 0.976 - 1.000) for 9 and a quadratic fit (R² = 0.985 - 0.996) for 3 of the 12 subjects. Only 1 of the 3 subjects with a quadratic fit for the O₂ pulse versus VO₂ relationship displayed a response consistent with a plateau in the O₂ pulse. **CONCLUSIONS:** The highly linear relationship between O₂ pulse and VO₂ for 75% of the subjects indicated that O₂ pulse thresholds could not be detected during treadmill running using the O₂ pulse versus VO₂ relationship. These findings do not support the use of the O₂ pulse as a non-invasive measure of fatigue thresholds.

512 Board #333 May 31 11:00 AM - 12:30 PM
Pre-season Maximum Oxygen Uptake of Female Division III Cross-Country Runners

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The mean maximum oxygen uptake (VO₂ max) from laboratory testing protocols of elite female long distance runners has been described as 68.4 ml.kg⁻¹.min⁻¹ for 3K to 10K runners (Daniels and Daniels, 1992) and 63.2 ml.kg⁻¹.min⁻¹ for elite female triathletes (Schabert et al, 2000). It is not known how NCAA Division III female cross-country runners compare to these groups.

PURPOSE: To describe the pre-season maximum oxygen uptake of NCAA Division III female cross-country runners
METHODS: Eighteen female cross-country runners were recruited from two NCAA Division III teams. After consenting to participating in the study, the subjects completed a progressive protocol to exhaustion. VO₂ max and respiratory exchange ratio (RER) were measured at peak.
RESULTS: Mean age of subjects was 19.4 years (SD=1.2) and mean VO₂ max was 52.2 ml.kg⁻¹.min⁻¹ (SD=5.9). The VO₂ max range was from 40.3 to 63.5 ml.kg⁻¹.min⁻¹ and the median was 52.4 ml.kg⁻¹.min⁻¹. The interquartile range was 49.6 to 56.8 ml.kg⁻¹.min⁻¹. Mean RER at VO₂ max was 1.08 (SD=0.06) and ranged from 1 to 1.21.
CONCLUSIONS: Mean pre-season VO₂ max of Division III cross-country runners was 23.7% lower than reported mean elite distance runners levels and 17.4% lower than mean elite triathlete levels. This is the first pilot study to describe NCAA Division III female cross-country runners, future studies should also describe ventilatory and anaerobic thresholds for this population.

513 Board #334 May 31 11:00 AM - 12:30 PM
Analysis of Critical Speed Derived from "All-Out" Shuttle and Continuous Running.

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Analysis of critical speed derived from "all-out" shuttle and continuous running
 Luke Krynski, Nicholas A. Jamnick, Mark Kramer, Robert W. Pettitt
Abstract

Time limits associated with short and middle-distance running performances are estimated validity using the critical speed (CS) concept; however, little is known about applications for shuttle running, a feature of team sports. **PURPOSE:** To evaluate the CS of shuttle versus continuous running. **METHODS:** A total of 20 varsity, male soccer players wearing global positioning sensors (GPS) engaged in a shuttle 3-min all-out running test (i.e., 70 m switch-backs) followed shortly by a 90 s continuous all-out running test on a 400 m track. Intermittent CS (CSi) and true CS were calculated using the last 30 s of each test and the running capacity at speeds exceeding CSi (D') was calculated using: (speed of 150 s - CS) * 150 s. **RESULTS:** There was a moderate effect size difference (Cohen $d = 0.72$) between true CS (3.78 ± 0.61) and CSi (3.40 ± 0.46) ($t = 6.44$, $p < 0.01$); however, the two parameters were positively, correlated ($r = 0.92$, $p < 0.01$), where true CS (m/s) could be predicted from $y = (CSi \times 1.24) - 0.43$ (standard error of estimate = 0.25 m/s). Poor correlations were observed between true CS and CSi versus D' (144 ± 46 m) ($r = -0.43$, $p = 0.07$ and $r = -0.32$, $p = 0.18$, respectively). **CONCLUSION:** Shuttle running evokes a consistent, predictable decline in CS. The CSi method likely reflects the same physiological variables mediating true CS, and the D' measure appears as a distinct metric.

514 Board #335 May 31 11:00 AM - 12:30 PM
Longitudinal Study of Changes in 1.5 Mile Run Times of Police Recruits Over 18 Years

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Cardiovascular endurance is an important aspect in the performance of police duties. Departments have a need to assess ability to run as it is important not only for the officer's health but also to protect citizens. **PURPOSE:** To evaluate patterns in cardiovascular fitness of police recruits upon entry into the police academy over 18 years including gender differences. **METHOD:** During the first week of police recruit training in a large southeastern metropolitan area, physical fitness levels were evaluated. This study's variable of interest was: 1.5 mile run. ANOVA, and Bonferroni post hoc procedures were used to evaluate data. **RESULTS:** Initial ANOVA comparisons were significant between years for both males and females ($p \leq 0.001$). The post hoc analysis of males indicated that in the first four years 1990 to 1994, there was a significant decrease in run times (min:sec) from ($12:32 \pm 1:30$ to $11:14 \pm 1:17$, $p < 0.05$). There was an increase in run times from 1994 to 2007, ($11:14 \pm 1:17$ to $12:11 \pm 1:38$, $p \leq 0.001$). As in the males, there was a significant decrease in run times for females from 1990 to 1996, ($15:15 \pm 2:32$ to $12:25 \pm 1:20$, $p \leq 0.01$). **CONCLUSION:** Overall, it appears in this metropolitan police department males are tending to have lower cardiovascular fitness levels as time progresses with little change in females. These recruits may be mirroring the lower cardiovascular fitness levels of the society from which they came.

515 Board #336 May 31 11:00 AM - 12:30 PM
Marathon Training Improves Aerobic Capacity, Running Performance, and Reduces Body Fat in Men and Women

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Introduction: Training for a 42.2-km marathon run consists of high volume aerobic training, which may increase VO_{2MAX} , reduce percent body fat (BF) and body mass (BM), and improve running performance. Previous research has produced mixed results with respect to sex differences in response to training. We hypothesize that in a

relatively large population following the same training program, men and women will see similar improvements in 2-mile time trial (2TT), reduce BF and BM, and increase VO_{2MAX} after completing a 20-week marathon training program, and that changes in all 4 variables will be significantly correlated with each other. **Purpose:** To assess sex differences in response to marathon training and to determine the relationship between changes in running performance, aerobic capacity, and body composition in this population. **Methods:** Students in a marathon training class ($n=147$, 111 females; 21.0 ± 1.7 years) completed the following before and after a 20-week marathon training program: 2-mile time trial (2TT) on an indoor 200-m track, underwater weighing (average of 3+ trials calculated with the Brozecz equation) for percent body fat (BF), and a VO_{2MAX} test using a graduated protocol on a treadmill with a Medgraphics Ultima system. Mixed-design ANOVA was used to assess changes and sex differences. Percent change was calculated for 2TT, BF, VO_{2MAX} , and BM, and Pearson's r was used to assess correlations between the changes. **Results:** Subjects improved in VO_{2MAX} (men: 54.0 ± 7.5 to 56.5 ± 7.0 ml \cdot kg $^{-1}$ \cdot min $^{-1}$; women: 46.8 ± 5.4 to 48.1 ± 5.3 ml \cdot kg $^{-1}$ \cdot min $^{-1}$; $P \leq 0.001$), and 2TT (men: 14.5 ± 1.8 min to 13.1 ± 1.6 min; women: 16.8 ± 1.6 to 15.5 ± 1.4 min; $P \leq 0.001$), reduced BF (men: 15.3 ± 5.2 to $14.3 \pm 5.6\%$; women: 25.0 ± 4.7 to $23.8 \pm 4.7\%$; $P \leq 0.001$), and did not change in BM (men: 75.0 ± 10.4 to 74.5 ± 10.3 kg; women: 63.1 ± 7.7 to 63.3 ± 7.8 kg; $P = 0.378$). No sex-by-time interactions were found for any of the measures. Changes in all measures were significantly correlated with each other (VO_{2MAX} and BF: $r = -0.178$, $P = 0.033$; VO_{2MAX} and 2TT: $r = -0.311$, $P \leq 0.001$; VO_{2MAX} and BM: $r = -0.279$, $P = 0.001$; BF and 2TT: $r = 0.341$, $P \leq 0.001$; BF and BM: $r = 0.419$, $P \leq 0.001$; 2TT and BM: $r = 0.208$, $P = 0.012$). **Conclusion:** In a healthy, young population following the same marathon training program, both men and women improve 2TT and VO_{2MAX} and decrease BF with no change in BM.

516 Board #337 May 31 11:00 AM - 12:30 PM
The Effect Of ACTN3 Genotype On Self-reported One-mile Running Time In Young, Recreationally Active Women

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Alpha-actinins form a crosslink between actin filaments and adjacent sarcomeres, and play a role in signaling and energy metabolism. Alpha-actinin-3, is encoded by the ACTN3 gene and only presents in Type II muscle fibers. Homozygosity for the 577X allele (XX) results in complete deficiency of α -actinin-3 and a compensatory upregulation of α -actinin-2, whereas heterozygosity (RX) and homozygosity for the 577R allele (RR) provide for the production of α -actinin-3. Research has reported a greater proportion of elite female distance runners are homozygous for the 577X allele compared to controls. However, no study to date has examined that apparent relationship in recreational women runners. **PURPOSE:** To examine the effect of ACTN3 genotype on self-reported one-mile running personal records (PR) in young, recreationally active women. **METHODS:** Thirty nine participants, grouped by the presence (RR+RX: $n=27$, age: 21.7 ± 3.8 years, BMI: 22.9 ± 3.3 kg/m 2) or absence (XX: $n=12$, age: 21.2 ± 3.2 years, BMI: 21.5 ± 1.8 kg/m 2) of the 577R allele, reported one-mile running PR. Genotype effects were examined using independent-sample t-tests and magnitude-based inference (MBI). **RESULTS:** A trend ($p=0.065$) toward faster one-mile times was observed in XX genotypes (415.7 ± 78.9 s) when compared to the RR+RX group (480.3 ± 104.8 s). MBI revealed a mechanistically beneficial effect of XX genotype (mean difference; $\pm 90\%$ CI; -65 s, ± 57 s). Similar observations were made among a subset of thirteen faster runners, who reported a one-mile PR of less than seven minutes (RR+RX: $n=7$, age: 21.9 ± 5.0 years, BMI: 20.9 ± 3.4 kg/m 2 ; XX: $n=6$, age: 19.5 ± 0.5 years, BMI: 21.8 ± 1.5 kg/m 2). Though not statistically significant ($p=0.378$), those in the XX group (355.8 ± 46.5 s) reported 5.4% faster times than those in the RR+RX group (376.3 ± 33.6 s). MBI revealed a mechanistically beneficial effect of XX genotype (-20 s; ± 40 s). **CONCLUSION:** These findings suggest a potential benefit of XX genotype on middle-distance endurance performance. This is in agreement with prior investigations that have linked XX genotype to endurance capabilities in elite female athletes.

517 Board #338 May 31 11:00 AM - 12:30 PM
Performance Changes in Consecutive Day Marathon Runners

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Over the last five years, the popularity of marathon running to complete a marathon in each of the 50 states has grown. As such, new businesses have arisen to accommodate completing this faster. There are now multiday marathon series that cover two to seven

states (i.e. seven days, seven marathons, seven different states). There is currently very little in the literature about these types of events and a lack of analyses of the finish times for participants that complete multiple days of marathons. **PURPOSE:** To determine the performance changes across the multiday marathon events.

METHODS: 145 runners completed between one and seven marathons over a seven day period at the 2016 Mainly Marathons New England Series. Data for all finishers were retrieved after the completion of the series from the series website. Descriptive analyses and a comparison of means were performed on participants who completed one marathon (1MAR, n=63) and those that completed all seven marathons (7MAR) covering the seven different days (n=20).

RESULTS: Descriptive statistics, a paired t-test and independent t-test were performed using IBM SPSS version 21 with significance set at p<0.05. There was no significant difference in age between 1MAR and 7MAR (49.3±13.7 vs. 50.9±14.4 yrs, p=0.653). In addition, no statistically significant difference was found between 1MAR and day one of 7MAR finish times (350.4±96.7 vs. 362.1±80.0 min, p=0.625). However, 7MAR ran 11.7 minutes slower on average for day one. Finally, day one versus day 7 finish times for the 7MAR group were significantly different (362.1±80.0 vs. 390.8±60.2 min, p=0.006).

CONCLUSIONS: Even though the day one finish times were close to six hours on average, the toll of seven daily marathons still resulted in a significant decline in performance.

518 Board #339 May 31 11:00 AM - 12:30 PM
A Mile Trail Run Can Predict Performance for a 5K Trail Race

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PURPOSE: A common desire and strategy for many runners is to predict race time off of a shorter time trial. It is unknown whether these strategies apply to trail races. The purpose of this study was to determine if a 1-mile trail run could predict performance on a 5K trail race. It was hypothesized that a significant correlation would be present between a timed 1-mile run and 5K run time.

METHODS: Thirteen participants [Female: 3, Male: 10, Age:23±5 y, Height:175±9 cm, Mass:74±12 kg, BMI: 24±4] reported to the trailhead (Practice Loop, Three Peaks Recreation Area, Cedar City, UT) and completed a 1-mile and a 5K timed trail run one day apart in a counterbalanced order. Elevation at the trailhead was 1,641 m (5,385 feet) with a rise of 17 m (56 feet) throughout the marked 1-mile course, and 61 m (201 feet) on the 5K course. Testing was completed between 1500 and 1700h on both days. Environmental measures of temperature (23.9°- 25.6° C; 75°-78° F), humidity (13%-15%), and wind speed (4-9 mph) varied throughout the testing days. Data were analyzed using a Pearson product moment correlation coefficient with significance accepted at the p≤0.05 level.

RESULTS: A significant correlation was observed between 1-mile time and 5K performance (r=0.987, p=0.0001, R²=0.974). The equation to predict 5K time from the mile time trial was: 5K time (expressed as a decimal) = 4.2881 * mile time (expressed as a decimal) - 4.5521. The average running velocity during the 1-mile trail run was 3.94±0.9 m.sec⁻¹, and 3.4±1.0 m.sec⁻¹ for the 5K.

CONCLUSIONS: Our results show that a 1-mile trail run time trial can be used to predict performance for a 5K trail race. Also, based on these data, 5K trail running velocity is approximately 15% less than during a 1-mile trail run bout.

519 Board #340 May 31 11:00 AM - 12:30 PM
Standardized MET Overestimates Resting VO₂ And Underestimates Energy Cost of Running in Low Cardiorespiratory Fitness Men

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Multiples of the metabolic equivalent (MET) are widely used to prescribe exercise intensity and quantify the energy cost of physical activities. A growing body of empirical evidence, however, suggests the standardized 1-MET value, represented by a resting oxygen uptake (VO₂) of 3.5 mL.kg⁻¹.min⁻¹, significantly overestimates observed resting VO₂ in populations with lower cardiorespiratory fitness (CRF).

PURPOSE: Compare the standardized MET and resting VO₂ with respect to these two applications and explore the association between CRF and resting VO₂. **METHODS:** A heterogeneous cohort of 114 healthy men, aged 18 to 38 yr, volunteered to

participate in two studies. First, 100 men [lower CRF: n = 48, VO_{2max} < 50.0 mL.kg⁻¹.min⁻¹; higher CRF: n = 52, VO_{2max} ≥ 50.0 mL.kg⁻¹.min⁻¹] visited the laboratory twice to explore the association between directly assessed VO_{2max} and resting VO₂. Second, 14 men performed a 30-min bout of running at 8.0 km.h⁻¹ (8.3 METs according to the Compendium of Physical Activities) to investigate the use of the MET to quantify the energy cost of treadmill running. **RESULTS:** The VO_{2max} was strongly positively correlated with resting VO₂ (R = 0.68, P < 0.001). The mean observed resting VO₂ values of 3.28 (n = 100) and 3.07 (n = 14) mL.kg⁻¹.min⁻¹ were significantly lower than the standardized value of 3.5 mL.kg⁻¹.min⁻¹ (P < 0.001 and P = 0.005, respectively). When compared to the standardized value, groups with lower CRF demonstrated significantly lower mean observed resting VO₂ values of 3.06 (1st part of the study: P < 0.001) and 2.67 (2nd part of the study, P < 0.001) mL.kg⁻¹.min⁻¹. However, no significant difference was observed between standardized and observed resting VO₂ values for the groups with higher CRF (1st part of the study: P = 0.87; 2nd part of the study: P = 0.78). Hence the observed values for the energy cost of treadmill running were significantly underestimated when calculated using the standardized resting VO₂ value of 3.5 mL.kg⁻¹.min⁻¹ (P = 0.005 to P < 0.001) only for the groups with lower CRF. **CONCLUSION:** The standardized MET value considerably overestimated observed resting VO₂ in men with lower CRF. Direct determination of resting VO₂ is therefore preferred to improve the accuracy of the aforementioned applications in this population.

520 Board #341 May 31 11:00 AM - 12:30 PM
An Evaluation of Time-Trial Based Predictions of VO₂max and Recommended Training Paces For Collegiate and Recreational Runners

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PURPOSE: Determine the accuracy of Jack Daniels' VDOT Running Calculator for the prediction of VO₂max, and recommendations of interval and threshold training paces (pIN & pTH) in samples of NCAA Division 1 track athletes (ATH, n = 11) and recreational runners (REC; n = 9). **METHODS:** Predicted variable data were obtained using results from indoor 5km time-trials. Data from the VDOT calculator was compared to laboratory tested VO₂max, pace at VO₂max (VO₂max_{pace}), and lactate threshold pace (LT_{pace}). **RESULTS:** VDOT underestimated VO₂max in ATH (t (10) = -6.00, p < .001, d = 1.75) and REC (t (8) = -8.96, p < .001, d = 3.44). Follow up between-groups analysis indicated that the difference between VDOT and VO₂max was significantly greater in REC than ATH (p = .0031, d = 1.59). pIN was slower than VO₂max_{pace} in REC (t (8) = -4.26, p = .003, d = 1.76), but not different in ATH (t (10) = 0.52, p = .614, d = 0.14). Conversely, pTH was faster than LT_{pace} in ATH (t (8) = -4.17, p = .003, d = 1.49), but not different in REC (t (8) = 1.64, p = .139, d = 0.57). **CONCLUSIONS:** Practically, pTH can be confidently used for threshold training regardless of ability level. pIN also appeared to be accurate for ATH, but may be not be optimal for improving VO₂max in REC. Practitioners should interpret VDOT with caution as it may underestimate VO₂max.

Table 1. Descriptive characteristics of subjects.

Variable	Whole Group (n = 20)		ATH (n = 11)		REC (n = 9)	
	Mean	SD	Mean	SD	Mean	SD
Age (years)	21.45	2.21	20.36	0.92	22.78	2.64
Height (cm)	174.42	10.59	177.48	9.23	170.67	11.46
Body mass (kg)	67.06	8.96	67.40	8.31	66.63	10.20
5 km time trial (min)	20.65	3.93	18.22	2.11	23.61	3.64

ATH = NCAA Division 1 track athletes; REC = recreational runners

Table 2. Predicted and actual test data and difference scores by group.

	Mean ± SD	p	Cohen's d
NCAA Division 1 Athletes (n = 11)			
VO ₂ max (mL.kg ⁻¹ .min ⁻¹)	61.05 ± 6.61		
VDOT (mL.kg ⁻¹ .min ⁻¹)	56.33 ± 7.17		
VDOT - VO ₂ max	-4.72 ± 2.61	<.001	1.754
VO ₂ max _{pace}	5.75 ± 0.77		
pIN	5.79 ± 0.64		
pIN - VO ₂ max _{pace}	0.04 ± 0.26	.614	0.137
LT _{pace} *	6.75 ± 0.94		
pTH*	6.37 ± 0.75		
pTH - LT _{pace} *	-0.38 ± 0.28	.003	1.489
Recreational Runners (n = 9)			
VO ₂ max (mL.kg ⁻¹ .min ⁻¹)	51.41 ± 6.83		
VDOT (mL.kg ⁻¹ .min ⁻¹)	42.17 ± 7.54		
VDOT - VO ₂ max	-9.24 ± 3.10	<.001	3.437
VO ₂ max _{pace}	6.89 ± 0.84		
pIN	7.40 ± 1.08		
pIN - VO ₂ max _{pace}	0.51 ± 0.36	.003	1.762
LT _{pace}	7.88 ± 1.38		
pTH	8.03 ± 1.16		
pTH - LT _{pace}	0.15 ± 0.27	.139	0.574

VDOT = predicted VO₂max, pIN = predicted interval pace, VO₂max_{pace} = pace corresponding with velocity at VO₂max, LT_{pace} = pace corresponding with velocity at lactate threshold, pTH = predicted threshold pace. Units for all pace times are in min mile⁻¹.
 *n = 9

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Effects of Footwear on Running Economy and Preferred Foot Strike Pattern in Collegiate Distance Runners
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 (No relationships reported)

The influence of foot strike pattern on running performance has produced inconsistent results (Kasmer et al., Int. J. Sports Physiol. Perform. 29:286-292, 2013; Larson et al., J Sports Sci 29:1665-73, 2011) as has the effect of footwear and foot strike pattern on running economy (Perl et al., Med. Sci. Sports Exerc. 44:1335-1343, 2012). **PURPOSE:** To examine the effects of varying footwear on running economy and preferred foot strike pattern in collegiate distance runners. **METHODS:** Ten (5 female, 5 male) healthy, trained National Collegiate Athletic Association Division II distance runners were randomly assigned to 3 footwear conditions: 1) barefoot (BF), 2) minimally shod (MS) and 3) traditionally shod (TS). For each condition, running economy ($\dot{V}O_2$), heart rate (HR), rating of perceived exertion (RPE), and preferred foot strike (PFS) pattern (forefoot, mid-foot, rear foot) were measured between the 5th and 6th min of treadmill running at 0% grade, 3.35 m/s. **RESULTS:** Repeated measures ANOVA analysis revealed no significant difference ($p>0.05$) across BF, MS and TS footwear conditions for $\dot{V}O_2$ (41.2 ± 2.5, 40.7 ± 1.9, 41.6 ± 2.2 ml/kg/min), HR (168.6 ± 17.5, 166.7 ± 15.8, 168.6 ± 16.1 bpm) and RPE (9.6 ± 1.8, 9.3 ± 2.1, 9.5 ± 1.8). The PFS data were analyzed using a Friedman's test followed by a Wilcoxon signed rank test. The Friedman's test showed a significant difference ($p<0.05$) in PFS patterns across footwear treatments. Subsequently, the Wilcoxon test indicated the PFS pattern for BF was forefoot and, in contrast, for both MS and TS conditions the PFS was rearfoot. **CONCLUSION:** There is no metabolic advantage to BF, MS, and TS footwear in collegiate male and female distance runners and, although PFS varies with footwear, it has no effect on running economy. This suggests collegiate distance runners can select footwear of their choice without sacrificing running performance.

522 Board #343 May 31 11:00 AM - 12:30 PM
Decreasing Total Training Time Efficient In Improving Speed and Aerobic Cost in Competitive Runners
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 (No relationships reported)

In addition to overall volume, an essential variable in an optimal endurance training program is the distribution of exercise intensity. Training intensity distribution (TID), which is the percentage of time an athlete spends training in low, moderate, and high intensity efforts, has been used to prescribe training programs and monitor athletes. Training based on a demarcation of high intensity at onset of blood lactate (OBLA) of 4mM has been suggested to provide a more precise stimulus to yield optimal metabolic and peripheral adaptations. Adaptations which shift OBLA allow an individual to exercise at higher work rates for longer periods, translating into better overall endurance performance. **PURPOSE:** Identify TID related factors that delay OBLA for competitive runners. **METHODS:** Sixteen University of Oklahoma Cross Country athletes (8 males and 8 females) initially performed two lactate threshold (LT) tests to determine training intensity zones (TIZ) based on heart rate (HR) and blood lactate. TIZ categories consisted of: low (Z1) = LA <2mM, moderate (Z2) ≥2mM and ≤4 mM, and high intensity (Z3) >4M. Subjects subsequently wore GPS HR monitors (blinded) to practice every day for the next 5 weeks, including all training runs and races, while concluding the study with a final LT test. Total training time and TID parameters were recorded as well as the performance metrics of both running speed and aerobic cost at OBLA (S4 and AC4). Correlational analysis and multiple regression estimation were used to analyze the data. **RESULTS:** Bivariate correlations were not significant between most TID variables and the performance variables. However, when using multiple regression ($\alpha = 0.05$) to control for gender differences, total training time emerged as having a statistically significant ($p < 0.01$) negative relationship with performance changes ($\Delta S4$, $\Delta AC4$) over the time frame examined. Additionally, the coefficient analysis suggested that the proportion of training time in Z3 might be positively related to $\Delta S4$ ($p = 0.089$) and $\Delta AC4$ ($p = 0.062$). **CONCLUSION:** This study shows that improvements in an athlete's S4 and AC4 may be achieved by decreasing overall training time and potentially increasing the proportion of time in Z3. From a practical point of view, this could be achieved by elimination of training time in Z1 and/or Z2.

523 Board #344 May 31 11:00 AM - 12:30 PM
Effect of Short-term Altitude Training on Sprint Running Performance
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It is suggested that intermittent hypoxic training (IHT) improved repeated sprint ability and maximal 30-s cycling sprint (Faiss et al., 2013; Hamlin et al., 2010; Kasai et al., 2015). Therefore, IHT may be suitable for enhancing sprint performance. However, IHT and/or altitude training have not yet been conducted in track events sprinters. **PURPOSE:** The purpose of the present study was to determine the effects of short-term altitude high intensity training on sea level sprint running performance in well-trained 400-m runners. **METHODS:** Eighteen college male 400-m runners were assigned to either a Hypoxic group ($n = 9$) or a Normoxic group ($n = 9$) and performed high intensity running training twice a day for 5 days. Both groups trained same high intensity training program in all weather running track. Hypoxic group trained and rested in Hida-Ontake Kogen Highland Training Area (1,700-1,800m). Before and after the training, subjects were completed 60-m and 400-m maximal running test, and vertical jump test. The post-training test periods were conducted 2, 7, 14, 21, 28 days after the final training session. **RESULTS:** After the 5 days of high intensity training, no significant changes in 400-m running time in both groups. However, percentage changes of 400-m running time were significantly higher in Hypoxic group ($2.1 \pm 1.0\%$) than in Normoxic group ($1.0 \pm 0.9\%$). 30-m time during the latter half of 60-m running was significantly increased in 7-days after training (Hypoxic: 3.15 ± 0.04 vs 3.23 ± 0.03 sec, Normoxic: 3.16 ± 0.03 vs 3.22 ± 0.03 sec) and significantly decreased in 21-days after training (Hypoxic: 3.08 ± 0.03 sec, Normoxic: 3.11 ± 0.03 sec) compared to before training. There were no significant changes in vertical jump in both groups. **CONCLUSIONS:** These results suggest that altitude high intensity training is effective for 400-m runners.

524 Board #345 May 31 11:00 AM - 12:30 PM
The Effects of a Medicine Ball Training Program on Running Economy
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Running economy (RE) has been shown to improve with the addition of concurrent explosive strength training, plyometrics, and heavy load resistance training. However, there is little research to date on the effects of RE with functional resistance training. **PURPOSE:** To determine the effect of a medicine ball training program on running economy. **METHODS:** At this time, 7 runners (age = 22.86 ± 6.23 years) have completed the pre- and post push-up, curl-up, running economy at 187 m/min and 204 m/min, and a maximal oxygen consumption test, with 10 additional runners in the process of completing the protocol. Following the pre-test, participants were matched for gender and $\dot{V}O_{2max}$ and randomly assigned to either the intervention (I) or control (C) group. The intervention group completed a 6-week progressive medicine ball training program. Statistical analysis was performed using independent t-tests and Pearson product-moment correlations. Significance was set to $p < 0.05$. **summary of RESULTS:** The following is preliminary data on the 7 participants (4 I, 3 C) that have completed the protocol. The number of push-ups completed following the post testing increased by 6.8 ± 4.1 for the I group and 6.3 ± 9.5 for the C group. The I group increased the number of curl-ups completed by 21.0 ± 19.0 while the C group decreased by 3.3 ± 10.2 . Running economy at 187 m/min, decreased by 2.07 ± 1.0 ml/kg/min and 0.7 ± 4 ml/kg/min for the I and C groups, respectively. At 206 m/min running economy, decreases by 1.9 ± 1.3 ml/kg/min for the I group and increased by 0.5 ± 2.4 for the C group. $\dot{V}O_{2max}$ decreased by 0.2 ± 1.2 ml/kg/min for the I group and increased by 0.8 ± 7 ml/kg/min for the C group. Independent t-test analyses are not currently showing statistically significant changes in the preliminary data ($p < 0.05$). Although not statistically significant, the Δ in push-ups and Δ in curl-ups are showing a positive correlation with RE at both speeds (187m/min: $r = 0.762$, $p = 0.238$; 204 m/min: $r = 0.871$, $p = 0.129$; 187 m/min: $r = 0.262$, $p = 0.738$; 204 m/min: $r = 0.420$, $p = 0.580$, respectively). **CONCLUSION:** These preliminary data suggest that the inclusion of a medicine ball training program may help improve abdominal endurance (curl-up) and running economy in trained endurance runners.

525 Board #346 May 31 11:00 AM - 12:30 PM
Effects of Replacing Run Training with Elliptical Bicycle Training in Experienced Runners
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(No relationships reported)

Run training can improve fitness and performance. Many runners have seen high rates of injury, which can lead to detraining. Cross-training methods attempt to attenuate detraining. A novel outdoor elliptical bicycle (EBIKE) has been designed to emulate the running motion without impact forces. **PURPOSE:** To determine the effectiveness of replacing 50% run training with elliptical bicycling on maximal oxygen consumption ($\text{VO}_{2\text{max}}$), ventilatory threshold (VT), respiratory compensation point (RCP), and 5,000 m time trial (TT) over a 4-week training period. **METHODS:** Fourteen male ($n=9$) and female ($n=5$), experienced runners (age=22.1 \pm 3.6 y, running experience=9.6 \pm 4.2 y) were classified as healthy and experienced via a health history screening, body composition assessment (skin fold method), and a graded $\text{VO}_{2\text{max}}$ test (GXT) on a treadmill during an initial testing session. The TT was performed on an indoor 300m track 24-72 hours following the GXT. Each participant was then randomly assigned to either the RUN group (100% normal run training) or COMBINED (COM) group (50% normal run training/50% elliptical bicycle training). An identical testing session was conducted following the 4-week training period. **RESULTS:** All results are reported as mean \pm SD. Paired *t*-tests ($\alpha<0.025$) were utilized to compare the physiological variables before and after training separately for each group. A Bonferroni correction was performed in order to adjust the alpha value to avoid statistical error. Before training values for $\text{VO}_{2\text{max}}$ (ml/kg/min) (RUN [59.94 \pm 3.92] and COM [62.67 \pm 6.41]) were not significantly different ($p>0.025$) compared to after training values of $\text{VO}_{2\text{max}}$ (RUN [60.59 \pm 4.61] and COM [63.17 \pm 7.97]). There also were no significant differences for VT, RCP, or TT values ($p>0.025$) before and after training for both the RUN and COM groups. No significant differences were seen when VT and RCP were expressed as a percent of relative $\text{VO}_{2\text{max}}$. **CONCLUSIONS:** In this novel investigation replacing 50% of run training with elliptical bicycle training over a 4-week period was able to maintain physiological and performance variables similar to 100% run training in this population of experienced runners. Coaches and runners should consider the EBIKE as a viable cross-training option for replacing up to 50% of run training.

526 Board #347 May 31 11:00 AM - 12:30 PM
Improvement in 3200-m Running Performance following Acute Inspiratory Muscle Training
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Prior high-intensity exercise has been shown to augment the oxidative energy contribution to subsequent exercise and enhance competitive performance. Inspiratory muscle training (IMT) is a form of resistance training for the muscles primarily involved in the processes of breathing using a resisted respiratory breathing trainer, which has also been shown to modify VO_2 kinetics and enhance performance. The potential impact of acute IMT as part of a warm-up on competitive performance, however, has not been investigated. **PURPOSE:** To compare the effects of acute resisted IMT (EXP) to sham IMT (CON) as part of a warm-up on running performance. **METHODS:** In a randomized cross-over design, 17 trained distance runners (age 20.1 \pm 1.4 yr, body mass 62.2 \pm 8.1 kg, height 1.73 \pm 0.09 m) completed two 3200-m performance trials on separate days, preceded by two different warm-up procedures. Prior to each 3200-m trial, subjects performed a warm-up which consisted of a 20 min self-paced run and standardized mobility drills, followed by either EXP or CON in a randomized order and 4x 80m strides. Inspiratory muscle function was measured pre and post IMT. Heart rate (HR), rating of perceived exertion (RPE), rating of perceived dyspnea (RPD) and expired gases were collected using a metabolic analyzer during each trial. **RESULTS:** 3200-m run performance was significantly faster after EXP (11.3 \pm 1.1 vs. CON 11.8 \pm 1.5 min, $p=0.01$). Baseline inspiratory muscle function characteristics were not different between groups. Following each warm-up condition peak volume (EXP, 3.30 \pm 0.85 vs CON 2.99 \pm 0.68 L, $p<0.01$), peak flow (EXP, 7.20 \pm 1.77 vs CON 6.81 \pm 1.73 L, $p=0.03$), and peak strength index (EXP, 134 \pm 39 vs CON 127 \pm 34 cmH₂O, $p=0.03$) were significantly higher after EXP. HR was not different between conditions (EXP, 183 \pm 9 vs CON 182 \pm 11), but VO_2 at each 800-m interval (EXP, 800-m 3.55 \pm 0.65, 1600-m 3.63 \pm 0.67, 2400-m 3.72 \pm 0.70 vs CON 800-m 3.43 \pm 0.66, 1600-m 3.54 \pm 0.67, 2400-m 3.64 \pm 0.70 L/min, $p>0.05$) as well as peak VO_2 attained (EXP, 3.83 \pm 0.73 vs CON 3.74 \pm 0.76 L/min, $p=0.25$) tended to be greater after EXP. RPE (EXP, 14.6 \pm 1.1 vs CON 14.8 \pm 0.9, $p>0.05$) and RPD (EXP, 5.1 \pm 1.2 vs CON 5.7 \pm 1.6, $p=0.06$) tended to be lower following EXP. **CONCLUSION:** These data indicate that acute resisted IMT as part of a warm-up enhances 3200-m time-trial performance in trained runners.

527 Board #348 May 31 11:00 AM - 12:30 PM
Body Composition, Bone Density, Metabolic Rate and Dietary Intakes of Collegiate Synchronized Swimmers
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(No relationships reported)

Synchronized swimming is a physiologically demanding sport that requires strength, endurance, power, and artistic grace. Currently, limited information exists that outlines various physiological and dietary attributes surrounding the sport. **PURPOSE:** This study's aim was to identify physiological characteristics and dietary habits of collegiate synchronized swimmers. **METHODS:** Twenty-one female collegiate synchronized swimmers (20.4 \pm 0.3 yrs, 168.0 \pm 1.1 cm, 64.4 \pm 1.9 kg) were tested. Maximal oxygen uptake ($\text{VO}_{2\text{max}}$) was measured using indirect calorimetry during a graded treadmill exercise test. Resting metabolic rate (RMR) was assessed using indirect calorimetry with standardized criteria. Body composition was determined using skinfolds (4-site and 7-site) and dual-energy X-ray absorptiometry (DEXA). Dietary intake was assessed using four-day dietary records using Vitabot software. Data is presented as means \pm SD. Pearson correlation coefficients were used to determine significant relationships. **RESULTS:** $\text{VO}_{2\text{max}}$ was 43.8 \pm 1.0 mL/kg/day while absolute and relative (normalized to body mass in kg) RMR values were determined to be 1,702 \pm 52 kcal/day and 26.5 \pm 2.5 kcal/kg/day, respectively. DEXA determined fat mass (17.7 \pm 5.3 kg), lean mass (43.0 \pm 4.4 kg) and percent body fat (28.7 \pm 4.8 % fat) were computed. Percent fat values using 4 and 7-site skinfolds (25.7 \pm 4.8 % fat and 25.3 \pm 4.7 % fat, respectively) were similar but both values were different from DEXA determined percent body fat values ($p>0.05$). Total lumbar (1.03 \pm 0.11), trochanteric line (0.79 \pm 0.08), intertrochanteric line (1.14 \pm 0.12), femoral neck (0.96 \pm 0.12) and Ward's triangle (0.91 \pm 0.24) bone mineral density values were determined (in g/cm²) using DEXA. Relative daily calorie (29.0 \pm 10.1 kcal/kg), carbohydrate (3.6 \pm 1.1 g/kg), protein (1.3 \pm 0.4 g/kg) and fat (1.2 \pm 0.5 g/kg) were computed. No significant correlations were reported between any of the bone mineral density, body composition and dietary intake data ($p>0.05$). **CONCLUSION:** Synchronized swimmers have similar aerobic fitness, body composition and training habits as other competitive aquatic athletes. Reported energy intakes indicate low levels of energy availability; future work should explore menstrual complications and female athlete triad development.

528 Board #349 May 31 11:00 AM - 12:30 PM
Gender Differences in Water-Based Aerobic Capacity During Freestyle Swimming to Exhaustion
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Aerobic capacity plays an essential role in physical performance. Females have been shown to have lower aerobic capacity during land-based incremental testing when compared to their male counterparts. However, there have been few studies on gender differences in aerobic capacity during water-based incremental swimming. Understanding the gender differences is an important step in coaching/training. **PURPOSE:** The purpose of this study was to examine aerobic capacity gender differences. **METHODS:** A total of 15 males (23.6 \pm 6.7yrs, 179.3 \pm 6.4cm, 75.2 \pm 11.5kg) and 15 females (22.6 \pm 6.3yrs, 167.6 \pm 6.4cm, 65.7 \pm 9.5kg) participated in the study and completed an incremental swimming test to exhaustion. The protocol involved swimming a minimum of 250 meters (10 lengths) using the freestyle stroke. Rest periods following each 22.9 meter length decreased from 10 seconds to 3 seconds throughout the test. Following 9 lengths, subjects continuously swam at maximal velocity until $\text{VO}_{2\text{max}}$ had been achieved or until exhaustion occurred. Aerobic capacity was measured with a portable metabolic system suspended above the swimmer using a cable pulley system, enabling a standard freestyle stroke with continuous measure of VO_2 . Ratings of perceived exertion (RPE), blood lactate (BLA), and maximal heart rate (HR_{max}) were also measured at the end of the test. Data were tested for normality, and independent samples *t*-tests or Mann-Whitney *U* tests were used, as appropriate ($p<0.05$). **RESULTS:** Males had significantly higher aerobic capacity (males: 48.4 \pm 7.4ml/kg/min, females: 39.8 \pm 5.3ml/kg/min, $p=0.001$) and lower HR_{max} (males: 173.3 \pm 6.9bpm, females: 180.7 \pm 7.7bpm, $p=0.032$) compared to females. There were no gender differences in RPE (males: 9.6 \pm 0.7, females: 9.5 \pm 0.7, $p=0.689$) or BLA (males: 11.3 \pm 3.5mmol/L, females: 9.9 \pm 2.9mmol/L, $p=0.269$). **CONCLUSIONS:** The current results have revealed significant gender differences in aerobic capacity at the maximal effort (with similar RPE scale and BLA values). These findings are in accordance with other land-based gender studies on aerobic capacity,

largely due to smaller stature/lung in females. Future studies should examine the effects of gender-specific and customized land/water-based training on their aerobic capacity. Supported by ONR: N00014-14-1-0022/N00014-15-0069

529 Board #350 May 31 11:00 AM - 12:30 PM
Gender Differences In Mean And Peak Swimming Force, Validity, Reliability, Of A Tethered Swimming Test

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 (No relationships reported)

Consistent differences between males and females have been shown in land based measurements of anaerobic performance. Evidence shows that a 30-second max tethered swim (TST) is a valid and reliable measure of anaerobic power (F_{peak}) and capacity (F_{mean}) in swimmers. However, gender differences have not been investigated. **PURPOSE:** To explore gender differences for anaerobic performance, reliability, and validity of a TST. **METHODS:** 14 males and 14 females completed 4 sessions: Wingate cycling anaerobic test (WAnT), a performance swim (PS) session, and 4 TST over 2 sessions. Gender differences were determined using independent t-tests. Reliability was determined using an ICC (2, 1) for F_{peak} and F_{mean} . Criterion validity of the TST was determined using Pearson's Correlation analysis among F_{peak} and F_{mean} obtained during the TST and WAnT, and the swim velocity obtained during the PS. **RESULTS:** Gender differences are shown in Table 1. For males/females respectively, intercession for F_{peak} (0.764/0.696) and for F_{mean} (0.965/0.985), and intrasession for F_{peak} (0.645/0.786) and F_{mean} (0.920/0.990), were statistically significant ($p < 0.05$). Criterion validity is shown in Table 2.

Table 1.

	Males		Females		T-test
	Mean	SD	Mean	SD	
TST F_{peak}	277.43	54.51	191.58	37.56	0.000
F_{mean}	99.31	24.58	74.30	19.67	0.006
WAnT F_{peak}	1005.53	188.89	724.87	104.12	0.000
F_{mean}	707.47	99.81	443.27	96.42	0.000

Table 2.

Criterion Validity: TST F_{mean}	Pearson	Criterion Validity: TST F_{peak}	Pearson
Males:			
WAnT F_{mean}	0.280	WAnT F_{peak}	0.396
PS 25yd	0.666*	PS 25yd	0.636*
PS 50yd	0.746*	PS 50yd	0.336
PS 100yd	0.763*	PS 100yd	0.566
Females:			
WAnT F_{mean}	0.775**	WAnT F_{peak}	0.698*
PS 25yd	0.931**	PS 25yd	0.679*
PS 50yd	0.906**	PS 50yd	0.710*
PS 100yd	0.869**	PS 100yd	0.684*

CONCLUSIONS: Although gender differences exist for anaerobic performance of swimmers, the TST is still considered a reliable method with moderate/strong association with swim velocity. Results of this study further solidify the need for a mode specific measure of anaerobic power and capacity, due to the lack of association between the TST and land based measures in males. Supported by ONR: N00014-14-1-0022/N00014-15-0069

530 Board #351 May 31 11:00 AM - 12:30 PM

Reliability and Validity of Swimming Pool Protocol to Measure Maximal Aerobic Power of Healthy Adults

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 (No relationships reported)

A modality specific swimming protocol to assess maximal aerobic power (MAP) is essential to accurately prescribe and monitor swimming conditioning programs. However, variable hydrodynamics properties can alter propulsive forces of a freestyle swimming stroke, and consequently impede the ability to consistently and accurately perform a MAP swimming protocol. **Purpose:** To assess: 1) reliability of a swimming pool maximal oxygen consumption (VO2max_{sw}) (i.e. MAP) protocol; and 2) validity of a VO2max_{sw} test using swimming pool performance swim (PS) tests as the criterion. **Methods:** Thirty healthy males (n=15) and females (n=15) (age, 23.1±6.5 yrs; height, 173.4 ± 8.6 cm; weight, 70.4 ± 11.4 kg) performed two swimming pool VO2max_{sw} tests (VO2max_{sw}_A and VO2max_{sw}_B), and two PS tests [50 yard (31.20 ± 4.5 seconds) and 200 yard (159.2 ± 25.5 seconds)]. Test-retest reliability of VO2max_{sw} (ml·kg⁻¹·min⁻¹), HRMax (b·min⁻¹), cardiorespiratory efficiency (O2 pulse) (VO2max_{sw}/HRMax), maximal respiratory exchange ratio (RERMax), and ventilation (VeMax) (L·min⁻¹), data was assessed calculating ICC's (2,1). Test validity was determined by correlating VO2max_{sw}_A with PS swims using Pearson's coefficients. **Results:** Intra-subject reliability (ICC) cardiorespiratory responses during the VO2max_{sw}_A and VO2max_{sw}_B tests are presented in Table 1.

Table 1.

Variable	N	VO2max _{sw} _A	VO2max _{sw} _B	ICC	p-value
VO2max _{sw} (ml·kg ⁻¹ ·min ⁻¹)	29	44.2 ± 7.7	42.9 ± 8.5	0.899**	<0.001
HRMax, (b·min ⁻¹)	19	177.5 ± 8.5	178.1 ± 9.0	0.586**	.004
O2pulse(ml·b ⁻¹)	19	0.2 ± 0.0	0.2 ± 0.0	0.833**	<0.001
Peak RER	29	1.0 ± 0.1	1.0 ± 0.1	0.538**	.001
VeMax (l·min ⁻¹)	29	95.2 ± 20.7	94.3 ± 21.2	0.785**	<0.001

**p<0.01

For validity, moderately strong correlations were found between VO2max_{sw}_A and 50 (r = -0.543; p<0.05), and 200 (r=-0.486; p<0.05) swim performance time. **Conclusions:** The VO2max_{sw} test employed presently was found to be a reliable and functionally valid test of MAP. Future studies should consider the suitability of a pool-based VO2max_{sw} test for military, clinical populations, or injured athletes. Supported by ONR: N00014-14-1-0022/N00014-15-0069

531 Board #352 May 31 11:00 AM - 12:30 PM

Empirical Model Of Lane Bias Suggests Different Finish Order At 2016 Olympic Swimming Competition

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Distance freestyle (FR) swimmers at recent elite-level competitions were shown to be faster swimming in one direction versus the other dependent on lane assignment (LA). These observations were consistent with a subsequent analysis of the 50-m FR events in that the change in performance from prelim (p) to semifinal (sf) to final (f) was also dependent on the swimmers' LA. Although some swimmers were concluded to have been advantaged over others, the extent to which the race outcomes were affected was not quantified.

PURPOSE: To determine if the 2016 Olympic swim performances were biased due to LA, and if so, to quantify the effect of the bias on 50-m FR race outcomes. **METHODS:** 800-m, 1500-m, and 50-m FR results from the 2016 Olympic Games were obtained from online sources. A linear model estimated the interaction effects between distance FR swimmers' LA and their Direction (toward or away from finish end) on 50-m splits. Each 50-m FR performance was adjusted using model estimates of the Direction effect for each lane, and the change in adjusted performance from p to sf to f heats calculated. Linear regression with the change in adjusted 50-m performances (input) and the change in actual 50-m performances (response) was used to re-adjust sf and f 50-m performances. Actual ranks minus ranks based on re-adjusted performances in a given lane was tested using the Wilcoxon signed-rank test.

RESULTS: The change in adjusted 50-m FR performance significantly predicted the actual change ($F(1,46) = 186, p < .01, R^2 = .79$). Corrected rank was different than

actual rank for lanes 1-3 and 6-8 ($p < .05$); median difference in rank (interquartile range) for Lanes 1-8 was 1 (0.5 to 1.5), 1 (0.5 to 1.5), 3 (2.5 to 3.5), 0.5 (0.5 to 1), 0 (0 to 0.5), -1.5 (-2 to -1), -2 (-2.5 to -1.5), and -3 (-3.5 to -2.5), respectively.

CONCLUSIONS: This analysis provides evidence that 2016 Olympic swimmers' performances were affected by their LA. Use of model estimates of the effects of LA and Direction on distance FR splits to estimate unbiased 50-m FR performances is a practical, post-hoc tool to quantify the lane bias effect on race outcomes. 50-m swimmers in Lanes 6-8 benefitted the most, finishing 1 to 3 places higher than they would have without the bias. That some athletes may have won medals simply due to factors of the pool environment should be very alarming to all swim stakeholders.

532 Board #353 May 31 11:00 AM - 12:30 PM
Maturational Timing and Performance in Collegiate Female Swimmers

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Although it's well documented that top-performing swimmers are relatively late maturers, it's not well understood why this is so. One explanation is that there are certain physical traits common to later maturers that contribute to better swim performance. And as a result, later maturers are more likely to be 'selected' for continued sport participation. **PURPOSE:** To determine if: (1) top-performing swimmers are later maturers than lower-performing swimmers; (2) later-maturing swimmers perform better than earlier-maturing swimmers; and (3) there are physical traits common to both top performers and later maturers. **METHODS:** Maturational timing was estimated using age at menarche (AaM), which was determined retrospectively in collegiate swimmers ($N = 273$). Each swimmer's best performance during the 2015-2016 NCAA season was obtained from the USA Swimming database and selected based on Power Point Score (PPS), a standardized score given to all performances in the database. Independent samples t tests were used to compare (1) AaM and BMI (from self-reported height and weight) between bottom-performing (lowest 25% of PPS) and top-performing (highest 25% of PPS) swimmers and (2) PPS and BMI between earlier-maturing (youngest 25% of AaM) and later-maturing (oldest 25% of AaM) swimmers. **RESULTS:** The top performers were later maturers than the bottom performers (AaM 14.0 vs. 13.4 years, $t = 2.48$, $P = 0.02$, $d = 0.46$) and had lower BMIs (22.5 vs. 23.5 kg/m², $t = 2.30$, $P = 0.02$, $d = 0.41$). The later maturers performed better than the earlier maturers (PPS 802.6 vs. 753.4, $t = 2.11$, $P = 0.04$, $d = 0.39$) and had lower BMIs (22.5 vs. 23.4 kg/m², $t = 2.29$, $P = 0.02$, $d = 0.40$). **CONCLUSION:** Previous research has shown that top-performing swimmers and later-maturing women are more linear in body shape than their low-performing and earlier-maturing counterparts. Our results pertaining to weight per height (i.e., BMI) are consistent with these reports. And taken together, they provide evidence that there are physical traits common to top-performing swimmers and later-maturing women. So it's certainly possible that later maturers are being selected (by themselves or others) for continued swim participation on the basis of these traits. But additional longitudinal research is required to determine the extent to which this is the case.

533 Board #354 May 31 11:00 AM - 12:30 PM
Age-associated Changes In Training Volume And Athletic Performance: Cross-sectional and Longitudinal Analyses of Masters Swimmers

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Masters athletes make every effort to maintain or even improve the athletic performance they accomplished when they were young. However, a decline in athletic performance is one of the inevitable consequences of aging. Precise physiological mechanisms of age-related decrease in athletic performance are not known but it is thought to be driven by decreases in exercise training stimuli. **PURPOSE:** We determined the influence of changes in training volume with aging on swimming performance by using both cross-sectional and longitudinal approaches. **METHODS:** Competitive swimmers who were members of the US Masters Swimming association were included if they had logged their yearly training volume and had participated in 50m freestyle events at a USMS meet between 2011 and 2015. A total of 692 and 98 swimmers aged 20-88 years were studied in the cross-sectional and longitudinal analyses. Multiple regression and mixed effects multiple regression models were used with gender as a covariate. The longitudinal data was then centered around different ages to find the age at which training is a significant predictor of performance. **RESULTS:** Both cross-sectional and longitudinal analyses showed no significant

associations between swimming training volume and age. In the longitudinal analyses, training volume was not significant as a predictor in swimming performance for younger swimmers (53 years and younger). In middle-aged swimmers (54-79 years), increases in training volume resulted in mildly better swimming performance (i.e., 3 miles/month increases in training volume were related to .05 sec better swimming time). Increases in training volume with advancing age had more significant effects on swimming performance in older swimmers (80 years and older) (i.e., 3 miles/month increases in training volume were associated with .27 sec better swimming time). **CONCLUSION:** In younger swimmers, changes in training volume did not have any significant impact on swimming performance. However, in middle-aged and older swimmers, there was a graded relationship between yearly increases in training volume and swimming performance such that the impact of training volume on swimming performance appears to become greater with advancing age.

534 Board #355 May 31 11:00 AM - 12:30 PM
Associations between Land-Based Laboratory Measures and Freestyle Swimming Performance: A Comparison between Males and Females

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Swimming requires technical proficiency to perform effectively and efficiently. Directly analyzing technique and performance is expensive and time consuming. Understanding underlying factors and characteristics which relate to swimming performance is of benefit. To quantify, land-based laboratory measures (LM) can be used, but associations between the LM and swimming times must be established. Further, it is unknown if technique and performance characteristics are equal in both sexes. **PURPOSE:** To examine associations of LM to swimming performance (SP) in female and male swimmers. **METHODS:** Fifteen female (22.6 ± 6.3 years, 167.6 ± 6.4 cm, 65.7 ± 9.5 kg) and 15 male (23.6 ± 6.7 years, 179.3 ± 6.4 cm, 75.1 ± 11.5 kg) recreational and competitive swimmers completed LM (body anthropometrics/composition, passive shoulder range of motion, shoulder laxity, and isokinetic scapular strength), and 50 and 200 yd freestyle SP. Spearman correlations were performed comparing LM with SP for each female/male group. Females and males were then split by a median cut point (fastest and slowest) for the 50 (Female = 32.6s; Male = 30.5s) and 200 (Female = 168.6s; Male = 159.3s) yd swims. After testing for normality, Mann-Whitney tests compared group means ($p < 0.05$). **RESULTS:** Correlations were found between female fat free mass (FFM) and 50 yd (-0.713; $p = 0.003$) and 200 yd (-0.724; $p = 0.002$) freestyle SP. Compared to the slower female, the faster female had greater height ($p = 0.021$) and leg length ($p = 0.015$) in relation to 50 yd SP, and greater FFM for both 50 yd ($p < 0.001$) and 200 yd ($p = 0.005$) SP. Males showed no sig. correlations in LM, nor sig. associations in LM between the faster and slower swimmers during the SP tests. In both sexes, shoulder girdle LM were not associated with SP. **CONCLUSION:** Time to completion was the only measure of SP. Therefore, an increase in relative female height may act to reduce the magnitude of wave drag encountered, allowing for faster speeds in relation to a specific propulsive impulse. Correlation between FFM and faster SP demonstrates that females with more muscle mass can compete at higher levels. To predict capabilities for future SP, and assess associations between LM and SP, studies should examine shoulder biomechanical measurements during the freestyle stroke. Supported by ONR: N00014-14-1-0022/N00014-15-0069

535 Board #356 May 31 11:00 AM - 12:30 PM
Predicting Performance: The use of Nonlinear Regression Models to Predict Olympic Performance in Swimmers

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PURPOSE: Due to recent external biases shown to have influenced the ability of a nonlinear regression model to predict Olympic performance, the purpose of this study was to employ additional statistical analytics as a means to characterize the progression of performances at future Olympic swim competitions. **METHODS:** Nonlinear regression models were fit for each swimming event for men (m) and women (w) at the Olympic Games ($n=26$) from 1948 to 2012. From these, and based upon predicted and observed performances, a 'best fit' model including 7 Olympic Games from 1988 to 2012 was selected. To predict future performances (2016), 1454 championship finals swim performances from this time frame were utilized. The mean time of the 8 swimmers in each final was used as the dependent variable to fit the model [$\text{time} = a \times \text{year}^b$]. A 95% percent confidence interval was

calculated using a Monte Carlo simulation method. Residual squared error (RSE), r-squared (r^2), confidence interval (CI) length, and absolute difference between observed and predicted of each regression model were compared.

RESULTS: Average RSE_m (1.24 ± 1.25), RSE_w (1.39 ± 1.15). Average r^2_m (0.76 ± 0.09), r^2_w (0.72 ± 0.12). There were no statistically significance differences in average RSE ($p=0.35$) or average r^2 ($p=0.35$) between sex models. Average length of the 95% CI_m (3.07 ± 3.13), CI_w (3.44 ± 2.86). No difference existed between length of CI between sex ($p=0.76$). Absolute difference in time between observed and predicted for men (0.79 ± 0.73 s), women (1.56 ± 1.89 s). No differences existed between the absolute difference in observed and predicted between the men and women models ($p=0.19$). 92.3% ($n=12$) of observed men and 69.2% ($n=9$) observed women mean performances for 2016 fell within the 95% confidence interval of the predicted model value.

CONCLUSIONS: In general, the nonlinear regression prediction models produce a valid and accurate approximation of Olympic performance progression as reflected by the 2016 Games. However, it is unclear why there is a different accuracy of 'fit' for the men and women predictions. Further study is needed to evaluate the potential factors apparently allowing the women to out-perform the 'best fit' model.

536 Board #357 May 31 11:00 AM - 12:30 PM
Nutrition and Physiological Recovery in Smith College Swimmers
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Nutrition and Physiological Recovery in Smith College Swimmers
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Athletes have an increased requirement for nutrients such as protein and carbohydrates in order to facilitate recovery. However, female athletes don't often receive a thorough nutritional education and often focus on maintaining a specific body weight to ensure peak performance. As a result, many women and girls do not consume enough food to satisfy the physical demands of their sports, increasing their risk of long term health problems later in life.

PURPOSE: To determine if members of the Smith College swim team meet their recommended dietary intake guidelines, and to explore the relationship between dietary intake, non-nutritional requirements, and physiological recovery. **METHODS:** Participants filled out an anonymous questionnaire daily for 7 days. The questionnaire included questions regarding daily food intake, total hours of sleep, any changes in caffeine intake and/or health, and their level of fatigue. Recovery was evaluated using the REST-Q, a 7-question survey that attempts to measure perceived exertion, perceived recovery and recovery effort in order to determine if the athlete is exhibiting signs of overtraining. Each question on the REST-Q is evaluated based on a scale from 0-6. Dietary intake was evaluated using MyFitnessPal, a free online website that allows the user to enter the name of a food item into a database and determine its nutritional content. Nutritional analysis was restricted to four nutrients: protein, carbohydrates, fat and calories. Recommended intake guidelines for each athlete were based on the values described in the literature and calculated by hand. **RESULTS:** Less than half of the participants met guidelines for the intake of at least two of the four nutrients studied. The two most common deficit nutrients were carbohydrates and calories. All but one participant met or exceeded guidelines for protein consumption. All participants reported on average low recovery scores and workouts that required significant effort to complete. **CONCLUSION:** Based on average dietary consumption during this study, none of the participants met all of their recommended dietary intake guidelines.

537 Board #358 May 31 11:00 AM - 12:30 PM
Role of Dryland Resistance Training on Musculoskeletal Injuries and Healthcare Costs in Masters Swimmers

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An increased incidence of orthopedic injuries with age interfere with Masters athletes to pursue better performance and place economic burden on these athletes. **PURPOSE:** We determined the prevalence and economic impact of swimming-related musculoskeletal injuries in Masters swimmers. **METHODS:** A comprehensive questionnaire was administered to the United States Masters Swimming (USMS) membership. A total of 498 swimmers (304 female and 194 male) aged 20-86 years responded. The swimmers had been swimming for 13.3 ± 11.5 years, and 67% of them participated in resistance training. Economic impact was determined by their total healthcare costs. Healthcare costs were costs associated with a doctor's visit, healthcare visit or another healthcare professional. Binary logistic and linear multiple regression tests using age, sex and years of swimming as covariates were run to

determine predictors for both injuries and healthcare costs. **RESULTS:** Thirty one % of the swimmers reported swimming-related musculoskeletal injuries. Prevalence of swimming-related injuries and healthcare costs were not different between females and males and was not related to aging. Accumulating years of dry-land resistance training were significantly associated with reductions in the prevalence of injuries. Yet they were also related to increases in healthcare costs ($p<0.05$). Resistance training participation was associated with an increase in the length of injuries ($p<0.05$), which predicted an increase in healthcare costs ($p<0.05$). **CONCLUSIONS:** Years of dry-land resistance training are associated with lower prevalence of swimming-related injuries but act to increase healthcare costs with elevating major injuries requiring lengthy recovery.

538 Board #359 May 31 11:00 AM - 12:30 PM
Ergogenicity Of Inspiratory Muscle Training Is Affected By Weekly Training Distance In Swimmers

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PURPOSE. The aim of this study was to examine the impact of weekly swimming training distance on the ergogenicity of inspiratory muscle training (IMT). **METHODS.** Thirty-three well trained youth swimmers were recruited and separated into a LOW (age: 16 ± 3 years; mass: 65.9 ± 6.6 kg; stature: 1.76 ± 0.12 m; $n = 18$) and HIGH (age: 16 ± 1 years; mass: 65.2 ± 8.3 kg; stature: 1.75 ± 0.11 m; $n = 15$) group based on weekly training distance (LOW: $15\text{-}31$ km wk^{-1} ; HIGH: $42\text{-}56$ km wk^{-1}). The LOW and HIGH groups were further subdivided into control and IMT groups for a 6-week pressure-threshold IMT intervention giving a total of four groups: LOW_{con}, LOW_{IMT}, HIGH_{con}, HIGH_{IMT}. Before and after the intervention period, swimmers completed maximal effort 100 m and 200 m front crawl swims, with maximal inspiratory and expiratory mouth pressures (P_{imax} and P_Emax, respectively) assessed before and after each swim. **RESULTS.** Before IMT, 100 m and 200 m swimming times were on average 19.1 s and 20.8 s faster, respectively, in the HIGH_{con} and HIGH_{IMT} groups than the LOW_{con} and LOW_{IMT} groups ($P < 0.001$). IMT increased P_{imax} (but not P_Emax) by 36% in LOW_{IMT} and HIGH_{IMT} groups ($P < 0.001$) but 100 m and 200 m swims were faster only in the LOW_{IMT} group (3% and 7% respectively, $P < 0.05$). **CONCLUSION.** Performance benefits only occurred in those training between $15\text{-}31$ km wk^{-1} and indicate that the ergogenicity of IMT is affected by weekly training distance. Consequently, current/anticipated training distances are important considerations when deciding whether or not to supplement swimming training with IMT.

539 Board #360 May 31 11:00 AM - 12:30 PM
Muscle Damage, Soreness And Stress Over 6-weeks Of Pre-season Training In Ncaa D1 Male Swimmers

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In 2014, three of our male swimmers were hospitalized for symptomatic exertional rhabdomyolysis (Stanfa M et al 2016). **PURPOSE:** To serially monitor and assess relationships between skeletal muscle damage, upper and lower body soreness, and physiological stress during the first six weeks of high volume training in collegiate male swimmers. **METHODS:** Seventeen male NCAA D1 swimmers presented to the lab six times during pre-season training. Blood was drawn weekly for measurement of serum creatinine kinase (CK), myoglobin (MYO) and a complete metabolic panel. Serum cortisol (C), testosterone (T) and T/C ratio were assessed at Weeks 1 (baseline), 4 and 6. Upper body soreness (US) and lower body soreness (LS) were assessed weekly via a visual analogue scale (0-10-inch unmarked scale). Repeated measures ANOVA with a Bonferroni correction were performed, with data reported as means \pm SD. Correlation analyses performed with significance set at $p<0.05$. **RESULTS:** Weekly training load consisted of: 88% swimming, 6% running, and 6% weight training which gradually increased from 16 hours to 20 total training hours/week over the first six weeks of training. Significant changes in CK (174 ± 2 ; 438 ± 259 ; 358 ± 309 ; 274 ± 112 ; 276 ± 127 ; 301 ± 126 U/L; $p<0.0001$), MYO (38 ± 16 ; 47 ± 18 ; 38 ± 18 ; 33 ± 12 ; 31 ± 10 ; 30 ± 7 ng/mL; $p=0.001$), US (1.5 ± 1.6 ; 3.5 ± 2.0 ; 3.7 ± 2.2 ; 5.1 ± 1.7 ; 5.4 ± 2.5 ; 4.8 ± 2.5 ; $p<0.0001$), LS (1.7 ± 2.0 ; 5.5 ± 2.5 ; 3.9 ± 2.0 ; 4.9 ± 1.7 ; 4.6 ± 2 ; 5.5 ± 2.2 ; $p<0.0001$), cortisol (15 ± 6 ; 10 ± 3 ; 9 ± 4 ng/dL; $p=0.0004$), and T/C ratio (37 ± 17 ; 48 ± 21 ; 58 ± 32 ; $p=0.04$) were noted while

changes in testosterone were not significant over time (456 ± 127 ; 438 ± 119 ; 416 ± 111 ng/dL; $p=0.38$). Significant correlations noted between CK vs. MYO ($r=0.36$), cortisol ($r=0.39$), alanine aminotransferase ($r=0.22$), and aspartate aminotransferase ($r=0.48$) when all data were combined. **CONCLUSION:** Muscle damage in collegiate male swimmers was modest despite cumulative training which peaked at 20hrs/week. A disconnect was noted between muscle damage (CK, MYO) and (upper and lower) body soreness, at moderate (~5/10) degrees of muscle soreness. Serum cortisol decreased over time, while testosterone remained unchanged, which promoted an anabolic hormonal environment despite gradual increases in high volume training at the commencement of the new (Fall) academic year.

540 Board #361 May 31 11:00 AM - 12:30 PM
Muscle Damage, Soreness, and Stress Over 7-weeks Of Pre-season Training In Ncaa Female Swimmers

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In 2014, three female swimmers were hospitalized with symptomatic exertional rhabdomyolysis (Stanfa M et al 2016). **PURPOSE:** To serially monitor and assess relationships between skeletal muscle damage, upper and lower body soreness, and physiological stress during the first seven weeks of high volume training in collegiate female swimmers.

METHODS: 23 female NCAA D1 swimmers presented to the lab six times during 7-weeks of pre-season training. Blood was drawn at six timepoints for measurement of serum creatinine kinase (CK), myoglobin (MYO) and a complete metabolic panel. Serum cortisol (C), testosterone (T) and T/C ratio were assessed at Weeks 1 (baseline), 4 and 7. Upper body soreness (US) and lower body soreness (LS) were assessed, at the six timepoints that blood was drawn, using a visual analogue scale (0-10-inch unmarked scale). A repeated measures ANOVA with a Bonferroni correction were performed, with data reported as means \pm SD. Correlation analyses performed with significance set at $p<0.05$. **RESULTS:** Weekly training load consisted of: 88% swimming, 6% running, and 6% weight training which gradually increased from 16 hours to 20 total training hours/week over the first seven weeks of training. Significant changes were noted in CK (135 ± 68 ; 446 ± 723 ; 171 ± 83 ; 202 ± 80 ; 180 ± 100 ; 206 ± 170 U/L; $p=0.01$), US (1.5 ± 1.8 ; 3.9 ± 1.7 ; 3.3 ± 1.8 ; 5.4 ± 1.6 ; 6.1 ± 1.8 ; 3.7 ± 2.0 ; $p<0.0001$), LS (1.3 ± 1.5 ; 5.0 ± 2.2 ; 3.4 ± 1.8 ; 5.0 ± 1.9 ; 4.8 ± 1.8 ; 4.1 ± 2.0 ; $p<0.0001$), cortisol (19 ± 10 ; 15 ± 6 ; 11 ± 5 ng/dL; $p<0.0001$), and T/C ratio (2.4 ± 2.3 ; 3.0 ± 1.8 ; 4.1 ± 2.8 ; $p=0.0003$) but not in MYO (39 ± 20 ; 63 ± 141 ; 29 ± 18 ; 30 ± 17 ; 24 ± 4 ; 29 ± 14 ng/mL; $p=0.32$) or testosterone (33 ± 14 ; 37 ± 14 ; 36 ± 14 ng/dL; $p=0.29$). Significant correlations noted between CK vs. MYO ($r=0.84$), alanine aminotransferase ($r=0.21$), and aspartate aminotransferase ($r=0.49$) when data were combined, but largely driven by an outlier with CK=3558U/L and MYO=691ng/mL at Week 2 (first training week). **CONCLUSION:** Muscle damage in collegiate female swimmers remained largely within the normal range (CK<200U/L) on average, but was highly variable between individuals. No correlations noted between muscle damage (CK, MYO) and (upper and lower) body soreness, at moderate (2-6) ratings of muscle soreness. Serum cortisol declined over training, promoting an anabolic hormonal environment.

541 Board #362 May 31 11:00 AM - 12:30 PM
Strenght Of Shoulder Rotators After A Swimming-training (inside And Outside Of The Pool) And Detraining

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It is known that in the same way the training provide several adaptations, the interruption or change the types of physical activities can lead to the decline of skills developed. However, there are limited researches that indicate these effects on swimmers. **PURPOSE:** To evaluate the strenght of shoulder rotators of recreational swimmers after a swimming activities program, after a similar swimming-training program outside of the pool and after 8-week detraining. **METHODS:** Ten recreational swimmers (age: 44.0 ± 19.0 years) were evaluated using isokinetic dynamometry applied to dominant shoulder rotators: peak torque (PT) for external and internal rotation at velocity of 60°/s and 180°/s. The evaluations were performed after a swimming activities program inside of the pool (SWI: 28 weeks); after a swimming activities program outside of the pool (OUT: 8 weeks); after 8 weeks detraining (DET). These three experimental moments happened sequentially over the time. Both programs consisted of 60-minute sessions twice a week targeted mainly

upper limb strenght muscles. For statistical analysis a two-way ANOVA with repeated measures with Tukey-Kramer post hoc was carried out. **RESULTS:** It was showed a PT-decrease ($p<0.05$) after OUT (22.3 ± 7.7 N.m) and DET (21.1 ± 7.1 N.m) when compared with SWI (25.4 ± 7.7 N.m) for external rotation at 60°/s; Only DET (16.9 ± 5.7 N.m) showed significant difference when compared with SWI (21.4 ± 7.7) for external rotation at 180°/s. No significant differences were showed for internal rotation. **CONCLUSION:** Swimming activities program outside of the pool did not produce positive effects to maintain strenght level acquired after a swimming activities program inside of the pool only for external rotation at 60°/s, indicating that decline of skills previously developed may be muscle and velocity-dependent. Also, 8 weeks detraining was deleterious for strenght profiles of the shoulder rotators in recreational swimmers.

542 Board #363 May 31 11:00 AM - 12:30 PM
The Influence of an Educational Intervention on Hydration Status in Collegiate Swimmers.

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Much research and many guidelines exist relating hydration and sport, yet many athletes don't understand the role it plays with training and performance. Athletes often come to practice or competition dehydrated. Hydration education has been shown to reduce dehydration in land-based athletes, but hasn't been studied in swimming. **PURPOSE:** The purpose of this study was to determine if an educational intervention improves the hydration status of collegiate swimmers.

METHODS: Participants (N=14) were collegiate level swimmers (n=6 female, n=8 male). Hydration status was determined using urine specific gravity (USG), urine osmolality (UO), and change in body mass. Measurements were taken before and after practice during week one. Athletes deemed dehydrated by any of the measures (n=9) were given an educational intervention during week two. The intervention provided information based on position statements from the American College of Sports Medicine and the National Athletic Training Association. The same hydration measures were made in week three after the educational intervention. A dependent t-test was used to determine any significant differences in pre-post intervention hydration measurements using the dehydrated swimmers to determine the program's effectiveness.

RESULTS: There was no significant difference in USG or UO ($p>0.05$). Pre and post-practice USG and UO values from week one were compared to week three.

CONCLUSIONS: While no significant differences were present as a result of the educational intervention, previous research has suggested educational interventions can improve the understanding of hydration and how it impacts performance and elicits positive performance outcomes. (Cleary et al., 2012; McDermott et al., 2009) In the present study, daily fluctuations in hydration and practice time, subjects misunderstanding/disregarding information provided during the intervention, or using a single determinant of hydration status, may be possible reasons for no change. Further investigations may want to both account for these variables and extend the educational intervention.