

G-19 Thematic Poster - Environmental Determinants of Physical Activity and Sedentary Behavior

Saturday, May 30, 2020, 9:00 AM - 11:00 AM
Room: CC-2007

3618 May 30 9:00 AM - 11:00 AM
Chair: Eric J. Shiroma. *National Institutes of Health, Bethesda, MD.*
(No relevant relationships reported)

3619 Board #1 May 30 9:00 AM - 11:00 AM
Do Environmental Factors Predict Changes To Physical Activity And Sedentary Behaviour Equally?
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Purpose

To investigate environmental determinants of change to sedentary behaviour (SB), light-intensity physical activity (LPA) and moderate-to-vigorous intensity physical activity (MVPA) in those at risk of diabetes.

Methods

Cohort of 808 adults recruited from family practice (age = 63 years, BMI = 32 kg/m², women = 36%) followed up annually over 3 years. Participants were included based on being above the 90th percentile of the Leicester Diabetes Risk Score, indicating a high risk. SB, LPA and MVPA were measured by accelerometer (Actigraph GT3X) using the Freedson cut-points with at least 4 valid days of data. Geographical and air pollution mapping were used to link environmental data to participant's home address. Data were analysed using a repeated measures design assessing determinants of change to SB, LPA and MVPA. Results are presented as mean (SD) or mean (95% CI).

Results

At baseline, accelerometers were worn for an average of 649 (83) minutes/day, during which an average of 27 (25) minutes/day, 288 (77) minutes/day and 543 (100) minutes/day were spent in MVPA, LPA and SB respectively. Across the study period, wear time did not change, whilst SB increased by 9 (7, 10) minutes/day per year, matched by a decrease in LPA and MVPA of 7 (5, 8) and 2 (1, 2) minutes/day per year respectively. Less green space, higher road connectivity (busier traffic), greater air pollution and a higher density of fast food restaurants were all determinants of increasing SB and decreasing LPA (See Table 1), but none were associated with change to MVPA. Environmental factors were stronger determinants of change to SB and LPA than an overall index of social deprivation.

Conclusion

In this high risk population, a less healthy environment predicted greater annual increases in SB and decreases in LPA, but not MVPA. Policies and interventions aimed at improving the liveable environment may therefore act to slow the trajectory of increasing SB and decreasing LPA in populations at risk of diabetes.

Table 1: Association between environmental factors and annual change to SB, LPA and MVPA

Environmental determinant	Change in sedentary time (minutes/day per year) for a given unit difference in the corresponding environmental factor	Change in light-intensity physical activity (minutes/day per year) for a given unit difference in the corresponding environmental factor	Change in moderate-to-vigorous physical activity (minutes/day per year) for a given unit difference in the corresponding environmental factor
Greenspace (% within 800m radius)	-2.34 (-4.30 to -0.38)	2.00 (0.26 to 3.74)	0.32 (-0.22 to 0.86)
Road density (km of road within 800m radius)	0.96 (-0.35 to 2.26)	-0.78 (-1.95 to 0.38)	-0.16 (-0.52 to 0.20)
Footpath density (km of footpath within 800m radius)	1.06 (-4.85 to 6.96)	-0.97 (-6.22 to 4.28)	-0.06 (-1.68 to 1.56)
Intersections that are connected (% within 800m radius)	6.41 (1.19 to 11.64)	-6.43 (-11.07 to -1.79)	-0.045 (-1.39 to 1.48)
Air pollution (prevailing outdoor nitrogen dioxide and particulate matter concentrations with 800mx 800m area: NO ₂ , PM2.5 and PM10/µg·m ³)	1.42 (0.34 to 2.50)	-1.25 (-2.20 to -0.29)	-0.16 (-0.46 to 0.14)
Fast Food (restaurants within 1km radius)	1.09 (0.38 to 1.80)	-1.00 (-1.63 to -0.47)	-0.09 (-0.28 to 0.11)
Social deprivation (index of multiple deprivation score)	0.04 (-0.09, 0.18)	-0.06 (-0.19, 0.07)	0.02 (-0.02, 0.06)

Data as mean (95% CI). Adjusted for age, sex and ethnicity. Bold indicates significance (p < 0.05)

3620 Board #2 May 30 9:00 AM - 11:00 AM
Differences In College Student Physical Activity Relative To Living Environment
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(No relevant relationships reported)

BACKGROUND: Physical activity (PA) levels are decreasing among college aged individuals in the US. To develop healthy behavior-change strategies for these individuals, a better understanding of their living environment is needed. **PURPOSE:** This study compared PA trends of college students relative to their living environment. **METHODS:** A volunteer sample of students (n = 338) from a large northeastern US university completed an online survey. Demographics, height/weight, frequency/mode of active travel to/from campus, and amount of self-reported weekly PA were obtained. Students were dichotomized into groups depending on their self-reported walking time to campus (≥15 or <15 minutes), never walk or walk ≥ once/week to campus, and if they have a bus pass or not. An equipment index was created using the participants self-reported responses to their access of multiple types of recreational facilities/equipment at their home (e.g. treadmill, pool, etc.). These groups were compared to moderate PA (MPA), strength training (ST), vigorous PA (VPA) minutes, and walking time to campus using t-tests. **RESULTS:** Participants were primarily white (n = 182, 60.3%) and majority were female (n=153, 50.5%). Students that live ≥ 15 minutes from campus had significantly lower levels of weekly MPA (p = .024), METS (p = .021), and ST (p = .002). Weekly MPA, METS, and ST (p < .05) were also significantly lower in students who did not walk to campus at least once a week. Students that had access to a bus pass showed lower amounts of MPA, METS, and ST per week (p < .05). Students who did not walk once a week to campus and those who lived ≥ 15 minutes away from campus had significantly higher accessibility to exercise equipment. **CONCLUSIONS:** There were significant differences in the amount of weekly PA for those living further from campus. Even though students showing higher

accessibility to exercise equipment live further away, they are more likely to use non-active travel methods. Active travel, especially in college students, is shown to be an important and significant variable to increase and meet weekly PA levels.

3621 Board #3 May 30 9:00 AM - 11:00 AM
Age-difference In The Association Of Built Environment With Walking In Older Adults

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 (No relevant relationships reported)

PURPOSE: It remains unclear whether the relationship between built environment and walking behavior differ by age groups. Therefore, this study aimed to examine age-related differences in associations of built environmental attributes with walking in older Taiwanese adults. **METHODS:** This study was based on a cross-sectional telephone survey using a computer-assisted telephone interviewing, targeting 1,068 older Taiwanese adults (over 65 years) in 2017. Time spent in walking was measured by the short version of the International Physical Activity Questionnaire. Built environmental attributes were assessed by geographic information systems (GIS), including population density, street connectivity, sidewalk availability, leisure destinations, utilization destinations & access to public transportation. Adjusted binary logistic regression models adjusting for potential confounders were employed to examine the relationships between the seven built environment variables & walking time in total sample, and stratified for young (65-74 year) & old (75+ years) older adults. **RESULTS:** A total of 1,040 respondents provided complete information for analysis. The mean age (SD) of the respondent was 73.04 (\pm 6.13) years. 68.8% achieved 150 min of walking in a week. In total sample, only one GIS-derived environmental attribute - leisure destinations was positive associated with the 150 min of walking in a week (odds ratio (OR)=1.34, 95% confidential interval (CI)=1.02-1.75). After stratifying by age groups, among 65 to 74 age group, population density was negative associated with the 150 min of walking in a week (OR=0.65, 95%CI=0.46-0.93) and number of leisure destination was positive associated with the 150 min of walking in a week (OR=1.55, 95%CI=1.10-2.19). However, no significant associations were observed between all built environmental attributes and walking in old adults who aged over 75 year. **CONCLUSIONS:** These results showed that age could be a potential moderator between built environment and walking in older adult population. High-density neighborhoods with favorable leisure destinations can be supportive for walking among young older adults (65-74 year). However, for old older adults (over 75 years), it is critical to further explore other multi-level factors related to their walking behavior.

3622 Board #4 May 30 9:00 AM - 11:00 AM
Physical Fitness And Neighborhood Design - Walkability, Cardiorespiratory Fitness, Muscular Strength, And Flexibility In Adults

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 (No relevant relationships reported)

Regular physical activity can improve physical fitness levels and promote health. Consistent evidence suggests an association between the neighborhood built environment and physical activity exists, yet few studies have investigated the contribution of the neighborhood built environment to fitness levels in adults. **PURPOSE:** To investigate the associations between objectively-determined and self-reported neighborhood walkability and perceived cardiorespiratory fitness, muscular strength, and flexibility. **METHOD:** We recruited a random sample of 592 adults (\geq 18 years of age) from Calgary (Canada). Participants provided complete data to an online questionnaire capturing perceived cardiorespiratory fitness (CRF), muscular strength (MS), and flexibility, frequency of moderate-to-vigorous physical activity (MVPA), frequency of strength training, and sociodemographic characteristics. The questionnaire also captured participant's perceptions of their neighborhood's walkability (Physical Activity Neighborhood Environment Scale; PANES) and the physical activity supportiveness of neighborhood parks (Park Perceptions Index; PPI). Objectively-measured walkability was estimated using Walk Score® assigned to each participant's residential postal code. Covariate-adjusted linear regression estimated the associations between the built environment and perceived fitness variables. **RESULTS:** The average age of participants was 46.6 (14.8) years and 67.2% were female. Participants, on average, participated in at least 30-minutes of MVPA on 3.4 (2.1) days/week and reported strength training 2.0 (1.8) days/week. Walk Score® was not associated with any fitness variables. The PANES index was positively associated ($p < .05$) with CRF, MS, flexibility and overall fitness and the PPI was positively

associated ($p < .05$) with all fitness variables except MS. **CONCLUSION:** Our novel findings suggest the neighborhood built environment has the potential to support and promote higher fitness levels in adults.

3623 Board #5 May 30 9:00 AM - 11:00 AM
Features Of Neighborhood Parks Associated With Use And Physical Activity In Knoxville, Tn

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Visits by people to local neighborhood parks for moderate-to-vigorous physical activity (MVPA) may relate to the design of the park. The number, and condition, of facilities and amenities integrated into the park design can create a variety of potential activity zones for MVPA. **PURPOSE:** To understand how park users acquire MVPA across a variety of park features within the City of Knoxville, a mid-sized city in the Appalachian region. **METHODS:** Physical activity, both active and passive, was assessed at 12 parks equally distributed across the City of Knoxville Parks and Recreation Planning sectors. The System for Observing Play and Recreation in Communities (SOPARC) was used to directly observe activity over two weeks, a week in October 2018 and a week in March 2019. Observations covered 4 days of the week at three different time points. Across all parks, 42 scan zones were identified and categorized into 6 physical activity zones (athletic field, athletic court, playground, open space, pavilion + athletic field, and pavilion + open space). Demographic profiles of users, their observed physical activity types, and average MET-intensity across zones were calculated. SPSS (version 25) was used to contrast observations. **RESULTS:** In total, 1,548 activity zone scans observed 3,961 residents using the parks. Users were predominately male (53.8%), adult (55.2%), and white (66.5%). During the scans, 70.5% of the zones were empty. In zones with users (N=477), the most commonly observed primary activity was walking (25.1%). The activity zones with the lowest level of users were athletic fields (13.5%), open spaces (16.1%), and athletic courts (17.3%). Playgrounds (32.2%) had the highest level of use. Related to intensity, zones with moderate or above intensity levels included: athletic fields (3.9 METs), athletic courts (3.8 METs), and playgrounds (3.16 METs). **CONCLUSIONS:** Park features with the greatest potential for MVPA (athletic courts/fields) attract the fewest number of park users. As recreation and public health officials strive to attract more users who are physically active when they visit a park, they should consider other features, especially those that promote walking.

3624 Board #6 May 30 9:00 AM - 11:00 AM
Effects Of Home Environment On Physical Activities With Different Intensity In High School Students

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Except school, home is the second largest place for students to encounter their daily lives, so physical and social environment of the family can contribute either positively or negatively to lifestyle behaviors of students. **PURPOSE:** This paper will quantitatively study the effects of home environment on different physical activities (PA) of high school students. **METHODS:** We conducted the research on 314 Chinese high school students and their parents. The home environment survey includes 39 items divided into four scales (PA availability, PA accessibility, Parental role modelling of PA, Parental policies to support PA). The PA of students divided into three different intensity (Sedentary Behavior, Light intensity, Moderate and Vigorous intensity) were measured by Actigraph GT3X+ device. The data was analyzed using the multiple linear regression. **RESULTS:** A one standard deviation (SD) increase in PA accessibility, mother role modelling of PA, mother policies to support PA was associated with a reduction in SB (minutes/week) by 65.44 ($p < 0.05$), 116.87 ($p < 0.01$) and 175.42 ($p < 0.01$) respectively. A one SD increase in PA accessibility, mother policies to support PA was associated with an increase in LPA (minutes/week) by 12.65 ($p < 0.01$) and 16.91 ($p < 0.01$) respectively; an increase MVPA (minutes/week) by 81.11 ($p < 0.01$) and 52.21 ($p < 0.05$) respectively. **CONCLUSIONS:** With the development of PA accessibility, the modeling and supportive policies of mother, the SB of high school students can be reduced significantly. And the PA accessibility and supportive policies of mother can evidently improve students' LPA and MVPA.

Table 1. Characteristics of sample

	Total	Male	Female	Range
N	314	178	136	
Characteristics, mean (SD)				
Age (year)	15.70(0.62)	16.08(0.47)	15.38(0.54)	14-19
Height (cm)	165.87(7.65)	175.9(5.82)	162.18(4.13)	155-183
Weight (kg)	62.63(12.72)	70.36(13.28)	59.79(11.24)	43.4-105.1
PA, mean (SD)				
SB (min/week)	7177.55(1872.00)	7590.31(952.20)	6637.33(2533.30)	2202.83-10149.23
LPA (min/week)	338.03(215.60)	446.71(178.62)	195.79(173.16)	199.16-832.72
MVPA (min/week)	1585.24(896.22)	2071.63(760.90)	948.64(618.84)	64.13-3492.83
Home environment, mean (SD)				
Home physical environment				
PA availability	12.62(3.65)	12.88(3.63)	12.29(3.66)	4-20
PA accessibility	7.83(3.52)	9.48(2.84)	5.68(3.14)	0-15
Home social environment				
Parental role modelling of PA				
Father	15.69(5.28)	16.65(5.37)	14.45(4.89)	0-33
Mother	16.74(4.11)	17.37(4.76)	15.91(2.88)	0-29
Parental policies to support PA				
Father	22.29(6.62)	23.82(7.20)	20.29(5.15)	0-43
Mother	8.64(3.17)	9.45(3.38)	7.58(2.52)	0-17

Table 2. The relationship between home environment and different physical activity of sample

Variable	Male only		Female only		Total	
	Coefficient	95%CI	Coefficient	95%CI	Coefficient	95%CI
SB^a						
PA availability	-46.47	(-92.19, -0.75)	-62.49**	(-87.55, -37.43)	-46.95	(-87.44, -6.46)
PA accessibility	-9.32	(-14.83, -3.81)	-49.24	(-109.47, 10.99)	-65.44*	(-90.11, -40.77)
Parental role modelling of PA (father)	-44.95	(-66.85, -23.05)	-308.42*	(-570.01, -46.83)	-57.68	(-65.94, -49.42)
Parental role modelling of PA (mother)	-9.60	(-26.88, 7.68)	-317.76**	(-476.13, -159.39)	-116.87**	(-184.88, -48.86)
Parental policies to support PA (father)	-60.70*	(-81.74, -39.66)	-64.61	(-79.53, -49.69)	-4.68 ^o	(-12.81, 3.45) ^o
Parental policies to support PA (mother)	-16.63	(-25.26, -8.01)	-54.66*	(-97.08, -12.24)	-175.42**	(-236.98, -113.86)
LPA^c						
PA availability	10.41**	(1.82, 19.00)	18.39**	(10.48, 26.31)	-0.15	(-6.93, 6.63)
PA accessibility	-9.18	(-21.24, 2.88)	-10.07	(-19.62, -0.51)	12.65**	(5.28, 20.01)
Parental role modelling of PA (father)	-7.92	(-21.42, 5.58)	2.51	(-15.50, 20.53)	6.32	(-5.81, 18.45)
Parental role modelling of PA (mother)	3.55	(-5.34, 12.44)	-16.49	(-27.39, -5.58)	-6.50	(-14.12, 1.13)
Parental policies to support PA (father)						
Parental policies to support PA (mother)	4.70	(-8.20, 17.60)	12.89*	(3.63, 22.15)	16.91**	(5.53, 28.30)
MVPA						
PA availability	-34.81	(-71.42, 1.80)	70.85**	(41.83, 99.86)	4.21	(-23.03, 31.45)
PA accessibility	-0.27	(-51.622, 51.093)	-19.75	(-54.76, 15.25)	81.11**	(51.52, 110.70)
Parental role modelling of PA (father)	-37.56	(-95.06, 19.94)	31.33	(-34.70, 97.35)	23.95	(-24.80, 72.69)
Parental role modelling of PA (mother)	4.45	(-33.40, 42.30)	44.41*	(4.44, 84.39)	-24.04	(-54.67, 6.59)
Parental policies to support PA (father)	49.80*	(0.94, 98.67)	20.69	(-82.32, 40.93)	5.48	(-38.71, 49.66)
Parental policies to support PA (mother)	10.99	(-43.94, 65.93)	27.22	(-33.34, 87.78)	52.21*	(6.48, 97.93)

Notes: * p < 0.05; ** p < 0.01.

3625

Board #7

May 30 9:00 AM - 11:00 AM

Home Environment Factors Associated With Children's Physical Activity Levels In A Rural Population

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(No relevant relationships reported)

The physical and built environments are related to physical activity (PA) in adults and the relationship seems apparent in children. Child PA behavior often depends on parents in a variety of ways including involvement, facilitation, or role modeling. The home environment is one setting in which these relationships may be further examined. **PURPOSE:** To examine how facets of the home environment and parent perceptions of neighborhood safety may be associated with child total PA and moderate-to-vigorous (MVPA) levels in a rural sample.

METHODS: Baseline data were analyzed from NU-HOME, a childhood obesity prevention, randomized controlled trial in rural communities. 105 children (age=8.96±1.06 yrs) and their parents (age=37.91±5.42 yrs) reported on sociodemographics and home/neighborhood environments. Child daily PA (total and MVPA) was measured using accelerometers and, using SAS 9.4, associations were examined with home/neighborhood environment variables through multivariate regression models, both unadjusted and adjusted for economic assistance. Normality was not met for child daily MVPA therefore analyses used the log-transformed variable.

RESULTS: Mean child total PA was 259.08±58.22 min/day and MVPA was 44.95±18.58 min/day. In unadjusted analyses, access to PA equipment in the home (p=0.037) and neighborhood safety (p=0.049) were associated with total PA; however, no factors were statistically significantly associated with MVPA, although access to PA equipment (p=0.088) and family support for PA (p=0.062) were trending towards significance. For both total PA and MVPA outcomes, the regression models including all variables and accounting for economic assistance were statistically significant (p=0.026 and p=0.034, respectively). For each model, the individual effects of parent PA and PA equipment were statistically significant (p ranges from 0.008 to 0.037).

CONCLUSIONS: This study highlights the potential of the home/neighborhood environment as a space for interventions to increase PA in rural children. Only 14% of children in this rural sample met PA recommendations, so interventions to increase PA, particularly MVPA, are needed. Future studies should include multiple levels of a rural child's environment (i.e., school, town) to examine which may play the largest role in PA.

3626

Board #8

May 30 9:00 AM - 11:00 AM

Patterning Of Physical Activity And Sedentary Behavior At And Away From School In Preadolescent Children

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(No relevant relationships reported)

BACKGROUND: Understanding *how* and *where* children accumulate their physical activity and sedentary minutes throughout the day has important implications for behavioral interventions. The purpose of this study was to examine the patterning of habitual physical activity (PA) and sedentary time (SED) at and away from school among preadolescent children. **METHODS:** Forty children ages 7-11 (55% girls; 60% non-white; 25% overweight/obese) participated in this study. Proportion of time spent in PA, moderate-to-vigorous physical activity (MVPA) bouts, proportion of time spent in SED, and SED bouts were examined on school days (in-school and out-of-school) and weekends via accelerometry. Accelerometers were worn on the right hip for one week. Data were downloaded into 60-second epochs and Evenson cut points were used to derive intensities. A MVPA bout was defined as consecutive minutes the accelerometer registered 2296 or more counts per minute, with a minimum of 5, 10, and 15 minutes or more of MVPA. A sedentary bout was defined as consecutive minutes the accelerometer registered less than 100 counts per minute, with a minimum of 30, 60, and 120 minutes or more of SED. **RESULTS:** In school days compared to weekend days, the proportion of time in vigorous PA was greater (0.9% (9.5 min.) vs. 0.6% (6.1 min.); p=0.02), but similar levels of light PA, moderate PA and SED (p's>0.05). When comparing school time with non-school time on school days, children accumulated a higher proportion of light PA [46.7% (3 hr.) vs. 33.8% (3.9 hr.), p=0.01] but similar proportions of moderate and vigorous PA (p's>0.05). There were no differences in the number of MVPA bouts accumulated in-school, out-of-school, on school days and weekends (p's>0.05). At school, the proportion of time spent in SED was less (48.8% (3.15 hr.) vs. 62.6% (7.28 hr.), p=0.01) and fewer children spent time engaged in prolonged sitting at school [uninterrupted sedentary time for 30 minutes (67.5% vs. 92.5%, p=0.006), 60 minutes (22.5% vs. 80.0%, p<0.001), and 120 minutes (7.5% vs. 42.4%, p<0.001)]. **CONCLUSIONS:** These findings suggest children are

the most active and least sedentary when at school, yet children only accumulated 17.5 minutes of MVPA in this environment. Thus, in-school and out-of-school interventions are needed to help children meet the daily recommended minutes of PA.

G-20 Thematic Poster - Physical Activity and Health Equity

Saturday, May 30, 2020, 9:00 AM - 11:00 AM
Room: CC-2009

3627 May 30 9:00 AM - 11:00 AM

Chair: Michelle Martin, FACSM. *University of Tennessee, Memphis, TN.*

(No relevant relationships reported)

3628 Board #1 May 30 9:00 AM - 11:00 AM

Influence Of Social Networks On Nutrition And Physical Function Of Ethnic Older Minorities Over Time

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BACKGROUND: Social networks (SN) are consistently shown to influence health outcomes in later life. However, relatively little is known about SN of ethnic older minorities, and how they impact on health outcomes over time. **PURPOSE:** To explore SN and their impact on nutritional intake and status, and physical function in ethnic older minorities (≥ 60 years) living in Birmingham, United Kingdom. **METHODS:** SN were assessed using the Wenger Practitioner Assessment of Network Types (PANT). Multiple-pass 24-hour dietary recalls and the Mini Nutritional Assessment-Short Form assessed nutritional intake and status, respectively. Short Physical Performance Battery (SPPB) and handgrip strength measured physical function. Correlation and regression analyses examined relationships between SN, physical function, nutrient intake and nutritional status. The influences of SN were captured through semi-structured interviews at baseline (N=92) and follow-up (N=81). Interviews were transcribed verbatim and analysed using directed content analysis. **RESULTS:** Of the 100 participants measured at baseline, 81 were followed up 8-months later. Mean age = 70.9 \pm 8.1 years (62% male) comprising African/Caribbean (65%), South Asian (28%), and other ethnicities (7%). Five SN were identified and grouped into two broad categories: integrated SN (locally integrated (44%) and wider community (8%)); and non-integrated SN (family dependent (25%), locally self-contained (17%), and private restricted (6%). At follow-up, SN declined in 19% and improved in 11%. There was an overall decrease in physical function (F(1))=9.73, P=0.03) and nutritional status (F(1))=6.04, P=0.016) over time. Participants in integrated SN compared with non-integrated SN at baseline were less likely to experience a decline in physical function at follow-up (OR: 0.17; 95% CI:0.04-0.63). Qualitative results indicate that participants with declines in SN perceived this as causing poorer physical function and eating behaviours. **CONCLUSION:** Changes in SN occurred over a relatively brief period in this sample, with integrated SN associated with better physical function, nutritional intake and status. These findings can inform interventions and community outreach programmes designed to enhance SN and the health status of this population.

3629 Board #2 May 30 9:00 AM - 11:00 AM

Acculturation And Leisure-time Physical Activity Among Asian American In The United States, 2011-2016

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(No relevant relationships reported)

The Asian population has become the fastest growing ethnic group in the United States (US). However, less than a quarter of Asian Americans met WHO Physical Activity (PA) Guideline. Few studies have examined the association between acculturation and leisure-time PA among Asian Americans.

PURPOSE: To examine the association between acculturation and leisure-time PA among Asian American adults.

METHODS: Data concerning 1,989 Asian Americans aged 20 years and older, came from the 2011-2016 National Health and Nutrition Examination Survey (NHANES). Acculturation was assessed in three dimensions: the language preference at home (only Non-English language, both English and Non-English language, and only English), length of residency in the US (<10 years, 10-29 years, ≥ 30 years, US born), and

birth locations (US-born, foreign-born). Using self-reported minutes/day and days/week moderate and vigorous leisure-time PA, we calculated moderate-to-vigorous PA (MVPA) MET minutes/week. MVPA was analyzed as a continuous variable and a categorical variable (i.e., meeting WHO PA guidelines, ≥ 600 MET minutes/week) in multiple linear and logistic regression models after controlling for covariates, respectively.

RESULTS: Among participants, 24.5% of Asian Americans spoke only English at home, while 47.8% spoke only non-English at home. 13.0% of participants were born in the US. The odds of meeting PA guidelines were higher among Asians speaking only English (adjusted OR [AOR]=1.8, 95% confidence interval [CI]: 1.4, 2.4) and those speaking both non-English and English at home (AOR=1.6, 95% CI: 1.3, 2.0), compared to those who spoke only non-English at home. US-born Asians were more likely to meet PA guidelines than foreign-born Asians (AOR=1.8, 95% CI: 1.3, 2.6) and on average they performed 137 more minutes of leisure-time MVPA each week than foreign-born Asians. Asians in the US since birth had higher odds to meet PA guidelines than Asians stayed in US for less than 10 years (AOR=2.2, 95% CI: 1.5, 3.3).

CONCLUSIONS: More acculturated Asian Americans such as those who spoke more English at home and US-born Asians, perform more leisure-time MVPA than less acculturated Asian Americans. Interventions are needed to promote PA among non-English speaking Asian immigrants and those who stayed in the US for less than 10 years.

3630 Board #3 May 30 9:00 AM - 11:00 AM

Developing Smart Goals With Latinos To Address Their Life Concerns Surrounding Physical Activity And Recreation

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(No relevant relationships reported)

PURPOSE: Raices was a community health worker (promotore)-delivered intervention offering non-directive social support to improve healthcare access, physical activity, and healthy eating among Latinos living in an emerging community, an area with a small yet growing Latino population. The purpose of this study was to determine whether the intervention helped participants develop SMART (i.e., specific, measurable, realistic, attainable and time-bound) goals that addressed their life concerns, specifically highlighting those findings related to physical activity. **METHODS:** Promotores used an intervention tool assessing wellness in eight domains of participants' lives (e.g., family, physical activity/recreation) and supported participants in developing SMART goals to address their life concerns. The research team summarized participants' data and assessed whether the goals 1) met SMART criteria and 2) focused on participants' identified concerns. **RESULTS:** We recruited 192 Latino participants from South America (42%), Mexico (30%) Central America (11%) and other countries (10%). Participants ranked physical activity and recreation (18.2%) and eating habits (17.8%) as top areas that were concerning or very concerning. Overall, participants developed 195 goals after the first intervention visit. Most goals met the SMART criteria completely (35.4%) or partially (48.7). Of the 195 goals set, 30% of them focused on physical activity/recreation, and 91% of those goals met the SMART criteria completely or partially.

CONCLUSIONS: Promotores successfully elicited participant life concerns and assisted them in setting SMART goals to address these areas of concern, including a top concern of physical activity/recreation. The intervention would benefit from additional promotores training in developing SMART goals.

3631 Board #4 May 30 9:00 AM - 11:00 AM

Aging Effects Of A 12-month Period On Cardiometabolic Risks In Older Adults

Kivana Keane¹, Alexis Sides¹, Austin Anderson¹, Malli Fowler¹, Sarah Gingerich¹, Shannon Hinson¹, Adam Lavis¹, Jessica Martin¹, Benjamin Patterson¹, Colleen Pecoraro¹, Tommy Scott¹, L. Jerome Brandon, FACSM², Trudy Moore-Harrison¹. ¹UNC-Charlotte, Charlotte, NC. ²Georgia State University, Atlanta, GA. (Sponsor: L. Jerome Brandon, FACSM)
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PURPOSE: Aging is characterized by decreased functional ability and increased cardiometabolic (CMO) risks. Being physically active is believed to slow these diminishing characteristics in older adults. Therefore, the purpose of this study was to determine if CMO values would decline following a 12-month period in active older adults.

METHODS: The participants were 148 active older adults from the metropolitan area of a southern city. Activity ranged from participating in structured fitness classes

to participating in limited physical activity. Overall, the community was active. The participants were measured for CMO risks and morphological characteristics initially and 12 months later and two tests were statistically evaluated for differences.
RESULTS: The participants were obese based on body fat% (40%) and overweight based on body mass index (BMI - 29.1). Triglyceride (Trig- 150 mg/dL) on the posttest and systolic blood pressure (137 mmHg) on the pretest were the only variables that met risk classification based on metabolic syndrome risk criteria. High density lipoproteins (59 to 62 mg/dL) improved on the posttest. Generally, there was a trend toward improvement for the other CMO variables. The percent different (%diff) between the variables for the two tests ranges from 0 for DBP to 13.6% for Trig. Trig had the largest %diff, but also had the largest variability between assessments and therefore, was not significant.
CONCLUSIONS: Data suggest that CMO variables remained stable in a physically active community of older adults during a 12-month period. Efforts should be made to keep older adults active as they age.

3632 Board #5 May 30 9:00 AM - 11:00 AM
Bmi Influence On Quality Of Life Following Physical Activity Program For Women In Homeless Shelters
 Lori A. Thomas. *Lebanon Valley College, Annville, PA.*
(No relevant relationships reported)

BMI Influence On Quality Of Life following Physical Activity Program For Women In Homeless Shelters
 Lori A. Thomas, Jenna M. Marx, McKenna Lupold, Abigail Kinneman, Hayley McGlory, Tonya Y. Miller.
 Lebanon Valley College, Annville, PA.
PURPOSE: Examine if BMI category was associated with the outcomes of a 4-week physical activity educational program on the quality of life and physical fitness of nine women who were homeless and residing in urban environment shelters. **METHODS:** The educational program, Be Active Your Way, intervention incorporated educational sessions one time a week for four weeks led by student investigators. Researchers measured the programs' effectiveness with pre- and post- program assessment using the Healthy Days Core Module, Two Minute Walk Test (2MWT), Perceived Stress Scale (PSS), and the Acceptance and Action Questionnaire (AAQ-II). **RESULTS:** Women who were overweight and residing in homeless shelters showed a trend on the AAQ-II in the decreased number of days their health affected activity, but the trend was not significant (pre=7.6 days, post=4 days); $p > .05$. Women who were Class II obese residing in homeless shelters showed a decreased trend in their psychological inflexibility score, but the trend was not significant (pre=29.5, post =20.5); $p > .05$. There were no significant statistics or other noticeable trends among BMI classification data in relation to PSS or 2MWT. **CONCLUSION:** Findings from this study showed that BMI category did not contribute significantly to health-related quality of life outcomes following a physical activity program among women residing in a homeless shelter. Women residing in a homeless shelter may find an educational physical activity program beneficial, regardless of BMI category.

3633 Board #6 May 30 9:00 AM - 11:00 AM
IDENTIFYING DISPARITIES IN YOUTH HEALTHCARE ACCESS POST-SPORT RELATED CONCUSSION AND POST CONCUSSION SYNDROME
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(No relevant relationships reported)

Disparities in healthcare may occur when availability, accessibility, and quality of healthcare services differ. These factors influence health, resulting in differences in morbidity and mortality. Among injuries, concussion and post-concussion syndrome may lead to significant long-term impairments in up to 40% of youth, with a greater number of impairments seen in minority populations. During recruitment for a previous study, lack of population diversity prompted an exploration of our patient population. **PURPOSE:** The purpose of the study was to explore differences in race, ethnicity, and sex among youth and young adults who sought care for concussion or post-concussion symptoms within a large academic medical center to determine whether differences exist among sub-groups.
METHODS: Utilizing an Integrated Data Repository, i2b2, a query was performed to determine the number of individuals ages 10 to 34 years of age who sought care for concussion or PCS between 9/2015 and 6/2019 within a large academic health system. Over 3,270 youth, adolescents, and young adults (YAYA) sought healthcare and received a concussion or PCS diagnosis.
RESULTS: Among recipients of concussion care, there were 2, 226 (68%) non-Hispanic White, 720 (22%) African American/Black (AA/B), and 224 (.07%) Other. Post-Concussion Syndrome diagnoses among 1,143 YAYA of whom 796 (70%)

Caucasian, 210 (18%) AA/B, 17 (2 %) Biracial, and 103 (9%) Other. While males had more overall concussion diagnoses (n=1339, 60%), females had higher incidence of PCS (n=646, 56.5%).
CONCLUSIONS: Comparison of these results with community demographic data reveals AA/B and Hispanic YAYA seeking concussion care may be underserved within the trauma system. Additionally, higher incidence of female PCS deserves further exploration to ascertain whether individual, initial management, or delays in connecting with the healthcare system may be factors in persistent symptomatology post-TBI. Additional research is needed to ascertain health system factors that may address and reduce future disparities in TBI care delivery and patient outcomes, including geocoding to ascertain the impact of YAYA residence and proximity to the trauma center.

3634 Board #7 May 30 9:00 AM - 11:00 AM
Kids Fun, Food & Fitness: The Need For An Exercise And Nutrition Program For Children With ASD
 M Alysia Mastrangelo, FACSM¹, Mary Kientz², Joan Perks², Gabriele Bandelli¹, Carly Burnup², Kristin Cavorley², Emily Disbrow², Emily Sorochynskyj². ¹*Stockton University, Shamong, NJ.* ²*Stockton University, Galloway, NJ.*
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PURPOSE: Nationally, 1 in 59 children are diagnosed with an autism spectrum disorder (ASD) with NJ having the highest rates at 1 in 34 children. Children with ASD are more likely to experience health disparities that can impact quality of life. The disparities include an increase in type II diabetes, issues with food sensitivities, sensory processing impairments, and a decrease in time spent in moderate to vigorous physical activity (PA). The purpose of this study is to assess the need for a community/family-based exercise and nutrition literacy program for children ages 8-15 y.o. with an ASD.
METHODS: Participants (n=9) with an ASD diagnosis, ages 8-15 y.o. were assessed prior to initiation of the Kids: Exercise, Food and Fun program. The assessment included anthropometric measures, grip strength, plank, Stork test bilaterally, sit and reach and 6-minute walk. This study was approved by the Institutional Review Board for Human Subject at Stockton University.
RESULTS: At baseline the mean age of participants was 12.1 y.o. with 6 boys and 3 girls. The average weight was 55.1 Kg, and height was 149.4 cm. BMI was determined and subjects were categorized by CDC classification; n=3, healthy, n=1, overweight and n=5, obese. Waist circumference measures determined the majority (n=5) were at or above the 80th percentile for risk. Mean fitness measures are as follows; right grip strength =12.8 Kg, Stork test, right =12.80 sec and left =10.09 sec, plank =10.31 sec and sit and reach =22.44 cm. The mean distance for the 6MW was 366.19m.
CONCLUSIONS: These results indicate most participants were overweight or obese with an expected increased risk for comorbidities at baseline. Study participants demonstrated decreased grip strength, upper body strength and standing balance. They could benefit from an exercise and nutrition program with a parent or caregiver. The aim of the study will be to improve access to fitness activities and healthy food options. Sessions will consist of age appropriate PA and a cooking/nutrition class where participants will learn basic nutrition principles, food safety, and prepare a food to consume themselves. Post-assessment will evaluate body composition and fitness measures.

3635 Board #8 May 30 9:00 AM - 11:00 AM
Are Physical Therapists' Attitudes About Disability A Predictor Of Their Attitudes About Client-self-directed-mobility?
 Winston Kennedy¹, Jafra D. Thomas², Samuel W. Logan¹.
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Physical therapists (PTs) are expected to play a key role in supporting individuals with disabilities to lead independent, active, and healthy lifestyles. However, limited knowledge exists about dispositional factors that could influence PTs' motivation to provide healthcare that: (1) assist clients to overcome acute barriers to independent living and (2) supports clients to lead active, healthy lifestyles across the lifespan. **PURPOSE:** This study determined if PTs' attitudes about disability predicted their attitudes about client-self-directed mobility (i.e. independent mobility). **METHODS:** A convenience sample of 308 pediatric PTs were recruited from workshops held across 11 U.S. states between 2016 and 2017. Topics covered in the workshops included promoting and teaching ways to modify ride-on cars for young children with disabilities. Prior to their participation in the workshops, study participants completed two questionnaires: (1) the Attitudes Toward People with Disabilities Scale (ATDP; Cronbach $\alpha = .80$); and (2) the Attitudes Towards Self-Directed Mobility Scale

(ATSDM; Cronbach $\alpha = .72$). The lower the score on the ATDP, the more favorable the attitude. The higher the score on the ATSDM, the more favorable the attitude. Simple linear regression was used to test if ATDP scores predicted ATSDM scores. **RESULTS:** The ATDP M score was 2.4 ($\pm .45$), and the ATSDM M score was 4.4 ($\pm .42$). ATDP scores were a significant predictor of ATSDM scores ($\beta = -.12, p < .05$), but ATDP scores explained a minimal amount of variance in ATSDM scores, $R^2 = 0.016, F(1,306) = 4.938, p < .027$. **CONCLUSION:** PTs' attitudes about people with disabilities was a weak predictor of their attitudes about client-self-directed-mobility. Further, the ratio between the two attitudes was not one-to-one, suggesting context is an influential factor. The observed results could have been due to the self-beliefs participants held towards disability because of their occupational status as PTs and how they viewed disability (e.g., social model of disability). Future research is needed aimed at incorporating a broader range of predictors of attitudes about client-self-directed-mobility. Such work would add insight into PTs' dispositional factors that could influence the quality and type of healthcare that they provide to individuals with disabilities.

G-21 Thematic Poster - Physical Activity Children and Youth

Saturday, May 30, 2020, 9:00 AM - 11:00 AM
Room: CC-2010

3636 Chair: Tao Zhang. *University of North Texas, Denton, TX.*
(No relevant relationships reported)

3637 Board #1 May 30 9:00 AM - 11:00 AM
Evaluating Extension-supported Implementation Of A Classroom-based Physical Activity Program In Under-resourced Schools

Thomas Packebush, Katherine B. Gunter, FACSM, Tammy Winfield. *Oregon State University, Corvallis, OR.*
(No relevant relationships reported)

PURPOSE: Regular exposure to physical education (PE) increases children's physical activity, but access is not equitable, particularly in under-resourced schools. Oregon recently passed legislation requiring public elementary schools to provide PE for ≥ 150 minutes per week. BE Physically Active 2Day (BEPA 2.0) is a K-5 classroom-based physical activity program aligned to PE standards, developed to help under-resourced schools reach the mandated PE minutes. We evaluated BEPA 2.0 implementation among teachers in schools receiving BEPA 2.0 trainings. **METHODS:** County-based Cooperative Extension faculty were trained to deliver BEPA 2.0 teacher trainings. Trainings were conducted in 33 schools in fall 2018 and winter 2019 and 433 teachers attended trainings. Three to six months post-training, a brief survey assessing implementation factors was distributed to all teachers at trained schools. Descriptive and chi-square analyses were conducted to evaluate BEPA 2.0 use, and the relationship of training to use. **RESULTS:** A total of 212 teachers from 11 Oregon counties provided survey responses (49% response rate). Overall, 92.4% of teachers reported using BEPA 2.0, most commonly to provide classroom activity breaks (88.8%) and meet PE minute requirements (44.9%). Forty-four percent of teachers chose BEPA 2.0 for its alignment to state PE standards. Most teachers (74.2%) implement 1-2 times per week, with extra support from trainers (e.g., email prompts, booster trainings) reported among 66.9% of users. More trained (82.8%) versus untrained teachers (53.3%) reported using BEPA 2.0 ($p=0.006$). **CONCLUSIONS:** Results indicate a high rate of BEPA 2.0 use, particularly among trained teachers. This suggests training is an important component of the implementation process. Increasing trainings and support for teachers may increase frequency of use.

3638 Board #2 May 30 9:00 AM - 11:00 AM
Aggregated Impact Of Locally Implemented SNAP-Ed Programming On Physical Activity In Michigan Youth

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(No relevant relationships reported)

Equity in physical activity engagement is a critical issue. Supplemental Nutrition Assistance Program Education (SNAP-Ed) reaches low-income youth, with physical activity as one of the key foci. In Michigan, SNAP-Ed includes locally relevant programs selected and implemented by community organizations. Consistent evaluation is conducted across programs. **PURPOSE:** To evaluate state-level change in physical activity and sedentary behaviors of Michigan youth who receive locally relevant SNAP-Ed programming selected and implemented by community-based

organizations. **METHODS:** Participants were youth (grades 4th-8th) receiving SNAP-Ed programming that included evidence-based interventions with a physical activity component. Youth received a physical activity questionnaire pre- and post-intervention. Participant data were matched based on demographic indicators, and data were aggregated at the state-level. Descriptive statistics were calculated for all variables of interest, and Wilcoxon Signed Rank tests were used to compare differences pre- and post-intervention for physical activity and sedentary behaviors (i.e. weekday hours spent watching TV). **RESULTS:** Participants included 1,899 youth (grades 4th-8th) from SNAP-Ed programming delivered through 15 different community organizations across Michigan. The majority of participants were Caucasian (65.0%) and non-Hispanic (86.5%), and approximately one-half were male (49.9%). A statistically significant increase was found for the number of days that youth self-reported being physically active for at least 60 minutes pre- and post-intervention (pre: 4.18 ± 2.13 ; post: 4.43 ± 2.05 ; $p < 0.000$), and a statistically significant decrease was found for the number of hours youth reported watching TV on a weekday pre- and post-intervention (pre: 1.76 ± 1.55 ; post: 1.66 ± 1.49 ; $p = 0.012$). **CONCLUSIONS:** Implementation of locally relevant SNAP-Ed programming selected by community organizations can positively impact physical activity and sedentary behaviors. Future research should explore commonalities amongst locally relevant programs to identify key implementation characteristics for greatest impact and progress toward equity.

3639 Board #3 May 30 9:00 AM - 11:00 AM
Investigation On The Prevalence Of Scoliosis In Primary And Secondary School Students In Changzhou

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(No relevant relationships reported)

Purpose: With the increase of academic pressure, students spend more time in sedentary behaviour. Long-term wrong sitting posture will bring many health problems. To investigate the prevalence of scoliosis among primary and secondary school students in Changzhou City.

Methods: From May to July 2019, we measured the spine index of 10229 students (age: 10-13 years) from 7 primary and 3 middle schools in Changzhou City, including 5437 boys and 4708 girls, 84 of whom did not participate in the screening, and 10145 of whom were effectively screened. We screen scoliosis in three steps: 1: with examine back exposed and standing naturally, the examiner check if the shoulders are equal in height; whether lower scapular horn, bilateral lumbar fovea is symmetrical; whether bilateral ilium ridge is equal; the above has an anomaly positive, can be defined as posture abnormality. 2: positive result of first test, carry out Adam test, if Adam bending test has the above signs, measure the back with the spine, the maximum oblique part and angle of spine, if the deviation is more than 5 degrees, it is suspected scoliosis, if it is greater than 10 degrees, it can be defined as scoliosis. If the Adam bending test has the above signs, the spine is measured by the ruler. 3: the patients with suspected scoliosis were diagnosed as scoliosis by radiologist to take the full-length orthopedic radiography of the upright spine and measure the Cobb angle $\geq 10^\circ$.

Results: In first step, 4585 cases of abnormal posture, the incidence of bad posture was about 45.2%, the detection rate of high and low shoulders among the students was 35.2%, the detection rate of boys was 28.5%. The detection rate of female students was 38.8%. The incidence of pelvic rotation was 15.1% in boys and 17.9% in girls, and the incidence of lateral flexion in neck was 4% in boys and 9% in girls. The detection rate of scoliosis was 24.3%. Finally, some students carried out the third inspection, and the consistency between the third inspection and the second inspection reached 98%.

Conclusion: Through screening, it was found that the detection rate of abnormal posture was high. Therefore, the establishment of spine health records will help them pay attention to spine health. Supported by Social Science Foundation of Jiangsu Province (BE2018752), Science and Technology Support Plan of Changzhou (CE20195046).

3640 Board #4 May 30 9:00 AM - 11:00 AM
Physical Activity Contributions From An Outdoor Education Pre-kindergarten Program

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Traditional educational practices may contribute to the overall decline in physical activity (PA) and increases in sedentary behaviors (SB) that have been documented as children age. Beginning early in children's elementary education, unstructured activities, such as free play and outdoor time, are often replaced by activities that are more structured, teacher-led, indoors, and desk-based. Incorporating more outdoor

learning opportunities into traditional educational practices may improve children's PA profile. **Purpose:** The primary purpose of this study was to compare differences in Pre-Kindergarten children's PA and SB between a nature-based or traditional classroom setting. **Methods:** 26 children from one Pre-K program enrolled in this study. Data was collected using waist-mounted accelerometers worn for 8 days (2h45min/day) across two separate weeks in the winter and spring. During each four-day week, participants spent two days in a traditional classroom setting, and two days in a nature-based setting. Accelerometer data was analyzed using Butte (2013) cutpoints. One-tailed paired t-tests were used to detect significant differences ($p < 0.05$) in PA and SB between settings. **Results:** In a nature-based setting, significantly more time was spent in moderate- to vigorous-intensity PA during Unstructured (Diff: $8.0 \pm 9.9\%$ of Wear Time [WT]; $p < 0.001$) and Structured time (Diff: $1.4 \pm 2.9\%$ WT; $p = 0.011$). Significantly less time was spent in SB during Unstructured (Diff: $-3.1 \pm 7.1\%$ WT; $p = 0.017$) and Structured time ($-2.5 \pm 6.1\%$ WT; $p = 0.023$) in a nature-based setting. Significantly more time was spent outside (Diff: 35min; $p < 0.001$) in a nature-based setting, however significantly less time (Diff: -2.9 ± 3.0 min; $p < 0.001$) was allocated to Unstructured free play. There were no significant differences in the amount of time participants spent in Structured time (Diff: 1.4 ± 7.9 min; $p = 0.375$) between class settings. **Conclusion:** Children engaged in significantly more PA and less SB while learning outdoors compared with indoor learning, despite less time being allocated to free play. Modifying educational practices to include outdoor education has the potential to increase the quantity of in-school PA children accumulate while simultaneously reducing SB.

3641 Board #5 May 30 9:00 AM - 11:00 AM
Comparative Discrimination Of Obesity By Muscular And Cardiorespiratory Fitness: A Receiver Operating Characteristics Curve Analysis.

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 (No relevant relationships reported)

PURPOSE: Muscular and cardiorespiratory fitness are associated with adiposity and cardiovascular disease risk in youth. The degree to which these measures discriminate obesity is not lucid. This study investigated muscular and cardiorespiratory fitness capacities to discriminate obesity. **METHODS:** Participants (N = 210; 116 males) (9.7 ± 1.08 years; 138.6 ± 9.4 cm; 42.3 ± 14.4 kg) (84% Hispanic/Latino) muscular and cardiorespiratory fitness were assessed using the 20-meter Progressive Aerobic Cardiovascular Endurance Run (PACER) and 90° push-up test, respectively, per FITNESSGRAM® protocols. Weight status was classified using CDC Growth Charts. Non-obesity was coded as "0" and obesity was coded as "1." A Receiver Operating Characteristics (ROC) curve analysis was performed to identify the True Positive Rate (TPR) (i.e., Sensitivity) and False Positive Rate (FPR) (i.e., 1 - Specificity) using SPSS. The area under the curve (AUC) indicated the degree to which each fitness measure distinguishes between the presence and absence of obesity. The measurement threshold with the greatest TPR-FPR distance was considered optimally discriminative. Statistical significance was set at $P < .05$. **RESULTS:** Of the sample, 43% had obesity and 55% did not. PACER was fairly discriminative of obesity in girls (AUC = .748; $P = .000$; 95% CI [.651, .845]) and boys (AUC = .755; $P = .000$; 95% CI [.665, .845]). 90° push-up was fairly discriminative in girls (AUC = .732; $P = .000$; 95% CI [.632, .831]) and boys (AUC = .789; $P = .000$; 95% CI [.703, .876]). PACER thresholds of 8 and 8 laps were optimally discriminative in girls (TPR = .714, FPRs = .352) and boys (TPR = .635, FPRs = .190), respectively. 90° push-up thresholds of 7 and 5 repetitions were optimally discriminative in girls (TPR = .714, FPRs = .333) and boys (TPR = .692, FPRs = .175), respectively. **CONCLUSIONS:** Based on the probability of classifying individuals with and without obesity as having obesity (i.e., TPRs and FPRs, respectively), PACER and 90° push-up appear similarly discriminative of obesity. Notably, the optimal PACER threshold to discriminate obesity was considerably lower than cut-off scores (23 for boys and 15 for girls) for HFZ classification in the same age group. Cardiorespiratory-related disease risk may persist in subpopulations of Hispanic/Latino youth without obesity.

3642 Board #6 May 30 9:00 AM - 11:00 AM
Impact Of Schoolyard Green Space And Hardscape Design On Play Behaviors Of Urban Children

Elena Daniel, Nkese Jack, Marcella Raney. *Occidental College, Los Angeles, CA.*
 (No relevant relationships reported)

Previous studies have shown that large-scale schoolyard greening projects increase physical activity (PA) participation. However, the relative impact of nature access and schoolyard design on free play behaviors is unknown. **PURPOSE:** To determine how green space and specific schoolyard design features impact individual and population-level PA and social behaviors during recess. **METHODS:** Recess behaviors were recorded with the validated SOPLAY and SOCARP observation tools for one week at four urban Title I elementary schools (N = 2051): 1) 1.5% green space, 10

zones; 2) 0% green space, 8 zones; 28% green space, 10 zones; 4) 50% green space, 8 zones. Data was analyzed with linear mixed models and Pearson correlation at a significance value of 0.05. **RESULTS:** Sedentary levels were higher for older students at locations with fewer play areas regardless of green space square footage (1st-3rd grade: $49.5 \pm 2.9\%$; 4th-6th grade: $59.7 \pm 3.1\%$) and lower for younger students in green compared to asphalt schoolyards (52.8 ± 1.8 vs. $47.4 \pm 1.7\%$) ($p < 0.01$). More students were engaged in moderate-to-vigorous physical activity (MVPA) while playing tag ($71.2 \pm 4.1\%$) or gymnastics/climbing/jumping/dance ($58.1 \pm 3.3\%$) in green space and on play structures compared to traditional playground games (e.g. handball, 4-square, tetherball) on asphalt ($45.6 \pm 1.7\%$) ($p < 0.001$). Students spent more time in small groups (10.8 ± 0.7 vs. 9.3 ± 0.4 min, $p < 0.05$) and in vigorous PA in green space vs. hardscape (2.3 ± 0.2 vs. 1.1 ± 0.1 min, $p < 0.05$). Small group activity was positively correlated with the frequency of prosocial interactions ($r = .158$, $p < 0.001$). In asphalt schoolyards, students spent more time vigorous when more play options were available (2.1 ± 0.2 vs. 1.3 ± 0.1 min, $p < 0.05$). Although active minutes were similar between sexes in areas with trees, logs, and woodchips (girls: 4.8 ± 0.4 ; boys: 5.4 ± 0.7 min, $p > 0.05$), boys spent more time active in both hardscape (girls: 3.6 ± 0.2 vs. 4.9 ± 0.2 min) and green space (girls: 5.0 ± 0.8 ; boys: 6.9 ± 0.8 min) areas designed for sport ($p < 0.05$). **CONCLUSION:** Schoolyards that increase access to nature, provide diverse sport and non-sport play options, and present motor skill challenges optimize MVPA participation and positive peer interactions for both sexes and all age-groups in urban low-income elementary schools.

3643 Board #7 May 30 9:00 AM - 11:00 AM
Relationship Between Physical Activity Among Preschool Children And Their Parents

Keisuke Koizumi. *Chiba University, Chiba-city, Japan.*
 (No relevant relationships reported)

PURPOSE: The lack of physical activity among children is a global issue that requires attention. It has been suggested that a relationship exists between the lifestyles of children at an early age and that of parents. We quantified physical activity relationships among preschool children and their fathers and mothers.

METHODS: Forty-seven children (kindergarten level: aged 6.11 ± 0.267 years) and their parents (fathers: aged 43.1 ± 4.83 years, mothers: aged 41.1 ± 4.29 years) participated in this study. Each participant wore an activity tracker on the waist during waking hours to measure step counts and time of moderate-to-vigorous physical activity (MVPA). The data were divided into work/school day and day off and evaluated accordingly. Partial correlation coefficient was used to evaluate the physical activity relationships between children and fathers or mothers.

RESULTS: For the work/school days, there was a significant positive correlation of step count between children and mothers (children: $15,800 \pm 2,560$ steps; mothers: $9,450 \pm 2,590$ steps, $r = 0.322$, $p < 0.05$) and a nonsignificant correlation between children and fathers ($8,820 \pm 2,990$ steps, $r = 0.249$). For the days off, there was a significant positive correlation of step counts between children and fathers (children: $11,700 \pm 3,520$ steps, fathers: $8,190 \pm 2,790$ steps, $r = 0.473$, $p < 0.01$) but no significant correlation between children and mothers ($10,000 \pm 2,530$ steps, $r = 0.096$). There was a significant positive correlation in MVPA time for days off between children and fathers (children: 74.5 ± 25.9 min, fathers: 51.0 ± 22.5 min, $r = 0.487$, $p < 0.01$) but no significant correlation between children and mothers (55.9 ± 16.9 min, $r = 0.075$). There were no significant correlations in MVPA time for work/school days between children and fathers (children: 97.5 ± 23.8 min, fathers: 59.8 ± 18.3 min, $r = 0.503$) and between children and mothers (56.9 ± 13.7 min, $r = 0.131$).

CONCLUSIONS: These findings suggest that the children may have spent time with their mothers on work/school days, and with their fathers on days off. Thus, an increase in fathers' physical activities may lead to a corresponding increase in the physical activities of some children with modern Japanese lifestyles.

3644 Board #8 May 30 9:00 AM - 11:00 AM
Effects Of Four-day School Weeks On Physical Education Exposure And Childhood Obesity

Emily J. Tomayko, Paul N. Thompson, John M. Schuna, Jr., Katherine B. Gunter, FACSM. *Oregon State University, Corvallis, OR.* (Sponsor: Katherine Gunter, FACSM)
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 (No relevant relationships reported)

Schools are critical venues to support child health and wellbeing. One mechanism to influence these outcomes is via school-based physical activity, but substantial declines in funding have forced many school districts to consider cost-cutting measures that may impact physical activity exposure and related outcomes. Use of four-day school weeks (FDSWs) as a potential cost-saving strategy has increased substantially, particularly in rural areas, which contain ~90% of FDSW districts. However, evidence regarding impacts of FDSWs on child health and related factors is lacking. **PURPOSE:** To examine physical education (PE) exposure and childhood obesity prevalence in four- and five-day Oregon schools. We hypothesized lower PE exposure and higher obesity in four- versus five-day models given reduced school

environment exposure. **METHODS:** We linked longitudinal FDSW data to existing data that included 1) school-level PE exposure for all Oregon elementary schools in 2011-2012 and 2017-2018 (n=1296 and 1243 schools, respectively) and 2) child-level body mass index z-scores from a state representative sample of 1st-3rd graders (n=4,625 children, 2011-2012). Instructional time, enrollment, demographics, and pupil-teacher ratio also were examined. T-tests compared mean school-level factors between four- and five-day schools overall and in rural schools only; complex samples weighted t-tests clustered at the school-level compared mean obesity data across school models. **RESULTS:** Enrollment, instructional time, and pupil-teacher ratio were significantly lower in four- versus five-day schools. FDSW schools provided significantly more PE, both as an absolute measure (120 vs. 101 minutes/week in four- vs. five-day schools in 2017-2018, p<0.01) and relative to total instructional time (6.9% vs. 5.0% in four- vs. five-day schools, p<0.0001). There were no differences in obesity prevalence between school models. **CONCLUSIONS:** The increased PE exposure in FDSW schools was unexpected, but it is unknown if this increase was related to a lack of difference in obesity prevalence. Given the known health and educational disparities experienced in rural communities, it is critical to better understand how FDSW use impacts physical activity, obesity risk, and other related factors for children in rural schools.

G-22 Thematic Poster - Running Technique Interventions

Saturday, May 30, 2020, 9:00 AM - 11:00 AM
Room: CC-2011

3645 **Chair:** Irene S. Davis, FACSM. *Harvard Medical School Spaulding-Cambridge, Cambridge, MA.*
(No relevant relationships reported)

3646 Board #1 May 30 9:00 AM - 11:00 AM
The Effect Of Backward Running On Patellar Tendon Loading

Naghmeh Gheidi, Thomas W. Kernozek, FACSM, Alexis Mehr, Lauren Strommen, Carolyn Apfelbach. *UWL, La-Crosse, WI.*
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Patellar tendinopathy is experienced in nearly 5% of distance runners during their career. Backward running (BR) has been recommended as a good rehabilitation exercise for patellofemoral pain patients as an intermediate progression from walking to forward running (FR). However, no studies have compared how BR affect patellar tendon stress.

Purpose: Identify differences in patellar tendon (PT) stress during FR (heel strike pattern) and BR. **Methods:** Twenty healthy male runners (Age: 21 ± 6.9 years, Height: 1.8 ± 0.6 m, Mass: 76.2 ± 14.1 kg, weekly running distance: 22.3 ± 7.6 km) participated in this study. Each performed 5 trials of over-ground FR (heel strike pattern) and BR with a running velocity of 2.8-3.4 m/s based on photoelectric timing. Kinematic data were collected at 180 Hz using a 15-camera motion capture system. Ground reaction forces (GRF) were collected at 1800 Hz using a force platform. The Newton- Euler inverse dynamics method was used to calculate the net knee joint moment. The average moment arm of each quadriceps muscles were determined using Graphics-Based Model. The net knee moment was then divided by this knee moment arm to determine quadriceps force. PT force was determined from summing quadriceps muscles forces (rectus femoris, vastus lateralis, medialis, and intermedius muscle). Static ultrasound imaging was performed for measuring PT cross sectional area (CSA). PT stress was estimated by dividing PT force by PT CSA. MANOVA with repeated measures, was performed to compare PT stress, PT force, vertical GRF, knee ROM, and knee moment in FR and BR. **Results:** There were differences between FR and BR for all variables, except for GRF (p<0.001). Knee moment (154.7 vs. 205.1 Nm), PT stress (47.42 vs. 60.06 MPa) and PT force (4335 vs. 5497 N) in BR were around 21-24% less than FR. In addition, knee joint (20.84 vs. 37.72 deg) exhibited near 45% less range of motion during BR. **Conclusion:** Larger knee ROM coupled with the larger knee moment occur during FR. This may be required to stabilize the tibia during stance phase placing a greater stress on the patellar tendon.

BR results in lower PT stress when compared to FR. The lower PT stress as well as higher coordination variability may make BR more suitable for rehabilitation in patients with patellar tendinopathy as a progression exercise to FR due to its lower PT stress.

3647 Board #2 May 30 9:00 AM - 11:00 AM
Influence Of Running Speed On Muscle Activity During Backward Running With Body Weight Support

Kenji Masumoto¹, John A. Mercer, FACSM². ¹*Kyushu University, Fukuoka, Japan.* ²*University of Nevada, Las Vegas, NV.* (Sponsor: Professor John A. Mercer, FACSM)
(No relevant relationships reported)

A change in running speed influences gait mechanics of running. **PURPOSE:** The purpose of this study was to investigate the influence of a change in running speed on muscle activity during forward and backward running at different body weight support (BWS) conditions. **METHODS:** Eleven participants (29.7 ± 12.3 years) ran forward and backward on a lower body positive pressure treadmill at 0%BWS, 20%BWS, and 50%BWS conditions. The running speed conditions consisted of forward and backward running at preferred speed (PS), PS+10%, and PS-10%. Muscle activity from the rectus femoris, biceps femoris, tibialis anterior, and gastrocnemius and stride frequency were measured. Muscle activity and stride frequency were analyzed using a 2 (running direction) x 3 (BWS) x 3 (running speed) repeated measures analysis of variance ($\alpha = 0.05$). **RESULTS:** Muscle activity from the rectus femoris (P<0.01) and gastrocnemius (P<0.01) were significantly different between running speeds. For example, muscle activity from the rectus femoris (P<0.05) and gastrocnemius (P<0.05) during running at PS were significantly greater than when running at PS-10%, regardless of running direction and BWS. Furthermore, muscle activity from the rectus femoris (P<0.01) and gastrocnemius (P<0.05) during running at PS+10% were significantly greater than when running at PS, regardless of running direction and BWS. Stride frequency was influenced by the interaction of running direction and running speed (P<0.05). Using the pairwise comparisons, stride frequency during running at PS was significantly higher than that of running at PS-10% only when running forward and backward at 0%BWS (e.g., 84.5 strides/min and 82.0 strides/min for backward running at PS and PS-10% conditions, respectively; P<0.05). Furthermore, stride frequency during running at PS+10% was significantly higher than that of running at PS during forward and backward running at 0%BWS (P<0.05). **CONCLUSIONS:** Muscle activity from the rectus femoris and gastrocnemius during running may increase with increasing running speed, regardless of BWS and running direction. However, unique biomechanical strategies for the increased muscle activity from the lower extremity may exist for running with BWS.

3648 Board #3 May 30 9:00 AM - 11:00 AM
The Effect Of Synchronous And Asynchronous Music On Treadmill Running Performance Of Recreational Athletes

Dimitrios Katsavelis, Isaac Burright, Megan Quast, Megan Ackerman, Erika Piper, Brooke Farmer, Terry Grindstaff.
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(No relevant relationships reported)

Background: Running with synchronous music tempo is associated with positive physiological and psychological effects that improve running performance as expressed by time to exhaustion. Changes in the music tempo may increase physiological efficiency (slow tempo) or improve motivation and mood (fast tempo), but there is no conclusive evidence whether asynchronous music tempo can influence distance covered or time to exhaustion. **Purpose:** To investigate the effect of different music tempo on running performance, force and cadence profiles of recreational athletes. **Methods:** Six college students (age = 21.2 ± 3 yr; weight = 75.4 ± 12 kg; height = 179.5 ± 10 cm) participated in the study. The participants were tested five times over a period of three weeks. During the first visit, lactate threshold speed (LTS) was assessed via blood samples. During the second visit participants run at 5% above their LTS (3.5 ± 0.4 m/s) with no auditory stimuli until exhaustion. During the last three visits participants were randomly assigned to run on an instrumented treadmill in three different tempo conditions until exhaustion: slow, matched and fast. Time to exhaustion, vertical ground reaction forces (vGRF) and cadence were calculated through Matlab. **Results:** A one-way repeated ANOVA (4 conditions) showed that there was a main effect of music, with the no music condition resulting in a decrease in time to exhaustion by 18-21% when compared to all the music conditions, but no significant differences among the 3 music conditions. The vGRF during running at slow tempo (2.58 BW) were significantly lower when compared to fast tempo (2.62 BW), whereas there was an increase in cadence between slow (167 steps/min) and fast (170 steps/min) tempo conditions. **Conclusion:** The findings indicate that music – in general – has a positive effect on running performance, while asynchronous tempi can only cause significant but subtle changes (less than 2%) in the force and cadence profiles.

3649 Board #4 May 30 9:00 AM - 11:00 AM
Effects Of Lower Limb Light-weight Wearable Resistance On Running Biomechanics

Aglaja Busch¹, Karl Trounson², Peter Browne², Sam Robertson².
¹Outpatient Clinic, Potsdam, Germany. ²Institute of Sport, Exercise and Active Living, Melbourne, Australia.
 (No relevant relationships reported)

Resistance training is important to maintain an athlete's health and regain strength after injury. Light-weight wearable resistance allows loading in the context of sport specific movements and can lead to specific strength adaptations benefiting the athlete. However, limited knowledge of the associated biomechanical changes with such a training modality exists.

Purpose: To determine biomechanical changes during running with lower limb light-weight wearable resistance.

Methods: Fourteen healthy participants volunteered for the study (age: 28±4 years; height: 180±8 cm; body mass (BM): 77±6 kg). Participants wore shorts and calf sleeves allowing attachment of light loads and performed 4 x 2 mins 20-m over-ground shuttle running bouts at 3.3 m*s⁻¹, alternating by 3 mins rest. The first running bout was unloaded and the other three bouts under randomised loaded conditions. The loaded conditions consisted of 1 %, 3 % and 5 % additional loading of the BM. Loads were distribution on the legs with 2/3 on the thigh and 1/3 on the shank. Two force plates embedded in the floor at the 10-m mark of the runway recorded peak vertical ground reaction forces (vGRF) and ground contact time (GCT). Recorded kinetic data was filtered using a low-pass Butterworth filter at frequency 120 Hz and normalised to body weight. A repeated measures ANOVA ($\alpha \leq 0.05$) was used to determine differences between conditions and Cohens *d* was calculated with effect sizes defined as small ($d = 0.2$), medium ($d = 0.5$) and strong ($d = 0.8$).

Results: Peak vGRF decreased (-0.5 %) with additional loading of 1% BM ($d = 0.17$, $p = 1$) and slightly increased (+1.1 %) with 3% BM loading ($d = 0.13$, $p = 0.91$) compared to unloaded condition. Higher peak vGRF (+1.4 %) was also found during 5 % BM loading ($d = 0.19$, $p = 1$). Ground contact time showed no significant differences ($0.13 \leq d \leq 0.20$, $0.4 \leq p \leq 1$) between all conditions and only a slightly increased with 5 % BM loading (+1 %).

Conclusion: Small changes in peak vGRF and GCT during loaded running occurred. Maintaining targeted speed and running economically might result from kinematic adaptations, needing further evaluation. Additionally, examination of acute neuromuscular alterations, hypothesised by increased muscular output before gait pattern changes develop, are necessary for appropriate use of light-weight wearable resistance.

3650 Board #5 May 30 9:00 AM - 11:00 AM
An Investigation Into The Feasibility Of A Split-belt Instrumented Treadmill Running Protocol With Perturbations.

Andrew Quarmby, Mina Khajooei, Tilman Engel, Hannes Kaplick, Frank Mayer. University of Potsdam, Potsdam, Germany.
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 (No relevant relationships reported)

Unexpected disturbances to human gait can occur during daily life or sports performance. Compensating successfully for such disturbances or perturbations is crucial in maintaining effective postural control and avoiding potentially injurious events. Studies of perturbed walking protocols using instrumented treadmills have previously been validated, however the validation of and responses to perturbed running protocols remain less investigated. **PURPOSE:** To investigate the feasibility of a new instrumented treadmill-perturbed running protocol. **METHODS:** Fifteen participants (28±3years; 172±9cm; 69±10kg; 60% female) completed an 8-minute running protocol at a baseline velocity of 2.5m/s (9 km/h), whilst 15 one-sided belt perturbations were implemented (*pre-set perturbation characteristics: 150ms delay (post-heel contact); 2.0m/s amplitude; 100ms duration*). Perturbation characteristics and sEMG responses (right leg: gastrocnemius medialis (GM), tibialis anterior (TA), peroneus longus (PL), biceps femoris (BF), vastus medialis (VM); trunk bilateral: rectus abdominus (RA), erector spinae L3 (ES); Root Mean Square (RMS) normalized to unperturbed walking) were recorded. Bland-Altman analysis (BLA) was employed (bias±limits of agreement (LOA; bias±1.96*SD)) and intra-individual variability of repeated perturbations was assessed via Coefficients of Variation (CV) (mean±SD). **RESULTS:** On average, 9.4±2.2 of 15 intended perturbations were identifiable. Perturbation delay was 143±10ms, amplitude was 1.7±0.2m/s and duration was 69±10ms. BLA showed -7±13ms delay, -0.3±0.1m/s amplitude and -30±10ms duration. CV showed variability of 19±4.5% for delay, 58±12% for amplitude and 30±7% for duration. sEMG RMS amplitudes were 113±25% (GM), 225±73% (TA), 139±68% (PL), 134±34% (BF), 200±168% (VM), 332±305% (RARight), 324±162% (RALeft), 220±130% (ESRight), 183 ± 122% (ESLeft). **CONCLUSION:** This study showed that the application of sudden perturbations during running can be achieved, though with increased variability across individual perturbations. The perturbations

with the above characteristics elicited a detectable neuromuscular response during running, especially in the muscles of the trunk and anterior leg. Responses in the calf muscles were minimal.

3651 Board #6 May 30 9:00 AM - 11:00 AM
The Effect Of Verbal Cues On Lower Extremity Kinetics During Running

Allison Lieb¹, Quinn Garner¹, Nicholas Reynolds¹, Jennifer Bagwell², Terry Grindstaff¹. ¹Creighton University, Omaha, NE. ²California State University, Long Beach, Long Beach, CA.
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 (No relevant relationships reported)

Previous research indicates that verbal cues such as "push with your feet" can alter ankle and hip kinetics during walking. Clinicians often use cues such as "push with your hips" when working with runners, but the effect of such verbal cues on lower extremity kinetics during running remains poorly understood. **PURPOSE:** The purpose of this study was to determine the effect of verbal cues emphasizing use of hips and glutes or use of toes and ankles on lower extremity running kinetics.

METHODS: Ten healthy subjects (age 23±1 years, mass 67±16 kg, height 168±11 cm) participated. Subjects performed 3 running trials, at a self-selected pace, on an instrumented treadmill while collecting kinematics and kinetics. First, a baseline running gait was established, then each subject was given the instruction to "push yourself forward with your hips and glutes" or "push yourself forward with your toes and ankles" in a randomized order. After 1 minute to adapt to each condition, 30 seconds of data were recorded. Variables of interest included peak sagittal hip, knee, and ankle moments and positive, negative, and total sagittal work at the hip, knee, and ankle. One-way repeated measures ANOVAs were used to assess kinetic changes across conditions.

RESULTS: There was a significant main effect of running cue with respect to negative and total work at the ankle ($p=0.031$ and $p=0.002$). Post-hoc analyses indicated that ankle negative work was greater when running with the ankle cue compared to baseline running (-0.44 ± 0.17 J/kg vs -0.38 ± 0.14 J/kg; $p=0.031$) and ankle total work was greater when running with the ankle cue compared with baseline and hip cue running ($p=0.019$ - 0.008). There were no significant differences in any of the other lower extremity sagittal moments or work across tasks ($p>0.05$).

CONCLUSIONS: Subjects demonstrated increased negative and total work at the ankle in response to the ankle running cue. There was no change in positive work, which was anticipated with a cue emphasizing forward propulsion. Running kinetics remained largely unchanged in response to either running cue, possibly due to the quality of the cue (i.e. internal rather than external focus). These data suggest telling clients to "use your hip more to run" may not be an effective method to change running mechanics.

3652 Board #7 May 30 9:00 AM - 11:00 AM
Influence Of A Novel Music App On Spatiotemporal Mechanics During Running

Danielle Mannino, Matthew F. Moran. Sacred Heart University, Bridgeport, CT.
 (No relevant relationships reported)

An increased running step rate (i.e., cadence) can decrease lower extremity joint loads and potentially reduce running-related injury (RRI) risk. Many gait interventions have significantly increased a runner's cadence through a variety of external stimuli (e.g., metronome). Runners have been shown to spontaneously manipulate their cadence when listening to music with a tempo that differed ±3% from their baseline cadence. However, no study has determined whether a runner will subconsciously increase cadence > 3% when listening to up-tempo music. **PURPOSE:** To determine if music tempo (beats per minute, bpm) set 10% higher than baseline cadence affects spatiotemporal running mechanics. **METHODS:** Utilizing a blinded experimental design, twenty-two runners (15F, 7M, 18-40 yo) were recruited, granted informed consent, were randomly assigned to a control (C) or experimental (E) group, and picked four motivational songs. The Brunel Music Rating Inventory was used to rate song motivational level. Subjects ran three 5-min trials (5/10 effort) on a pressure-sensitive treadmill (Noraxon U.S.A., 100 Hz) with vertical ground reaction force and pressure recorded during the last 45 sec and lowpass filtered (40 Hz). Five-min of rest was given between trials. During the second trial, subjects listened to music via headphones with the bpm set to baseline cadence (C) or 10% higher (E). Music was administered via a novel smartphone application that permitted song tempo to be adjusted and maintained in one bpm increments. The last trial was completed without music with velocity held constant across all trials. A mixed design analysis of variance was run in JASP with a significance set a priori at 0.05. **RESULTS:** Baseline cadence was not significantly different between groups (C: 165.4±9.5 steps per minute, E 167.2±6.8, $p=0.61$). There was not a significant main effect ($p=0.54$, $p=0.32$, $p=0.152$, $p=0.70$) of music tempo between groups for cadence (F (1,20)=0.39), step width (F(1,20)=1.02), stance phase (F (1,20)=2.22), or foot rotation (F(1,20)=0.16).

CONCLUSION: Spatiotemporal running mechanics do not spontaneously adjust when runners listen to motivational music set at a tempo 10% greater than baseline cadence. Listening to up-tempo music should not be considered an effective external stimulus to promote increased running cadence.

3653 Board #8 May 30 9:00 AM - 11:00 AM
Lower Extremity Joint Work Following A Long Hilly Run In Conventional And Maximalist Shoes

Christopher Casillas, James Becker. *Montana State University, Bozeman, MT.*

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 (No relevant relationships reported)

Trail running is a rapidly growing discipline which often contains uphill and downhill running segments. The varying elevation requires different muscular demands than level ground running and thus may influence how joint kinetics change following a long run. Many trail runners use highly cushioned maximalist (MAX) footwear. However, the influence of MAX footwear on joint kinetics following a long run is currently unknown. **PURPOSE:** To determine if there are differences in joint work following a long hilly run (LHR) in conventional (CON) and MAX footwear. **METHODS:** Twelve trail runners (sex: 10 M, 2 F; weekly mileage: 30.3 ± 14.9 miles) were randomly assigned to either a CON or MAX shoe and ran a 10-mile LHR which matched the elevation profile of a popular local trail run. 3D kinematics and ground reaction forces were collected during five-minute level ground running sections prior to and following the LHR. Sagittal plane positive (POS) and negative (NEG) joint work for the hip, knee, and ankle were calculated by integrating the POS and NEG portions of the joint power curves. Two-way mixed ANOVAs (shoe condition, time) were used to evaluate differences in joint work. **RESULTS:** There were no differences between groups in any joint work parameter before the LHR (Figure 1). Following the LHR, POS ($p = 0.014$) and NEG knee ($p = 0.041$) and NEG hip ($p = 0.014$) work increased in the MAX group. Compare to the CON group, the MAX group also had higher NEG knee work ($p = 0.009$) and was trending towards higher POS knee ($p = 0.072$). No differences were observed in ankle work or positive hip work. **CONCLUSION:** Proximal redistribution of joint work following a LHR was observed, but not to the extent reported in previous studies using level runs. However, the increased knee work in MAX footwear suggests the knee is being loaded more during a LHR compared to CON footwear. This may have implications for injury risk as higher knee loads are related to common running injuries.

Footwear provided by New Balance, Inc.

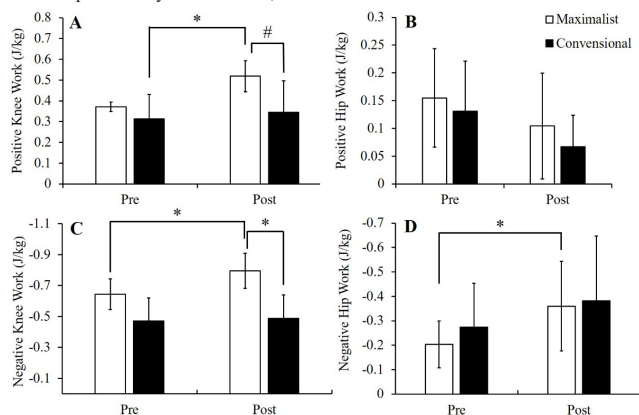


Figure 1: Mean and standard deviations for positive knee (A) and hip (B) joint work and negative knee (C) and hip (D) joint work prior to and following the LHR for the MAX and CON groups. * denotes statistically significant difference. # denotes data trending towards a statistical difference.

G-23 Clinical Case Slide - Medical Issues III

Saturday, May 30, 2020, 9:00 AM - 11:00 AM
 Room: CC-2005

3654 Chair: Dennis Khalili-Borna, FACSM. *Kaiser Permanente, Chino Hills, CA.*

(No relevant relationships reported)

3655 Discussant: Sandy Hoffmann, FACSM. *Idaho State University, Hilton Head, SC.*

(No relevant relationships reported)

3656 Discussant: Nailah Coleman, FACSM. *Children's National Medical Center, Washington, DC.*

(No relevant relationships reported)

3657 May 30 9:00 AM - 9:20 AM
Abstract Withdrawn

3658 May 30 9:20 AM - 9:40 AM
Nutritional Intervention In A Male Olympic Swimmer: Adequation Of Carbohydrate Intake Based On Metabolic Profile

Humberto Nicastro¹, Victor Hugo Rosa de Oliveira¹, Claudia Czapski², Gerson Leite¹, José Alves Balestrin¹, Leonardo Prieto¹, Felipe Domingues³, Gustavo Schirru³, Luciana Setaro², Gustavo Magliocca¹. ¹CareClub Health Center, São Paulo, Brazil. ²Centro Universitário São Camilo, São Paulo, Brazil. ³Confederação Brasileira de Desportos Aquáticos, São Paulo, Brazil.

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(No relevant relationships reported)

HISTORY: Male Olympic swimmer (100 m breaststroke; 32 y, 96.0 kg, 185 cm) with recurrent hypoglycemia and -related symptoms (hand sweating, blurred vision) at rest and during training and expressive weight loss on training days.

PHYSICAL EXAMINATION: Subject underwent DEXA (body composition), pre and post training blood glucose measurements and indirect calorimetry.

DIFFERENTIAL DIAGNOSIS:

1. Hypoglycemia at rest and during training sessions;
2. Body fat percentage: 14,9%;
3. Low fat oxidation at rest (45% of basal metabolic rate).

TEST AND RESULTS: Basal metabolic rate was of 2.360 kcal with glycolytic predominance (55% of total energy expenditure), confirming that energy metabolism is highly dependent of carbohydrate intake. At the beginning and end of the week, morning weight was 96.0 and 93.0 kg, respectively. Blood glucose pre-exercise was 84.0 mg/dl and 60 mg/dl post-exercise.

FINAL WORKING DIAGNOSIS: Training-induced severe hypoglycemia and expressive weight loss across the week. It was hypothesized that such events occur since in response of the elevated activity of glycolytic pathway and consumes and consumption of high glycemic index supplements during training.

TREATMENT AND OUTCOMES:

1. We focused on nutritional intervention based on high calorie intake and substitution of high by low glycemic foods and supplements throughout the day;
2. Additionally, we recommended beta-alanine supplementation (4 x 1.6 g) to prevent metabolic acidosis;
3. After 2 weeks of intervention, no symptoms of hypoglycemia were reported at rest and during training sessions;
4. Weight loss was attenuated (- 1.6 kg) and blood glucose values did not decrease after training (pre: 80 mg/dl; post: 125 mg/dl).

3659 May 30 9:40 AM - 10:00 AM

You Only Get One Bite Out Of This Apple

Jonathan R. Guin, Thomas J. Bollaert, James B. Robinson.

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(No relevant relationships reported)

HISTORY: A 21-year-old collegiate tight end sustained anterior neck trauma from his chin strap during a regular season game. During the first quarter, the athlete was struck in his anterior neck by an opponent's face mask. The patient felt throat pain and states it felt like his "Adam's Apple is to the right". He then went back into the game because he noted the pain was only mild, and he was otherwise asymptomatic. The athlete was able to continue playing until the early part of the third quarter of the game. At that time, he was evaluated by the team physician and held from the rest of the game. He was then sent to the emergency department for further evaluation and imaging.

PHYSICAL EXAMINATION: Examination on the sideline revealed a click upon palpation of the anterior neck near the thyroid cartilage. He had full ROM of his cervical spine with a normal neurological exam. He had no respiratory distress, subcutaneous crepitus, or voice changes. He did have some pain with swallowing. Hyoid bone and cricoid cartilage is non-tender. Cardiac and pulmonary exams were also unremarkable. Exam was stable when repeated in emergency department.

DIFFERENTIAL DIAGNOSIS: Fracture of Thyroid Cartilage Fracture of Hyoid Bone Contusion of Neck Carotid Artery Dissection

TEST AND RESULTS: CT Neck with Contrast Minimally displaced fracture involving the anterior right thyroid cartilage. The left thyroid cartilage has a concave appearance suggestive of a depressed nondisplaced cartilage fracture. The larynx is angulated to the right.

Nasolaryngeal scope True vocal cords were freely mobile. Airway is patent. Subglottis is normal without any hematoma or edema. Both true vocal cords are with some mild discoloration and edema, but no frank hemorrhage or hematoma within either vocal cord.

FINAL WORKING DIAGNOSIS: Fracture of Thyroid Cartilage

TREATMENT AND OUTCOMES:

1. Evaluated in emergency department where CT scan was performed that found a fracture of the thyroid cartilage 2. Nasolaryngeal scope done in ED by ENT 3. Admitted and stayed overnight in ICU because of risk for respiratory compromise 4. IV steroids given while in ICU to prevent any further edema 5. Evaluated at tertiary care facility day after discharge by ENT 6. Determined need for surgical repair 7. Athlete currently recovering with anticipated healing time of 4-6 weeks

3660 May 30 10:00 AM - 10:20 AM

Ovarian Torsion Presenting As Referred Cyclical Hip Pain In A Division I AthleteEmily D. Geyer¹, Christina L. Charles², Rachel Denison³, Bridget M. Geyer⁴, James A. Onate¹. ¹Ohio State University, Columbus, OH. ²Columbus Obstetricians-Gynecologists, Inc., Columbus, OH. ³University of Notre Dame, Notre Dame, IN. ⁴Duke University School of Medicine, Durham, NC.

Email: emily.geyer@osumc.edu

*(No relevant relationships reported)***HISTORY**

A 22-year-old female Division I rower presented to the emergency department (ED) due to severe right lower quadrant pain with nausea and vomiting. She had a three-year history of right hip pain diagnosed as femoroacetabular impingement (FAI) and infrequent flares of worsened hip pain treated with rest and intra-articular cortisone injections or oral steroid dose-pack. During ED visit, abdominal computerized tomography (CT) and transvaginal ultrasound (TVUS) revealed significantly enlarged right ovary diagnosed as ovarian cyst. She was discharged and was seen by OB/GYN that afternoon for follow up.

PHYSICAL EXAMINATION

Patient presented to the office in moderate distress due to unabated right lower quadrant (RLQ) pain. Abdomen was soft and tender throughout. Physical exam was otherwise unremarkable.

DIFFERENTIAL DIAGNOSIS

Prior to imaging:

1. Musculoskeletal: fracture, FAI, osteoarthritis, nerve compression, bursitis
2. Genitourinary: urinary tract infection, pyelonephritis, nephrolithiasis
3. Gastrointestinal: Irritable Bowel Syndrome, constipation, appendicitis
4. Gynecologic: ovarian cyst, ovarian torsion, pelvic inflammatory disease, tubo-ovarian abscess

TESTS AND RESULTS

TVUS revealed 7 cm edematous right ovary with 2 small follicles and no large cyst. There was very minimal to no Doppler flow. Blood work revealed elevated white blood cell (WBC) count.

FINAL/WORKING DIAGNOSIS

Suspected diagnosis of right ovarian torsion

TREATMENT AND OUTCOMES

1. Patient was admitted to the hospital for mini-laparotomy and right oophorectomy.
2. Right ovary torsed 5 times and appeared normal other than being significantly enlarged to 7-8 cm
3. Given that there was no cyst to be drained, the right ovary was removed.
4. The right fallopian tube, left ovary and fallopian tube, and uterus were all normal.
5. The patient tolerated the procedure well and has since experienced only mild hip pain consistent with FAI.
6. It is likely the patient's flares of pain over the previous 3 years were ovarian in etiology but disguised due to her irregular menstrual cycle and coincident chronic FAI. Ovarian etiology should be included in the differential for female athletes experiencing surges of lower quarter abdominal pain in a setting of hip pain.

3661 May 30 10:20 AM - 10:40 AM

Ehlers-Danlos Syndrome And CD5 Deficiency In A 22 Year-old MaleThomas Lowder, Courtney Holloway. *UNIVERSITY OF Central Arkansas, Conway, AR.*

Email: tlowder@uca.edu

(No relevant relationships reported)

HISTORY: A previously-active male presented with joint pain at age 15. He is positive for joint hypermobility and dislocation/subluxation, joint pain, food allergies, gastritis, gastroesophageal reflux, and CD5 immune deficiency (diagnosed at age 5, one of eight in the world at the time). He has a family history of aortic aneurysm.

PHYSICAL EXAMINATION: The patient exhibited joint pain and extreme hypermobility on examination. Genetic tests were performed on the patient, his mother, and his sister.

DIFFERENTIAL DIAGNOSIS: While there exists a family history of hypermobility, along with orthostatic hypotension in this patient (consistent with Ehlers-Danlos Syndrome, or EDS) the patient also exhibits CD5 immune deficiency, psychogenic seizures, a likely pathogenic variant in the AK2 gene (c.656delT), associated with reticular dysgenesis. His sister also carries this variant. He also carries the variant associated with cystic fibrosis, the congenital bilateral absence of the vas deferens, and chronic pancreatitis.

TEST AND RESULTS: We are presently working with this patient to determine if a moderate-intensity exercise program yields a decrease in joint pain, hypermobility, and downregulation of gene expression.

FINAL WORKING DIAGNOSIS: This is a work-in-progress of a patient with two rare diseases and a variety of genetic issues., which to our knowledge have never been exhibited in a single patient.

TREATMENT AND OUTCOMES: We will present working data and determine if an exercise intervention has a positive impact in this patient.

3662 May 30 10:40 AM - 11:00 AM

Left Flank Injury - SoccerJiao Xue. *Pomona Valley Hospital Medical Center, Pomona, CA.*

Email: jiao.xue.md@gmail.com

(No relevant relationships reported)

HISTORY: A 17-year-old senior high school soccer player sustained an elbow strike from opposing player to his left flank while practicing. Later that night, he experienced excruciating pain which led him coming to ED the following day. He was discharged despite elevated blood pressure (BP). 4 weeks later, he saw his primary care doctor who noted elevated BP in addition to flank pain, and patient was recommended to go to ED after concerning ultrasound findings. **PHYSICAL EXAMINATION:** On initial presentation to ED, patient's BP was 152/96. Examination revealed visible distension in the left abdomen. Palpable mass was appreciated in the same region while lying down. Tenderness to palpation to the left abdomen and left costovertebral angle were noted.

DIFFERENTIAL DIAGNOSIS: Left kidney hematoma v.s. muscular hematoma v.s. kidney contusion v.s. renal arteriovenous malformation v.s. ruptured spleen v.s. kidney mass

TEST AND RESULTS: CT Abdomen & Pelvis W/O Contrast revealed a 12 cm left perinephric hematoma with significant mass effect on the left kidney. Otherwise, CBC and BMP were unremarkable.

FINAL WORKING DIAGNOSIS: L subcapsular renal hematoma secondary to trauma

TREATMENT AND OUTCOMES: IR placed a pigtail drain with 1L output on the 1st day. BP was treated with amlodipine 2.5mg and Hydralazine 5mg PRN. Patient was discharged on the 4th day. On the day of discharge, patient's drain fell out accidentally during a school dance. A Trauma surgeon evaluated him in an outpatient setting. No additional imaging was done given he was asymptomatic. A few weeks later, he developed abdominal/back pain as well as headaches. He presented to Children's Hospital with hypertension to 170s/110s. Ultrasound showed 11cm left subcapsular hematoma with significant compression of left kidney. IR placed another drain which was eventually removed after 3.5 weeks. Prior to discharge, BP improved to 130s/70s

without medications. After discharge, patient was followed by a Pediatric Urologist with monthly imaging. 10 months later, he still had a small 0.5cm hematoma. Patient continues to have mildly elevated BP of unclear etiology. He was evaluated by a Pediatric Cardiologist, and echo did not show evidence of heart disease (LVH). He has not played soccer since the injury.

G-24 Clinical Case Slide - Thigh and Leg II

Saturday, May 30, 2020, 9:00 AM - 10:40 AM

Room: CC-2022

3663 Chair: Mary Lloyd Ireland, FACSM. *UK Healthcare Sports Medicine, Lexington, KY.*

(No relevant relationships reported)

3664 Discussant: Melody Hrubes. *Rothman Orthopaedics, New York, NY.*

(No relevant relationships reported)

3665 Discussant: Anastasia Noel Fischer, FACSM. *Nationwide Children's Hospital, Columbus, OH.*

(No relevant relationships reported)

3666 May 30 9:00 AM - 9:20 AM
Calf And Foot Injury- Crossfit

Jeff Nadwodny, Ahmad Al-Awadi, Michael Stiller, George Pujalte, FACSM. *Mayo Clinic School of Graduate Medical Education, Jacksonville, FL.* (Sponsor: George G.A Pujalte, FACSM)

Email: Jeffrey.Nadwodny@mayo.edu

(No relevant relationships reported)

HISTORY: A 51-year-old female presented with three-year worsening left lower leg and foot pain. No injury at time of onset but was active with CrossFit five times weekly. Pain began on bottom of forefoot with radiation through the sole of foot to posterior calf and popliteal fossa. Pain described as 7-8/10 in intensity, constant, sharp/stabbing in nature, with burning sensation on the bottom of foot. Associated with weakness of the left ankle, foot drop requiring patient to wear an ankle-foot orthotic, swelling, and color changes with her foot turning blue/red intermittently. Pain was unrelieved with oral NSAIDs, steroids, and only temporary relief with topical anti-inflammatory gel, heat/ice, deep tissue massage, and dry-needling with physical therapy.

PHYSICAL EXAMINATION: Examination revealed skin color changes with blue discoloration of left foot that was cool to touch. Tender to palpation maximally over left gastrocnemius muscle, Achilles tendon, sole and ball of foot; 0/5 strength with left ankle dorsiflexion/plantar flexion, ankle inversion/eversion or great toe extension. Sensation intact to light touch in L2-S2 dermatomes. Reflexes normal and symmetric bilaterally.

DIFFERENTIAL DIAGNOSIS:

1. Peripheral nerve damage secondary to entrapment/compression
2. Vascular insufficiency
3. Complex regional pain syndrome

TEST AND RESULTS:

MRI without IV contrast of left tibia/fibula, foot, ankle:

- Mild intramuscular edema within gastrocnemius and soleus, focal fatty atrophy adjacent to medial soleus muscle. Generalized subcutaneous edema throughout ankle. EMG:

- No evidence of left lumbosacral radiculopathy, left lower limb mononeuropathy, or large fiber peripheral neuropathy

US lower extremity Veins:

- No DVT in left lower extremity

Ankle brachial index:

- Normal arterial Doppler study on the left leg during rest with normal PVR waveforms.

NM bone scan:

- No abnormal blood flow or blood pool uptake involving the left foot or ankle. Mild radiotracer uptake in left midfoot.

FINAL/WORKING DIAGNOSIS: Complex regional pain syndrome

TREATMENT/OUTCOMES:

1. Physical Therapy focused on strengthening exercises and desensitization techniques
2. Diclofenac topical gel applied up to four times daily

3. Gabapentin 600mg BID

4. Referral to Pain Medicine for lumbar sympathetic nerve block

3667 May 30 9:20 AM - 9:40 AM

Acute Medial Calf Pain In Golfer

Kevin Baidoo¹, Luis J. Soliz¹, Jack Nickless². ¹*Rush University Medical Center, Chicago, IL.* ²*Midwest Orthopaedics at Rush, Chicago, IL.*

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(No relevant relationships reported)

History: 50-year-old male golfer presenting with 1-day history of acute onset right medial calf pain. He was playing golf and his pain started shortly after walking on flat ground when he felt a "snap" and "electric jolt" in the right medial calf. He subsequently had difficulty walking and has reported swelling in that area since that time. He denied any numbness, weakness, or tingling in his distal lower extremities. He has taken over-the-counter ibuprofen with some relief of his symptoms. His pain is constant and severe. He reported no prior injuries to his right calf before.

Physical Examination: Antalgic gait. Inspection of the right foot and ankle revealed minimal ecchymosis over the medial mid-gastrocnemius. There was moderate tenderness to palpation over the medial greater than lateral gastrocnemius muscle belly. Range of motion at the right ankle including dorsiflexion, plantarflexion, eversion, and inversion were normal. Strength was 4-/5 with right resisted plantarflexion but otherwise normal. Reflexes and sensation were grossly intact. Special tests including tib-fib squeeze, Thompson, anterior drawer, and talar tilt were negative. Distal pulses were intact.

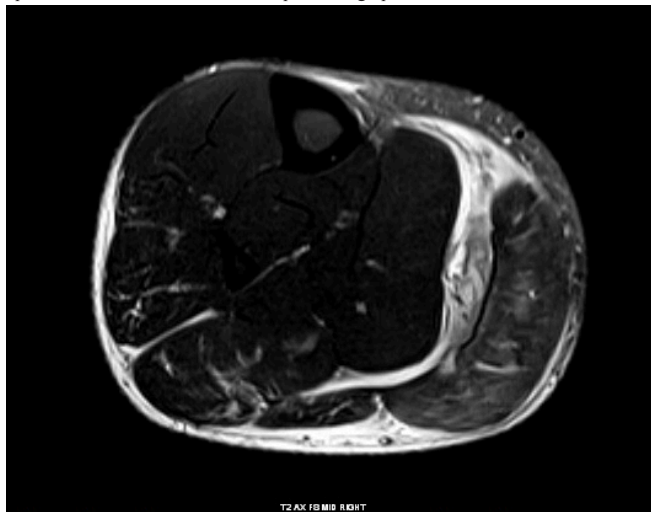
Differential Diagnosis: 1. Medial gastrocnemius strain 2. Tibia or fibular fracture 3. Acute peroneal nerve injury

Test and Results: Radiographs 4 views of the right tibia and fibula with soft tissue swelling and fullness in calf on lateral view. MRI right tibia and fibula with acute tear of the anterior gastrocnemius aponeurosis with a longitudinal component as well as a retracted transverse component.

Final Working Diagnosis: Acute L-Pattern tear of the aponeurosis of the medial calf

Treatment and Outcomes: 1. Offload right lower extremity with walking boot 2.

Course of physical therapy for 6 weeks 3. Indomethacin 50 mg BID for the next 10 days to help reduce risk of heterotopic ossification development in the calf 4. Follow up in 6 weeks for reevaluation and repeat radiographs



3668 May 30 9:40 AM - 10:00 AM

Lower Leg Injury - Basketball

Duke Yi-Fu Yeh. *Pomona Valley Hospital Medical Center, Pomona, CA.*

Email: Duke.Yeh@pvhmc.org

(No relevant relationships reported)

HISTORY: 24 year-old male basketball player presented to clinic with left lower extremity pain after inverting left ankle during a game. Immediately after the injury he grabbed his proximal fibula. He experienced moderate lateral ankle pain that's sharp and throbbing. He could bear weight but was unable to play. He also had swelling near the proximal fibula. The pain was worse with movement and relieved with rest, ice and elevation.

PHYSICAL EXAMINATION:

He was limping favoring his left side.

Left ankle with moderate amount of joint effusion and mild-moderate amount of swelling over proximal peroneal muscle.
 AROM and PROM: limited to pain, especially in inversion and plantarflexion.
 Tenderness to palpation in proximal peroneal tendon/fibula and distal peroneal muscle.
 Strength: Ankle Dorsiflexion 5-/5, Long peroneal, Plantarflexion, Inversion, Eversion all 4+/5. Left Anterior Drawer Test ankle has increased laxity.
 Unable to perform single foot toe raise on left. Neurovascularly intact.
DIFFERENTIAL DIAGNOSIS:
 Peroneal Muscle Strain
 Peroneal Tendon Rupture/Compartment Syndrome/Fibular fracture/Lateral Ankle Sprain
TESTS AND RESULTS:
 3v Xray Left ankle and 6v Xray Left tib-fib: no acute bony abnormalities.
 MRI Left tib-fib: high-grade partial to full-thickness tear of the peroneal longus tendon at the level of proximal fibula with torn tendon fibers to the level of proximal Meta-diaphysis. Low-grade partial tear of the proximal peroneal brevis tendon with intramuscular edema. Tendinosis and tenosynovitis of distal peroneal brevis and longus without high-grade partial tearing.
FINAL/WORKING DIAGNOSIS:
 Tear of Left Proximal Peroneal Tendon.
TREATMENT AND OUTCOMES:
 The patient was shut down from sports and placed in a Cam walker boot. Treatment with rest, ice and PT. Pain control with acupuncture, muscle relaxant, and Tylenol or ibuprofen as needed.
 2 days prior to the 2-week follow-up, the patient received 1 PRP injection at the site of pain.
 At 2 week follow-up, the patient's pain improved. He was able to ambulate without limping but still had tenderness in the proximal peroneal muscle. He was able to have pain free AROM and PROM and regained 5/5 strength in left ankle motions, except 5-/5 in Long Peroneal.
 At 4 weeks follow-up, all symptoms resolved and he was cleared to return to 15 minutes of contact practice.

3669 May 30 10:00 AM - 10:20 AM

Hi-ya!: A Rare Quadriceps Lesion In A Rising Champion

Jose F. Velasquez, James Pearson, Alex Casey, Hamed Shalika.
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 Email: jfvelasquezmd@gmail.com

(No relevant relationships reported)

HISTORY: A 10-year-old Female w/o past medical history was brought to the ED by her mother due to left leg pain and swelling. The mother states that the patient practices taekwondo. 3 days before during training, she sustained a direct kick over the left thigh. The patient states that since then she has been having pain. Mother has been doing supportive care at home including ice, Epsom salt compresses, and Amica. The mother states that despite the pain, the patient continued training. The mother states that the pain and swelling have markedly increased over the left thigh and knee, which started to impair ambulation with associated excruciating pain on palpation. The patient was taken to urgent care where X Rays ruled out a fracture. The patient was seen in the ED due to the worsening of swelling and pain. ROS was negative except for hpi. **PHYSICAL EXAMINATION:** Left lower extremity swelling from thigh to knee, tender to palpation in the lateral aspect over the quadriceps even with light touch. The patient was not able to bear weight or ambulate due to pain. peripheral pulses preserved. Skin is Normal color, warm, No bruise over the thigh. Neuro: grossly intact, motor/sensation. **DIFFERENTIAL DIAGNOSIS:** Quadriceps hematoma, Quadriceps strain, Quadriceps rupture, Compartment syndrome. **TEST AND RESULTS:** MRI LT femur w/o con: Severe sprain of the vastus intermedius muscle with partial tearing of the mid to distal aspect of the muscle lateral of midline associated with a large hematoma and intramuscular hemorrhage and edema. Mild straightening of the vastus medialis muscle proximally. **FINAL WORKING DIAGNOSIS:** Vastus intermedius rupture. **TREATMENT AND OUTCOMES:** RICE therapy, ACE wrap a few hours a day, Stretching exercises, Cryotherapy, Relative rest, cupping, acupuncture, and laser therapy. The Patient was pain-free and no longer needed crutches after a month. The patient started light level tournaments and after more than a month in recovery, she won a taekwondo National Championship.

3670 May 30 10:20 AM - 10:40 AM

Leg Injury - Football

Austin A. Brown, Joseph E. Escobar, James P. Toldi. *University of South Alabama, Mobile, AL.*

(No relevant relationships reported)

HISTORY: A 12-year old male quarterback sustained a right leg injury while cutting back across the field. He was running across the field and made a lateral cut to change directions, as this happened he tripped over himself and fell without a twisting motion.

He landed on his right lateral leg with immediate pain to the fibular head. There was no numbness, tingling, weakness or radiation of pain however he had a noticeable limp. He presented to clinic 2 days later and denied any prior injuries or trauma to the area. **PHYSICAL EXAMINATION:** 2 days post injury (PCP office) — No deformity, normal knee and ankle exams, no bony tenderness, moderate postero-lateral edema of proximal right lower leg, painful/antalgic gait, TTP lateral gastrocnemius and soleus, negative Thompson's. 4 days post injury (Sports Medicine Clinic) — Consistent with prior exam, new findings: point TTP just distal to fibular head, decreased edema, negative squeeze test, negative ER test. **DIFFERENTIAL DIAGNOSIS:** 1. R fibular contusion 2. R knee apophysitis 3. LCL sprain 4. Gastrocnemius contusion/strain 5. Distal Bicep Femoris strain **TEST AND RESULTS:** XR: R Tib/Fib AP and Lateral radiographs 2 days after injury — Bones/joints/soft tissue appear unremarkable.
 Repeat XR 13 days post injury — subtle irregularity along the lateral aspect of the proximal fibula physis with associated periostitis. Final XR 20 days post injury — Noted irregularity along the lateral aspect of the proximal fibula physis with increased benign periostitis. **FINAL WORKING DIAGNOSIS:** Salter-Harris II fracture of R proximal fibula physis
TREATMENT AND OUTCOMES: 1. Cam walker boot 3 weeks with weekly exams/XRs. 2. 20 days out from injury completely normal RLE exam, no pain, full ROM, XRs suggestive for healing SH2 fracture; patient was able to return to football as tolerated. **DISCUSSION:** In isolation this is a very rare injury. There was one reported case of a SH-3 fracture that presented with initial knee injury and ROM deficits that was treated non-operatively. Most injuries to the proximal physis of the fibula occur in combination with an interosseous membrane/syndesmotomic and distal tibiofibular injury - must rule out a Maisonneuve injury. The presenting complaint was pain and edema in the region of the soleus this may have been a soleus traction injury to the apophysys vs direct trauma from the fall.

G-31 Free Communication/Poster - Late-Breaking Abstracts

Saturday, May 30, 2020, 8:00 AM - 10:30 AM
 Room: CC-Exhibit Hall

3684 Board #1

Acute Effects Of Sauna Exposure Compared To Aerobic Exercise On Pulse Wave Velocity

Noah John Erb, Andrew D. Nelson, Julia D. Jenkins, Cory L. Butts. *Weber State University, Ogden, UT.*

(No relevant relations reported)

Cardiovascular disease is the leading cause of death worldwide. Aerobic exercise is recommended to reduce the risk of cardiovascular disease, however it may not be feasible for all individuals. Heat therapy via sauna exposure may be an alternative modality to aerobic exercise to improve cardiovascular health and lower risk of all-cause mortality. **PURPOSE:** To compare the influence of a single bout of sauna induced heat therapy to aerobic exercise on pulse wave velocity (PWV). **METHODS:** Ten participants (9 males, 1 female, age 23 ± 2 y, ht 1.74 ± 0.08 m, wt 80.9 ± 19.7 kg, BMI 26.5 ± 5.5 kg/m²) completed this randomized crossover, counterbalanced control study. Trials consisted of a 20-minute supine baseline followed by 30 minutes of either infrared sauna exposure (HEAT; $\sim 56^\circ\text{C}$), cycling exercise (EXER; 40-50% heart rate reserve), or upright sitting (control; CON). Following the intervention, participants completed a 60-minute supine recovery. Ultrasound measures were recorded at baseline and immediately, 30 minutes, and 60 minutes post-intervention to evaluate central and peripheral PWV. **RESULTS:** Rectal temperature at the end of treatment was greater in the EXER ($37.5 \pm 0.2^\circ\text{C}$) compared to HEAT ($37.1 \pm 0.2^\circ\text{C}$, $P < 0.001$) and CON ($36.9 \pm 0.1^\circ\text{C}$, $P < 0.001$). Heart rate at the end of treatment was also increased in EXER (121.8 ± 5.4 bpm, $P < 0.001$) and HEAT (84.0 ± 16.2 bpm, $P < 0.001$) compared to CON (58.3 ± 9.0 bpm). Central PWV decreased regardless of treatment from 30 to 60 minutes of recovery (-19.3 ± 12.4 cm/s, $P = 0.02$). Central PWV also exhibited medium effects for HEAT (-23.8 ± 27.2 cm/s, Hedge's $g = 0.57$) and EXER (-23.8 ± 27.2 cm/s, Hedge's $g = 0.48$) compared to CON. Lower peripheral PWV was not different between treatments (HEAT 914.6 ± 52.8 , EXER 912.6 ± 83.1 , CON 940.7 ± 97.0 cm/s, $P = 0.46$, $\eta_p^2 = 0.08$) or across time ($P = 0.53$, $\eta_p^2 = 0.07$). Upper peripheral PWV was also not different between treatments ($P = 0.84$, $\eta_p^2 = 0.02$) or across time ($P = 0.14$, $\eta_p^2 = 0.18$). **CONCLUSIONS:** The 30-minute sauna exposure and cycling exercise had minimal short-term impacts on PWV in our healthy population. These preliminary findings suggest that greater physiological strain may be required to elicit the acute changes shown in previous research.

3685 Board #2

Arm And Leg Vascular Responses To A Weekend Of Reduced Physical Activity

Garrett L. Heaney¹, Alexander H.K. Montoye, FACSM¹, Paul J. Fadel, FACSM², Jennifer R. Vranish¹. ¹Alma College, Alma, MI. ²University of Texas at Arlington, Arlington, TX.
(No relevant relations reported)

PURPOSE: Physical inactivity is associated with leg macrovascular impairment following 6 hours of uninterrupted sitting or 5 days of reduced physical activity, however vascular responses in the upper limb are less clear. Indeed, the impact of physical inactivity on both arm and leg microvascular and macrovascular function over a 72-hour period remains unknown. This may be important as it represents a real-world scenario of an active individual during the workweek, followed by sedentary behavior over the weekend. Further, previous studies have investigated the popliteal artery, which does not assess the entire lower limb. We tested the hypothesis that 72 hours of reduced activity (<5000 steps/day) would result in reduced brachial artery (BA) and superficial femoral artery (SFA) resting shear rate, microvascular function (reactive hyperemia-RH), and macrovascular function (flow-mediated dilation-FMD).

METHODS: Physical activity was monitored for the week prior to and during the 72 hours of inactivity in 5 healthy, young men who were currently physically active. BA and SFA resting shear rate, RH (shear AUC), and FMD were measured via duplex Doppler ultrasound before (Pre) and after (Post) a 72-hour inactivity period.

RESULTS: In the SFA, resting shear rate (Pre: 53.6±17.9 s⁻¹, Post: 32.1±14.7; P=0.03) and RH (Pre: 23376±6266 AU, Post: 16580±3304 AU; P=0.01) were significantly reduced after a 72-hour inactivity period. Similarly, BA resting shear rate and RH tended to be reduced (P=0.09 and P=0.07, respectively). Finally, FMD was unchanged in both the BA and SFA (P>0.05).

CONCLUSIONS: Herein, we demonstrate that resting hemodynamics and microvascular function are reduced over 72 hours of inactivity, while macrovascular function is preserved in the upper and lower limbs. These findings may highlight a distinction between the vascular impact of short-term sitting studies versus longer term inactivity studies, as the brachial artery appears to be more affected by the latter.

3686 Board #3

FIt-1 And Endothelial Function Soon After Delivery: Effect Of Physical Activity

Chloe W. Caudell, Samantha Bouknight, Katherine Kramps, Erin O'Connor, Paige Wilbanks, Abbi Lane-Cordova. *University of South Carolina: Arnold School of Public Health, Columbia, SC.*
Email: caudelle@email.sc.edu
(No relevant relations reported)

Vascular adverse pregnancy outcomes (APOs) are characterized by elevated levels of antiangiogenic Fms-like tyrosine kinase (FIt-1), attributable to placental ischemia. FIt-1 directly impairs endothelial function during pregnancy and contributes to maternal features of APOs, but infusion of FIt-1 into non-pregnant animals did not cause endothelial dysfunction. **Purpose:** The purpose was to evaluate the relation of FIt-1 and endothelial function in women 6 months – 3 years after delivery. Given the angiogenic effects of exercise, we tested the hypothesis that FIt-1 would be lower in women who achieved adequate prenatal and current physical activity (PA). **Methods:** 40 nonsmoking women free from diabetes and use of protease inhibitors (mean age: 33±1 yrs, mean BMI: 26.3±1.0 kg/m², 58% with adequate pregnancy PA) completed a blood draw and vascular testing after an overnight fast. We used an ELISA assay to determine levels of circulating FIt-1. Reactive hyperemia (RH) was measured with venous occlusion plethysmography to quantify resistance vessel endothelial function. A validated physical activity questionnaire (Godin Leisure Time Exercise Questionnaire) was used to determine current and second trimester PA; APO history was determined using self-report. We tested for associations of RH with continuous levels FIt-1 using linear regression, adjusted for APO status. We used t-tests to evaluate differences in FIt-1 between women who did versus did not achieve adequate PA during pregnancy or at the time of vascular testing. **Results:** There was no association of FIt-1 and peak RH; $\beta = -0.01 \pm 0.01$, $p = 0.50$. There was no difference in FIt-1 levels between women who did versus did not achieve adequate PA at the time of testing (412±17 versus 443±31 pg/ml, $p = 0.22$) or during pregnancy (408±20 versus 430±20 pg/ml, $p = 0.23$). **Conclusions:** Although related to vascular dysfunction during pregnancy, FIt-1 was not related to vascular function after delivery and did differ by current or pregnancy PA level. FIt-1 might not be useful for identifying women at risk of vascular dysfunction after pregnancy ends.

3687 Board #4

Blood Pressure, Fitness, And Fatness In Children The Arkansas Active Kids Study

Eva C. Diaz, Judith L. Weber, Sean Adams, Young G. Catarina, Bai Shasha, Elisabet Børshheim. *University of Arkansas for Medical Sciences, Little Rock, AR.*
Email: ECDiazfuentes@uams.edu
(No relevant relations reported)

Purpose The role of cardiorespiratory fitness (CRF) in pediatric health is gaining recognition. However, the quality and quantity of the current evidence are insufficient to inform clinical pediatric guidelines. **Objective:** to evaluate the association between direct measures of CRF and blood pressure status as determined by the 2017 screening guidelines from the American Academy of Pediatrics in school-age children. **Methods** Children (n=218) 7 to 10 years old participated in a single-study visit. Children were deemed to have high blood pressure (HBP) if blood pressure status was: elevated, stage-1 or stage-2 hypertension. CRF (VO_{2peak}) was measured using an incremental cycle ergometer test. Body composition was measured with DXA, and physical activity with accelerometers (7±1 days). Blood was sampled in the fasting state and estimated glomerular filtration rate (eGFR) calculated using the updated Schwartz equation. Children were categorized as having excess weight (EW) or normal weight (NW) if their fat mass index was above or below 1 z-score, respectively. Children were further classified into EW/NW more-fit or EW/NW less-fit using the groups' median VO_{2peak}. Multiple logistic regression analyses were used to model the probability of high blood pressure against VO_{2peak}. **Results** Participants' average age was 9 years, with 70% of EW children having HBP vs. 24% in the NW group ($p < .0001$). The probability of HBP decreased with increasing VO_{2peak} in the EW group only ($\beta = -0.09$, $p = 0.0095$). There was no association between CRF and probability of HBP in NW children. eGFR was lower in the less-fit groups than in more-fit groups regardless of adiposity status, even after adjusting for age and blood pressure status (adjusted mean difference between more-fit and less-fit groups: EW=7.1 ml·min⁻¹·1.73 m⁻², $p = 0.0046$ and NW= 2.9 ml·min⁻¹·1.73 m⁻², $p = 0.0144$). **Conclusion** The probability of HBP dramatically decreases with increasing CRF in children with EW but not in children with NW. eGFR is lower in children with lower CRF, regardless of obesity status, but the effect of CRF on kidney function is greater in EW than in NW kids. Funding USDA-ARS Projects 59-6250-4-001 and 6026-51000-012-06S. ECD partially supported by ArCAPT-8UG1OD024945.

3688 Board #5

Impact Of An Ankle-foot Orthosis On Physical Activity In Patients With Peripheral Artery Disease

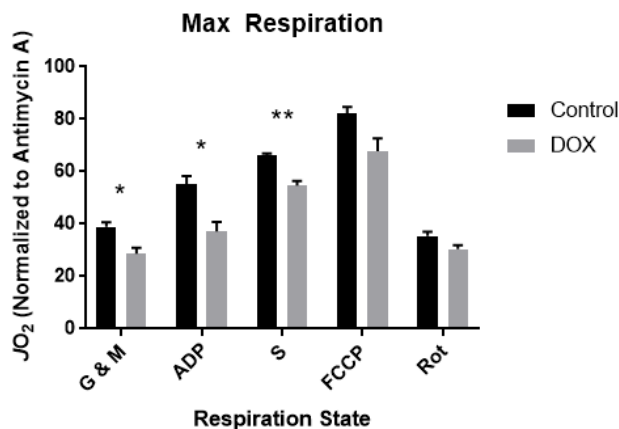
Mahdi Hassan¹, Danae M. Dinkel¹, Holly DeSpiegelae², Jason M. Johanning², Iraklis I. Pipinos², Sara A. Myers¹. ¹University of Nebraska at Omaha, Omaha, NE. ²Omaha Veterans' Affairs Medical Center, Omaha, NE.
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(No relevant relations reported)

Patients with peripheral artery disease (PAD) are sedentary due to claudication pain in the lower extremities. Our research has documented an inability of the ankle plantarflexors to generate normal push-off during walking. An ankle-foot orthosis (AFO) to offset push-off deficiency may improve physical activity levels and walking distances in patients with PAD. **PURPOSE:** To compare step count (SC), peak activity index (PAI), initial claudication distances (ICD), and absolute claudication distances (ACD) before and after an AFO intervention. **METHODS:** Six patients with PAD (Age: 71.7 ± 9.3 years; Body Mass Index: 27.5 ± 5.5 kg/m²) were enrolled in the study. They underwent measurements of SC and PAI over a week using an accelerometer. ICD and ACD were determined while subjects performed the Gardner treadmill protocol without wearing AFOs. All measures were assessed before and after the three month AFO intervention. Signed Rank tests were performed to determine differences following the intervention. **RESULTS:** ACD was significantly increased following the AFO intervention ($p = 0.046$). Mean ACD was 312 ± 169 meters at baseline and increased to 364 ± 194 meters after the three month AFO intervention. Measures before and after the AFO intervention of SC (2422 ± 1166 steps/day and 2349 ± 1112 steps/day), PAI (34 ± 13 steps/min and 30 ± 7 steps/min), and ICD (187 ± 111 meters and 173 ± 138 meters) were not significantly different. **CONCLUSION:** The preliminary results of this study indicated that the AFO intervention improves the ACD in patients with PAD while walking without AFO. Future work should increase the number of subjects and determine whether physical activity intensity levels (light, moderate, and vigorous) changed after AFO intervention. Supported by NIH Grant HD090333-01. We acknowledge Alex Dzewaltowski, Cody Anderson, and Kaeli Samson for supporting this study.

3689 Board #6

Doxorubicin Treatment Decreases Maximal Respiration In C2C12 MyotubesDavid Eastley, FACSM. *Brigham Young University, Provo, UT.*
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The chemotherapeutic drug doxorubicin (DOX) is commonly prescribed to treat patients diagnosed with cancer. However, patients on DOX cannot take it long term due to its cardio-toxic effects, as well as skeletal muscle wasting and dysfunction. The mechanism behind why skeletal muscle dysfunction occurs is not well known, so the effects of DOX on skeletal muscle mitochondria are currently being investigated. **PURPOSE:** To determine the maximal respiration levels in DOX treated C2C12 myotubes. **METHODS:** Immortalized C2C12 myotubes were cultured in vitro and allowed full differentiation. Fully differentiated cells were then treated with 0.5uM DOX for 16 hours. Maximal mitochondrial respiration was analyzed with high resolution respirometry. The following substrates were used: digitonin (permeabilize cells); glutamate (G), malate (M) (leak respiration), then ADP (complex I); cytochrome C (mitochondrial membrane integrity); succinate (S) (complex I & II); FCCP (uncoupled respiration); rotenone (Rot) (complex I inhibitor); antimycin A (complex III inhibitor). Results were analyzed using multiple t-tests. **RESULTS:** DOX caused an 18% reduction in complex I & II supported respiration compared to control (54.6 vs 66.2 JO₂, P <0.005; n=4), a 32% decline in complex I supported respiration (37.2 vs 55.2 JO₂, P <0.05), and a 26.6% decline in leak respiration (28.6 vs 38.99 JO₂, P <0.08), indicating an overall decrease in mitochondrial respiration. **CONCLUSION:** Treating C2C12 differentiated myotubes with DOX for 16 hours inhibits complex I & II supported maximal respiration. These findings enable future research to be conducted in order to better understand why these cells are decreasing in maximal respiration. We are currently investigating whether co-treatments can reduce or rescue reduction in respiration caused by DOX.



3690 Board #7

Effects Of Genetically Modified Probiotics And Exercise On Physical Function In Aged RatsYi Sun¹, Lisa Roberts¹, Anisha Banerjee¹, Youfeng Yang¹, Anthony Knighton¹, Sujitha Peramsetty¹, Amber Sanders¹, Amrisha Verma², Qiuhong Li², Christy Carter¹, Thomas W. Buford, FACSM¹. ¹University of Alabama at Birmingham, Birmingham, AL. ²University of Florida, Gainesville, FL.
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PURPOSE: Declining function in older individuals has enormous clinical and public health consequences, thus therapeutics for preserving function are needed. Advanced age is associated with changes in the gut microbiome, and these changes are associated with functional decline. Our prior work has demonstrated manipulating renin-angiotensin system (RAS) is a promising approach to mitigating age-related functional decline. Recently, genetically modified probiotics (GMP) have also been purported as a promising strategy to deliver drugs with precision and high site specificity. Physical exercise has also been suggested to promote gut health and has important interactions with the Ang(1-7) axis. Here we present preliminary data exploring the impact of oral delivery of genetically modified *Lactobacillus paracasei* secreting Ang(1-7) [LP-A] and exercise training on physical function in aged rats. **METHODS:** 24 month old, male F344/BN rats were randomized into 6 groups. They received oral gavage of LP-A, wild-type probiotics (*Lactobacillus paracasei*), or vehicle 3 times/week; combined

with or without exercise for 12 weeks. Exercised rats ran on a treadmill at 12 cm/sec, 10min/day, 5 days/week. Rats in sedentary group were placed on a non-moving treadmill for the same duration of time. After 12 week of intervention, an exercise tolerance test was performed, where all rats were running on a treadmill starting at 12cm/sec for 2 min, then increase by 2 cm/sec each minute until 16 cm/sec was achieved. Running time to exhaustion was recorded. Locomotor tests (open field assay) were also performed. **RESULTS:** Exercise (mean=1223s) significantly increased time to exhaustion in the exercise tolerance test compared with sedentary animals (mean=464s) in the aged rats. There was also preliminary, but not significant, evidence that LP-A (mean =1329s) group performed best compared to all other exercise groups (Range = 1115-1241s). LP-A increased overall physical activity, compared with all other groups, as measured by the total distance travelled and velocity in the open field test. **CONCLUSION:** Preliminary findings suggest exercise and LP-A increase physical function in aged male rats respectively, but not synergistically.

3691 Board #8

Undernutrition Promotes Oxidative Stress & Capillary Regression In Skeletal MuscleTakumi Hirabayashi¹, Badur un Nisa¹, Hiroyo Kondo², Hidemi Fujino¹. ¹Kobe University, Kobe, Japan. ²Nagoya Women's University, Nagoya, Japan.*(No relevant relations reported)*

PURPOSE: An undernutrition condition results in muscle atrophy and mitochondrial dysfunction. However, it is still not well-known that the characteristics of the skeletal muscle capillary network during undernutrition. The purpose of the present study was to verify the effects of undernutrition on the capillary network in skeletal muscle. **METHODS:** Male Wistar rats were assigned randomly to control and undernutrition groups. The rats in the undernutrition group fed low protein and limited 50% diets daily for 12 weeks. Plantaris and soleus muscle were analyzed. The three-dimensional capillary network of skeletal muscle was visualized using a confocal laser scanning technique. The capillary volume, mean luminal diameter and capillary-to-fiber ratio were measured in both skeletal muscles. In addition, the levels of VEGF and thrombospondin-1 proteins, lipid peroxidation and SOD-2 proteins were determined. **RESULTS:** The muscle mass decreased only plantaris muscle in the undernutrition group. The level of lipid peroxidation was increased, and the expression levels of SOD-2 in plantaris and soleus muscles were decreased. In addition, the capillary volume, mean luminal diameter and capillary-to-fiber ratio were decreased in both muscles of the undernutrition group. Furthermore, the level of VEGF protein was decreased, and thrombospondin-1 was increased in both muscles of undernutrition group. **CONCLUSIONS:** These results suggest that undernourished skeletal muscle induces capillary regression with increased oxidative stress, which also occurs in slow muscle without atrophy.

3692 Board #9

Long-chain Acyl-CoA Synthetases Relate To Fat Oxidation And Storage In Skeletal Muscle Of Lean HumansHarrison D. Stierwalt, Sarah E. Ehrlicher, Matthew M. Robinson, Sean A. Newsom. *Oregon State University, Corvallis, OR.*

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Recent evidence from genetically altered cell and mouse models indicate long-chain acyl-CoA synthetases (ACSLs), namely ACSL1 and ACSL6, may be critical determinants of partitioning of fatty acids toward oxidation or storage, respectively, within skeletal muscle. However, the role ACSLs serve in skeletal muscle fat oxidation and storage remains to be determined in humans, and it is unknown if ACSLs are altered by acute exercise. **PURPOSE:** To identify 1) relationships between skeletal muscle ACSL1 and ACSL6 protein content and measures of fat oxidation at rest and during exercise, and fat storage, and 2) whether acute exercise induces changes in ACSL protein content in humans. **METHODS:** Sedentary lean adults (n=14 [4M/10F], BMI 22.2 ± 2.1 kg/m², VO_{2max} 32.2 ± 4.5 ml/kg/min) completed two metabolic study visits in a randomized crossover design. Trials were identical other than completing 1 h of moderate intensity cycling exercise (65% VO_{2max}) or remaining sedentary. Vastus lateralis muscle biopsies were obtained 15 min post-exercise or rest and 2 h post-exercise to determine ACSL protein and triacylglycerol (TAG) content. TAG content was determined by lipidomic analysis. Substrate oxidation was assessed at rest and during exercise using indirect calorimetry. **RESULTS:** Skeletal muscle ACSL1 protein content was not related to whole-body fat oxidation at rest (P=0.64, r=0.14); however, ACSL1 tended to be positively related with whole-body fat oxidation during exercise (P=0.07, r=0.53), when skeletal muscle accounts for the vast majority of energy expenditure. Skeletal muscle ACSL1 was not altered 15 min or 2 h post-exercise (both P > 0.05 vs. Rest). Skeletal muscle ACSL6 protein content was positively associated with resting muscle TAG content (P=0.05, r=0.57). ACSL6 protein content was not

altered 15 min or 2 h post-exercise (both $P > 0.05$ vs. Rest). **CONCLUSIONS:** Skeletal muscle ACSL1 and ACSL6 protein content were positively associated with measures of whole-body fat oxidation during exercise and skeletal muscle TAG content, respectively. We interpret our results to indicate ACSLs may be critical regulators of partitioning of fatty acids within skeletal muscle, but protein content was not altered in the hours after acute exercise in sedentary lean adults. Supported by ACSM Foundation Doctoral Student Research Grant

3693 Board #10

Adiposity And Cardiovascular Health And The Reallocation Of Waking Activities In Preschool Children With Overweight

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Physical activity and sedentary behaviors differentially relate to health outcomes in children. Isotemporal substitution provides opportunities to evaluate the relation of hypothetical time replacement scenarios across intensity categories with health. Few isotemporal studies have been conducted among preschool-aged youth and ethnically diverse populations.

PURPOSE: To examine the relation of reallocation of waking activity behaviors on 1) adiposity and 2) cardiovascular health indicators among preschool-aged youth (ages 2-5 years) with overweight participating in Texas Childhood Obesity Research Demonstration (TX CORDD), a low-income, majority Hispanic cohort.

METHODS: Participants wore an ActiGraph wGT3X-BT monitor (waist) and attended health assessments. Valid wear time was defined as ≥ 10 hours between 06:00-22:59 hours on ≥ 3 days (≥ 1 weekend). Adiposity measures were percentage of the 95th percentile (%BMI₉₅), fat mass, fat mass index, waist circumference, and waist-to-hip ratio. Cardiovascular measures were resting systolic (SBP) and diastolic (DBP) blood pressure, and heart rate. Covariates included age, sex, ethnicity, and socioeconomic status. Isotemporal substitution modeling was employed to address the study purpose.

RESULTS: Complete data were available for 131 children (Mean age = 4.3 ± 1.1 , 53% female, 87% Hispanic, 31% $\leq 49\%$ income to poverty ratio). For boys, reallocating 15 minutes of sedentary, light, or moderate intensity activity to vigorous intensity activity was significantly associated with beneficial reductions in all adiposity indicators; for girls, these relations were statistically null. For boys and girls, reallocating 15 minutes of sedentary (-5.0 SBP, -3.7 DBP), light (-4.3 SBP, -3.2 DBP), or moderate intensity activity (-7.3 SBP, -5.5 DBP) to vigorous intensity activity was significantly associated with favorable cardiovascular indicators.

CONCLUSIONS: Substituting vigorous for lower intensity physical activity is associated with several favorable adiposity and cardiovascular health outcomes among preschool children with overweight and obesity. Teaching caregivers how to engage young children in vigorous intensity is needed, especially as overweight children spend more time sedentary and less time in higher intensity activities.

3694 Board #11

Operationalization Of The Youth Physical Activity Guidelines Using The International Children's Accelerometry Database (ICAD)

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PURPOSE: Use data from the International Children's Accelerometry Database to explore how different methods of operationalizing the youth physical activity (PA) guidelines influence: (i) the proportion of youth deemed compliant with the guidelines, and (ii) associations between guideline compliance and health indicators. **METHODS:** Accelerometer data for 21,612 youth (5-18y, 62.4% female) was used to explore PA guideline compliance defined by four operationalization methods: daily method (DM; ≥ 60 minutes moderate-vigorous PA [MVPA] on every day of the measurement period), average method (AM; average of ≥ 60 minutes MVPA per day over the measurement period), AM5 (compliance with AM and ≥ 5 minutes of vigorous PA [VPA] on ≥ 3 days), AM15 (compliance with AM and ≥ 15 minutes VPA on ≥ 3 days). Relationships between guideline compliance and health indicators (e.g., BMI z-score, cholesterol levels, blood pressure) were examined for all operationalization methods. Descriptive statistics and McNemar's tests were used to compare compliance estimates for the four methods. Multivariate regression models were used to test associations between compliance and health indicators. **RESULTS:** Operationalization method influenced estimates of compliance with the youth PA guidelines: 5.3% using DM, 29.9% using AM, 29.4% using AM5, 23.7% using AM15. Associations between guideline compliance and health indicators were similar for the AM, AM5 and AM15 methods, for example, BMI z-score: AM compliance (coefficient -0.28, 95% CI: -0.33,-0.23), AM5 compliance (coefficient -0.28, 95% CI: -0.33,-0.23), AM15 compliance (coefficient -0.30, 95% CI: -0.35,-0.25). Compliance with the DM method demonstrated similar or weaker associations with health indicators, potentially due to a small number of participants that complied with DM and also had health indicator data (n=250-1,127). **CONCLUSION:** Operationalization method influences estimates of the proportion of youth meeting the PA guidelines. This finding adds to the PA data processing decisions that researchers need to consider. While operationalization method appears to have a minor influence on associations between guideline compliance and health indicators, further research with a larger sample of DM-compliant participants with health data is needed to confirm this finding.

3695 Board #12

Addressing Motivational Barriers For Early Morning Outdoor Physical Activity Using Smartphones

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Lack of physical activity is a global health concern. Determining an appropriate time to motivate individuals for consistent outdoor exercise is challenging. Early morning outdoor physical activity (PA) has proven health benefits. However, in spite of known wellness benefits, people report motivational barriers such as lack of time, lack of enjoyment to experience morning outdoor PA. Smartphones are increasingly used as a tool to assist in outdoor PA. We have leveraged the smartphone technology capabilities to address the motivational barriers in early morning outdoor physical activity.

PURPOSE: The main purpose of our work is to share findings of an exploratory study for improving motivation of outdoor physical activity. **METHODS:** We developed an intervention called "Rise and Smile" led by one healthy participant and followed by 280 online followers for 365 consecutive days. The participant performed daily

15 minutes of early morning PA of walking or running to reach an outdoor Sunrise viewing location. The participant then captured a photo of the beautiful view of nature during sunrise on their smartphone camera upon completion of their PA. The participant then instantly published the photo on a social media page. **RESULTS:** The individual participant self-reported increased energy, better sleep and increased productivity. The virtual participants ($n=281$) showed positive acceptance via social media with regular sunrise photo likes. The positive reaction to the Sunrise photo also motivated the individual to establish the daily wellness habit. The positive experience of watching sunrise and the picturesque photos of nature during sunrise were used as motivational tools. The participant's motivation was used as a primary outcome measure and was reportedly improved upon successful completion of this study. The study also showed the influence of unique sunrise photos for emotional benefits and positive behaviour change. **CONCLUSION:** Our smartphone-enabled study suggested that use of technology to record unique picturesque outdoors during the sunrise can provide meaningful motivation for outdoor physical activity.

3696 Board #13**Physical Activity Prescription For Patients With Chronic Diseases: A Questionnaire Survey In Shenzhen, China**

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PURPOSE: To investigate the prevalence of prescribing PA in clinical setting for patients with chronic diseases in Shenzhen, China. **METHODS:** A total of 104 patients recruited from three general hospitals in Shenzhen of China completed a face-to-face questionnaire. Patients were asked "have you ever been provided with PA prescription by physicians/healthcare providers". Those who answered yes were then further prompted about the PA frequency (number of times per week), intensity (low, moderate or high intensity), duration (number of minutes per session) and type of PA provided by physicians/healthcare providers.

RESULTS: Overall, 53.4% patients reported receiving PA prescription from physicians/healthcare providers. Of those PA being prescribed, 61.8% of patients reported the frequency were introduced, whereas 65.5% included intensity and 67.3% included duration, respectively. Fewer participants (43.6%) reported being provided the type of PA, and the most common type of PA being prescribed was walking (75%). Moreover, less than a third of patients (31%) received a complete prescription (including PA frequency, intensity, duration & type) from their physicians/healthcare providers.

CONCLUSIONS: This study revealed that about half of physicians/healthcare providers are incorporating PA promotion into clinical setting in Shenzhen. However, only a small percentage of physicians/healthcare providers could provide completed PA prescription for chronic disease patients. Furthermore, the type of exercise that prescribed by physicians/healthcare providers seems to be limited. The results may support that further education/training to physicians/healthcare providers in China are needed in order to foster PA prescription in clinical setting.

3697 Board #14**Hydrotherapy With Hydrogen-rich Water Versus R.I.C.E. Protocol For Acute Ankle Sprain In Professional Athletes**

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Different therapeutic approaches with hydrogen (H_2) have been recently put forward in sports medicine, yet the effectiveness of specific experimental treatments with H_2 was rarely compared with standard clinical procedures. **PURPOSE:** To analyze the effects of intensive hydrotherapy with hydrogen-rich water (HRW) on injury recovery in athletic men who suffered an acute ankle sprain and compare it with RICE protocol (rest, ice, compression, elevation), a universally accepted as best practice immediately after acute ankle sprains.

METHODS: Eighteen healthy male professional athletes who incurred an acute ankle sprain during a sport-related activity were randomly assigned immediately after the injury to either hydrogen group ($n=9$) or the conventional RICE treatment group ($n=9$). Hydrogen group received six 30-min ankle baths with HRW throughout the first 24 h post-injury, with hydrotherapy administered every 4 hours during the intervention period. RICE group stood off the injured leg, with ice packs administered for 20 min every 3 hours (total of 8 sessions), with the injured ankle compressed with an elastic bandage for 24 hours and elevated at all possible times above the level of the heart. The trial was registered at *ClinicalTrials.gov* (NCT04167202).

RESULTS: Hydrotherapy with hydrogen-rich water was equivalent to RICE protocol to reduce ankle swelling ($2.1 \pm 0.9\%$ vs. $1.6 \pm 0.8\%$; $P=0.26$), range of motion (2.4 ± 1.3 cm vs. 2.7 ± 0.8 cm; $P=0.60$), and single-leg balance with eyes opened (18.4

± 8.2 sec vs. 10.7 ± 8.0 sec; $P=0.06$) and closed (5.6 ± 8.4 sec vs. 3.9 ± 4.2 sec; $P=0.59$). Neither intervention affected serum CRP, TNF- α and IL-1 β ($P>0.05$), although hydrogen treatment tended to reduce circulating IL-1 β levels at 24-h follow up (10.8% on average; 95% confidence interval from 6.0 to 27.6; $P=0.07$).

CONCLUSIONS: HRW appeared to be equally effective to RICE for improving recovery after an acute ankle sprain in professional athletes, therefore advancing this innovative approach as an effective alternative in the field of sports medicine. However, more studies are needed to corroborate these findings in other soft tissue injuries.

3698 Board #15**Clinical Benefit Of Cntx-4975 Intra-articular Injection For Moderate To Severe Osteoarthritis Knee Pain**

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Reported Relationships: R.M. Stevens: Salary; Centrexion Therapeutics Corp. Ownership/interest/stock; Centrexion Therapeutics Corp. Other (please describe); Funding for this abstract sponsored by Centrexion Therapeutics Corp.

Purpose: To evaluate the effect of CNTX-4975 intra-articular (IA) injection on pain, function, and quality of life (QoL) in subjects with knee osteoarthritis (OA). **Methods:** A phase 3, open-label, 8-wk study (NCT03661996) enrolled subjects aged 40–95 y with stable, moderate to severe OA knee pain in the index knee (average pain 24 h) after ≥ 2 failed therapies. Subjects were assigned to unilateral/bilateral CNTX-4975 1 mg IA injections as determined by OA pain/joint replacement status (Table) and randomized by site to 1 of 5 joint cooling/injection regimens to evaluate procedure experience. The circumferential joint cooling wrap used in the phase 2 pivotal trial was compared with 4 circumferential gel-pack wrap cooling groups with varying cooling schedules/injection techniques. Outcomes assessed through wk 8 included average daily index knee pain with walking (numeric pain rating scale [NPRS], 0 [no pain] to 10 [worst pain]) and Knee Injury OA Outcomes Score (KOOS) subscales (range, 0–100; higher is improvement; Table). Least squares (LS) mean, 95% CI, and P value were calculated for change from baseline in NPRS and KOOS scores using a mixed model for repeated measures. **Results:** The intent-to-treat population included 848 subjects; baseline NPRS index knee pain with walking scores (mean [SD]) by subject type: A, 6.5 (1.50); B, 7.4 (1.35); C, 6.2 (1.21). By day 3, NPRS scores were significantly ($P<0.0001$) improved; LS mean (SE [95% CI]): A, -3.98 (0.170 [-4.32, -3.64]); B, -4.21 (0.103 [-4.41, -4.01]); C, -3.71 (0.375 [-4.48, -2.94]). Improvement was maintained at wk 8; A, -3.48 (0.191 [-3.86, -3.10]); B, -4.02 (0.118 [-4.25, -3.79]); C, -3.52 (0.416 [-4.38, -2.67]); all $P<0.0001$. All KOOS subscale scores were significantly improved at wk 8 (Table). **Conclusions:** Subjects with moderate to severe knee OA pain showed significant clinical improvements as early as 3 days and through 8 wks post injection in knee pain, function, and QoL after a single CNTX-4975 1 mg IA injection.

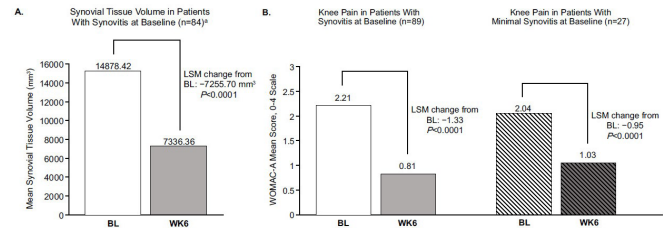
Table: KOOS Scores in the Index Knee After Single Intra-articular Injection of CN1X-4975 1 mg for Moderate to Severe Osteoarthritis Knee Pain

Outcome	Subject Type A: Unilateral Injection (no/mild pain, nonindex knee) n=273	Subject Type B: Bilateral Injection (moderate to severe pain in both knees*) n=523	Subject Type C: Unilateral Injection (prior nonindex knee replacement) n=52
KOOS Pain with walking			
Baseline mean (SD)	53.9 (20.12)	48.1 (19.35)	50.5 (19.03)
Week 8			
CFB (SD)	18.7 (24.43)	27.5 (28.21)	24.5 (26.96)
LS Mean (SE)	21.1 (1.74)	25.9 (1.04)	25.3 (6.06)
95% CI	17.7, 24.5	23.8, 27.9	12.8, 37.8
P value	<0.0001	<0.0001	0.0003
KOOS subscale Pain			
Baseline mean (SD)	47.9 (14.01)	43.3 (13.66)	46.8 (11.86)
Week 8			
CFB (SD)	19.0 (19.40)	27.9 (22.80)	23.4 (20.59)
LS Mean (SE)	22.5 (1.48)	25.6 (0.87)	23.9 (4.61)
95% CI	19.5, 25.4	23.9, 27.3	14.4, 33.4
P value	<0.0001	<0.0001	<0.0001
Other symptoms			
Baseline mean (SD)	52.6 (15.76)	48.7 (16.57)	53.9 (15.40)
Week 8			
CFB (SD)	13.9 (18.49)	23.4 (22.21)	16.6 (19.26)
LS Mean (SE)	17.2 (1.40)	20.9 (0.82)	20.4 (3.69)
95% CI	14.4, 19.9	19.3, 22.6	12.8, 28.0
P value	<0.0001	<0.0001	<0.0001
Function (Daily living)			
Baseline mean (SD)	52.2 (14.92)	46.6 (14.12)	49.0 (14.22)
Week 8			
CFB (SD)	18.2 (19.27)	27.4 (22.51)	23.6 (18.03)
LS Mean (SE)	20.9 (1.48)	25.6 (0.86)	25.7 (4.57)
95% CI	17.9, 23.8	23.9, 27.3	16.2, 35.1
P value	<0.0001	<0.0001	<0.0001
Function (Sports and Recreation)			
Baseline mean (SD)	28.0 (21.20)	26.7 (21.70)	27.8 (25.13)
Week 8			
CFB (SD)	20.2 (29.85)	31.2 (31.59)	26.2 (26.23)
LS Mean (SE)	25.2 (2.25)	27.8 (1.23)	33.1 (5.80)
95% CI	20.7, 29.6	25.4, 30.2	21.2, 45.1
P value	<0.0001	<0.0001	<0.0001
Quality of life			
Baseline mean (SD)	32.4 (16.35)	31.6 (17.96)	30.9 (15.78)
Week 8			
CFB (SD)	17.6 (23.42)	25.7 (26.21)	19.8 (26.07)
LS Mean (SE)	22.1 (1.90)	21.5 (1.06)	16.8 (6.26)
95% CI	18.4, 25.8	19.4, 23.6	3.8, 29.7
P value	<0.0001	<0.0001	0.0132

*In subjects receiving bilateral CN1X-4975 injections, the index knee was defined as knee with worse pain. Statistics were based on a mixed model of repeated measures. CFB, change from baseline; CI, confidence interval; LS, least squares; SD, standard deviation; SE, standard error; KOOS, Knee Injury and Osteoarthritis Outcomes Score (range, 0-100; higher scores indicate improvement).

Parameter	Statistics	Patients With Synovitis at BL* (n=89)	Patients With Minimal Synovitis at BL* (n=26)	All Patients (N=116)
Age, years	Mean (SD)	62.3 (7.9)	58.8 (8.3)	61.5 (8.1)
Female	%	64.0	63.0	63.0
BMI, kg/m ²	Mean (SD)	30.3 (4.4)	29.6 (5.3)	30.1 (4.6)
Years since diagnosis	Mean (SD)	9.0 (8.4)	9.6 (10.1)	9.1 (8.8)
Days with pain/mo	Mean (SD)	29.1 (2.8)	29.6 (2.7)	29.2 (2.8)
Bilateral OA	%	67.4	81.5	70.7
Prior index knee surgery	%	29.2	11.1	25.0
Prior IACS	%	43.8	29.6	40.5
Prior IAHA	%	13.5	7.4	12.1
KL grade 2	%	38.2	74.1	46.6
KL grade 3	%	61.8	25.9	53.4
Joint space width, mm	Mean (SD)	4.3 (1.3)	5.2 (0.8)	4.5 (1.3)
WOMAC-A (pain)	Mean (SD)	2.2 (0.6)	2.0 (0.5)	2.2 (0.6)
WOMAC-B (stiffness)	Mean (SD)	2.5 (0.7)	2.1 (0.8)	2.4 (0.7)
WOMAC-C (function)	Mean (SD)	2.3 (0.6)	2.0 (0.6)	2.2 (0.6)
KOOS-QOL	Mean (SD)	26.1 (16.6)	32.2 (13.6)	27.5 (16.1)
Baseline STV, mm ³	Mean (SD)	14,878.4 (10,349.3)	1405.0 (735.8)	11,693.8 (10,712.1)

*Patients with STV <3000 mm³ were defined post hoc as a population with minimal synovitis. BL, baseline; BMI, body mass index; IACS, intra-articular corticosteroid; IAHA, intra-articular hyaluronic acid; KL, Kellgren-Lawrence; KOOS-QOL, Knee Injury and Osteoarthritis Outcomes Score-Quality of Life; OA, osteoarthritis; STV, synovial tissue volume; WOMAC, Western Ontario and McMaster Universities Osteoarthritis Index.



*Imaging population: all pts from the safety population who had a diagnostic quality MRI pre-treatment and at least one post-BL. BL, baseline; LSM, least-squares mean; WK, week; WOMAC-A, Western Ontario and McMaster Universities Osteoarthritis Index (pain).

3699 Board #16

Effect Of Triamcinolone Acetonide Extended-release On Synovial Inflammation In Patients With Osteoarthritis Of The Knee

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PURPOSE: Synovitis is common in osteoarthritis of the knee (OAK) and is associated with pain and disease severity. This open-label phase 3b study is evaluating the effect of an intra-articular (IA) injection of triamcinolone acetonide extended release (TA-ER) on synovial tissue volume (STV), pain, and function (NCT03529942). A prespecified analysis of the primary endpoint is reported.

METHODS: STV was determined using gadolinium MRI; synovitis was defined as pre-treatment STV ≥3000 mm³ (3 mL). All patients (pts) received TA-ER 32 mg at baseline (BL) and were assessed at Weeks 6, 12, 18, and 24. MRIs were repeated at Weeks 6 and 24. Interim analysis was performed for the primary efficacy endpoint, mean standardized change from BL in STV at 6 weeks. Planned enrollment was based on earlier studies.

RESULTS: We enrolled 116 OAK pts with typical OA characteristics (Table); 89 (77%) demonstrated synovitis at BL. STV was significantly reduced from BL at 6 weeks (P<0.001; Fig. 1A). The primary endpoint was met: standardized least squares mean change in STV was -1.13 (95% CI, -1.35 to -0.91; P<0.001). Western Ontario and McMaster Universities Osteoarthritis Index (pain) was significantly reduced at 6 weeks in all pts (Fig. 1B). 24 (20.7%) pts experienced ≥1 treatment-emergent adverse event (TEAE); 6 (5.2%) pts had ≥1 index-knee TEAE. All TEAEs were mild or moderate; none were treatment related.

CONCLUSIONS: At 6 weeks, a single TA-ER IA injection markedly reduced STV in pts with synovitis at BL. Marked symptomatic improvement was observed in all pts at 6 weeks following TA-ER.

3700 Board #17

Choosing Wisely Initiative: Analysis Of Twelve Years Of Therapeutic Ultrasound

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In 2014, the Choosing Wisely Initiative partnered with the American Physical Therapy Association to produce a list of low-value physical therapy (PT) practices, titled “Five Things Physical Therapists and Patients Should Question.” This publication described the limited value of deep heat, or therapeutic ultrasound (TUS), to improve long term outcomes for a myriad of musculoskeletal conditions, yet TUS continues to be used. It is unclear how often TUS is used in contemporary PT practice, how its use has changed after this initiative and for what specific conditions it is most used. **PURPOSE:** To assess the historical use of TUS by physical therapists before and after the Choosing Wisely Initiative across a regional health network. **METHODS:** A de-identified Clinical Research Data Warehouse was queried using i2B2 software to collect the history of TUS usage by PTs between 2008 and 2019. The specific CPT code 97035 was used to identify TUS episodes of care. In addition, the total number of unique patients in PT each year was collected. Indications for individual TUS treatment units were analyzed in 2018 and 2019 to yield the most frequent ICD-10 codes for which TUS was performed. **RESULTS:** Episodes of TUS were standardized by the total number of patients seen in PT each year to account for the growth of the health network. The percentage of patients who received TUS each year was reported. TUS usage rates between 2008 and 2019 were compared using Pearson’s two proportion Z-test. Utilization was significantly lower in 2019 (5.2%) than it was in 2008 (24.0%) (χ² = 2059.6, p-value < 2.2e-16). Between 2018 and 2019, 5,936 units of TUS were performed by 118 unique PT providers. TUS was commonly performed for shoulder pain (13.0%), ankle or foot pain (9.6%), neck pain (9.6%), knee pain (7.7%), hip pain (6.1%), low back pain (6.0%), unspecified chronic pain (4.3%), and Achilles tendinopathy (4.1%). **CONCLUSION:** Over the last 12 years, there has been a significant decrease in use of TUS by PTs. This decline coincides with the Choosing Wisely Initiative. However, TUS continues to be used, albeit at a significantly lower frequency, for treating musculoskeletal conditions despite having little evidence in improving long term clinical outcomes. Supported by NIH Grant UL1TR001436.

3701 Board #18

High-intensity Interval Training Improves Cardiorespiratory Fitness In Prior Non-responders To Traditional Aerobic Exercise

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PURPOSE: Although most people respond to traditional aerobic exercise and improve cardiorespiratory fitness (CRF), some do not respond, called non-responders, and they are often ignored. One theory of non-response is the lower intensity of

traditional exercise. This study was conducted to answer the important question, "Can high-intensity interval training (HIIT) improve CRF for prior non-responders?" **METHODS:** Participants were 8 (5 women, mean age 54) prior non-responders from the CardioRACE study who were at high-risk of cardiovascular disease including 35-70 years old with overweight/obesity and elevated/stage 1 hypertension. They previously participated in CardioRACE traditional continuous aerobic exercise for 3 times/week, 60 min/session, at 50-80% heart rate reserve [HRR]. They were identified as non-responders due to no or minimal increase in CRF (similar to <5% CRF increase) after 6 months of exercise, following the recommended non-responder definition that considers technical errors in CRF assessment and day-to-day variability. In this study, participants performed HIIT exercise 3 times/week, 30 min/session for 1 month, containing four 4-min high-intensity intervals at 85-95% HRR separated by three 3-min active recovery at 40-60% HRR with 5-min warm-up and cool-down. CRF was measured by maximal treadmill test using a Balke protocol. **RESULTS:** This short HIIT exercise significantly improved CRF with a mean increase of 8% from 26.7 to 28.8 ml/kg/min ($p < 0.01$ from paired t-test) in prior non-responders to traditional exercise (Figure 1). All participants improved CRF and 6 became responders. All high-risk participants safely completed HIIT with 100% attendance rate without adverse events. **CONCLUSION:** Even half the HIIT exercise time (30 min/session) over 1 month significantly improved CRF in prior non-responders. A long-term HIIT trial with a control group is necessary to confirm the findings. CardioRACE was supported by NIH Grant R01HL133069

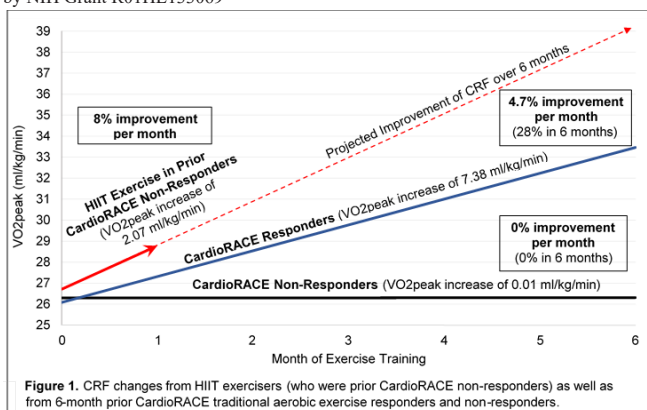


Figure 1. CRF changes from HIIT exercisers (who were prior CardioRACE non-responders) as well as from 6-month prior CardioRACE traditional aerobic exercise responders and non-responders.

3703 Board #20

Fitbit Analysis Shows Enhanced Mobility Of Knee Osteoarthritis Patients Treated With Triamcinolone Acetonide Extended Release

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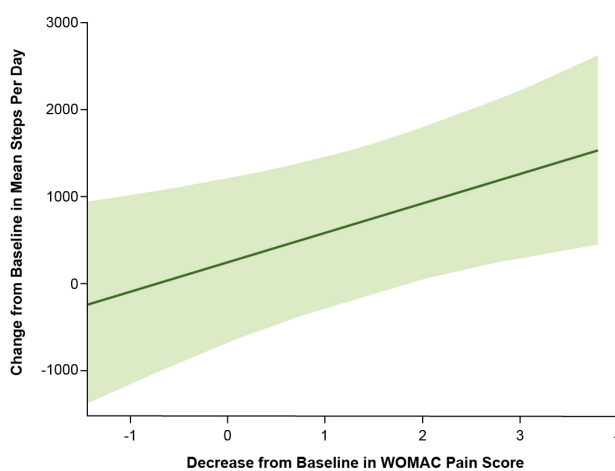
PURPOSE: In knee osteoarthritis (OAK), walking >6000 steps/day can prevent functional limitation (White DK. *Arthritis Care Res.* 2014;66:1328). Intra-articular triamcinolone acetonide extended-release (TA-ER) is approved for OAK pain. This Phase 3b study assessed safety and an exploratory endpoint of mobility (steps/day) in patients treated with TA-ER.

METHODS: OAK patients aged ≥40 years, symptomatic ≥6 months, with Western Ontario and McMaster Universities Osteoarthritis Index pain (WOMAC-A) score ≥6, and index-knee pain >15 days during the past month received TA-ER on Day 1. Movements were analyzed with a Fitbit® device (≥7 days prior to Day 1 to end of Week 12).

RESULTS: A total of 208 patients were treated with TA-ER; 67.8% had moderate-severe OAK, mean age of 60.8 years, and mean body mass index (BMI) of 31.4 kg/m². Baseline mean WOMAC pain score was 2.17. Mobility improved as seen by increases in weekly mean steps/day. 73 of 203 patients (36%) with sufficient step data at baseline had <6000 steps. Of these, 42 (57.5%) had ≥1 post-baseline week with average daily steps >6000; 19 (26.0%) had ≥50% of their follow-up with >6000 steps. Patients treated with TA-ER had mean changes from baseline in WOMAC pain scores of -1.4, -1.2, and -0.8 at Weeks 4, 8, and 12, respectively. A significantly greater change in steps from baseline was associated with decreases in WOMAC pain scores, male sex, lower BMI, lower baseline GPAQ average MET, and lower baseline steps/day. For every 1-unit decrease (from baseline) in mean WOMAC pain, mean steps/day increased by 339 (Figure 1).

CONCLUSIONS: OAK patients given TA-ER had increased mobility (≥6000 steps/day) as measured by fitness monitor which was associated with a decrease in pain. Limitations were incomplete adherence to monitor usage and a no comparator open-label design. Fitness monitors are a feasible tool to measure patient mobility and understand pain and function.

FIGURE 1. Effect of Change in WOMAC Pain Score from Baseline on Steps per Day



3702 Board #19

Strength Training Enhances Recovery After Surgery (STERAS)

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Undergoing general anaesthetic and complex surgery is associated with significant risk. Compounding this, reduced muscle mass is proven to be linked to increased post-operative complications and increased length of stay. Exercise focused prehabilitation research is emergent and increasingly supportive of preventive strategies to improve post-surgical outcomes. **PURPOSE** To investigate the role of a multi-site strength focussed exercise intervention in improving patient condition prior to surgery to enhance recovery **METHODS** 43 (26 male, 17 females; 68.3 ± 9.3 years) patients scheduled for surgery were randomly assigned to one of 3 groups; 1) prehabilitation [pre-surgery exercise] 2) prehabilitation + rehabilitation [pre and post-surgery exercise] or 3) usual care. The exercise program consisted of an aerobic component and 6 resistance exercises targeting the major muscle groups. Primary outcomes were length of stay (days) and post-operative complications. Secondary measures included; whole body resistance, muscular strength, aerobic fitness, physical function and quality of life. **RESULTS** There was no difference in length of stay between groups (prehab: 11.2±10.3; pre+rehab: 13.2±6.2; control: 13.9±12.4). Post-operative complications were not different between groups. A significant time*group interaction was observed for isometric grip strength ($p=0.046$). Patients reported significantly greater quality of recovery in the prehab+rehab exercise group compared to control ($p=0.05$). No differences were observed between groups for whole body resistance, aerobic fitness, measures of physical function or self-reported quality of life. **CONCLUSION** The preliminary results of this study indicate resistance-based exercise training prior to and following surgery results in greater muscular strength and enhanced quality of recovery compared to current standard care practices. These findings provide promising support for the development of future strength focused prehabilitation programs to improve patient function prior to surgery and reduce the surgery stress response, promoting an accelerated recovery. Supported by WA Cancer and Palliative Care Network NMHS20193593; Spinnaker Medical Research Foundation

3704 Board #21

Sex Differences In Quadriceps Angiogenic Signaling And Muscle Capillary Supply After ACL Injury

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Following an Anterior Cruciate Ligament (ACL) reconstruction, females have worse functional outcomes; however, skeletal muscle biology has preferentially been studied in males. Muscle adaptation and recovery from injury are intimately tied to the muscle capillary network, which delivers oxygen, nutrients, and hormones to muscle fibers. **PURPOSE:** To examine differences in skeletal muscle angiogenic signaling and capillary supply in males and females after ACL injury. **METHODS:** Vastus lateralis (VL) biopsies were collected (24.6 ± 5.5 yr; 8M, 5F) from the ACL injured (INJ) and non-injured (NI) leg before reconstruction. Samples were assessed for vascular endothelial growth factor receptor 1 and 2 (VEGFR1 and VEGFR2) by western blot. Capillary to fiber ratio (C:F), capillary to fiber perimeter exchange index (CFPE), and capillary tortuosity (% fiber border directly contacting capillary wall) were assessed by immunohistochemistry. **RESULTS:** The percentage of phosphorylated relative to total VEGFR2 was not different between INJ and NI, but was lower in females ($76.9 \pm 4.1\%$) compared to males ($89.2 \pm 3.2\%$; $P = 0.043$). VEGFR2 abundance tended to be higher ($P = 0.098$) and C:F was lower (INJ: 2.3 ± 0.2 capillary•fiber⁻¹, NI: 2.6 ± 0.2 capillary•fiber⁻¹; $P = 0.018$) in INJ compared to NI, but neither parameter was different between sexes. VEGFR1 abundance displayed a sex by injury interaction ($P = 0.004$), with females having greater abundance of VEGFR1 in INJ (548 ± 54 A.U.) compared to NI (478 ± 53 A.U.; $P = 0.050$), while males showed the opposite (NI: 461 ± 42 A.U., INJ: 383 ± 42 A.U.). CFPE was lower in INJ compared to NI (INJ: 5.1 ± 0.3 capillary• $1000\mu\text{m}^{-1}$, NI: 5.8 ± 0.3 capillary• $1000\mu\text{m}^{-1}$; $P = 0.002$), and post-hoc analysis revealed that the difference was driven by females. Capillary tortuosity was lower in INJ ($13 \pm 2\%$) compared to NI ($17 \pm 2\%$) for females only ($P = 0.006$). **CONCLUSION:** Differences in angiogenic signaling between males and females in both INJ and NI limbs were evident, and ACL injury resulted in an exacerbated deficit in muscle capillary supply for females. These results support the idea that sex-specific differences in VL capillary network remodeling following ACL injury contribute to different functional outcomes following reconstruction and rehabilitation. Supported by NIH grants: R01 AR072061 and K23 AR062069.

3705 Board #22

Mechanistic Insights Into Using Aerobic Exercise To Remodel Tumor Vasculature And Increase Chemotherapy Efficacy

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Tumor blood vessels pose obstacles for drug delivery because they are hyper-permeable and non-functional. There is a critical need to identify safe methods to increase chemotherapy delivery to the tumor. **PURPOSE:** We demonstrated that aerobic exercise improves tumor vasculature function, in multiple disparate tumor models, causing increased chemotherapy delivery and efficacy in mice. Across models, exercise reduced tumor vessel permeability. Because aerobic exercise increases blood flow both in healthy and tumor vessels, we aimed to investigate shear stress responsive mechanisms by which exercise may reduce tumor vessel permeability. **METHODS:** *In vivo* approaches including pharmacologic agents, a forced treadmill model of moderate aerobic exercise, and transgenic mouse models were utilized in combination with *in vitro* modeling of exercise induced shear stress, using a cone and plate viscometer. **RESULTS:** In tumor endothelium, we found the flow responsive kinase and co-transcriptional activator extracellular signal-regulated kinase 5 (ERK5) regulates tumor vessel permeability, similar to exercise. ERK5 activation in response to exercise was investigated *in vivo*, using a Krüppel like factor 2 (KLF2) reporter mouse. KLF2 is a well-defined downstream target of ERK5. KLF2 was upregulated by exercise in the lung and aorta endothelium providing the first evidence for the involvement of ERK5 activation in response to aerobic exercise. Based on this and our previous data demonstrating that exercise induced shear stress upregulates spingosine-1 phosphate receptor 1 (S1PR1) on tumor vessels, we hypothesized that exercise activates ERK5, causing S1PR1 upregulation and decreasing permeability in tumor endothelium. To investigate this, we modeled basal tumor vasculature (low shear stress, 3 dynes/cm²) and exercise-induced flow (high shear stress, 15 dynes/cm²) with a cone and plate viscometer *in vitro*. We found the ERK5 axis has a similar flow responsive pattern as S1PR1. Further, ERK5 directly regulates S1PR1 in cultured endothelial cells revealing a novel EC pathway, the ERK5-S1PR1 axis. **CONCLUSION:** In summary, our data

identifies the ERK5-S1PR1 axis as a potential exercise responsive pathway in tumor and healthy vasculature. We are currently investigating activation of the ERK5 axis in tumor vasculature.

3706 Board #23

The Impact Of High Intensity Interval Training On Fitness, Stress And Immunity In Breast Cancer Survivors

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PURPOSE: The aim of this study was to explore the impact of exercise intensity on aerobic fitness and autonomic cardiac regulation (heart rate variability (HRV)) and salivary biomarkers of the stress systems (HPA-axis, cortisol; sympathetic nervous system, α -amylase) and mucosal immunity (secretory(s)-IgA), in breast cancer survivors.

METHODS: Seventeen participants (62 ± 8 years) were randomly assigned to: 1) high intensity interval training (HIIT; n = 6); 2) moderate-intensity, continuous aerobic training (CMIT; n = 5); or 3) a wait-list control (CON; n = 6) for a 12-week (36 session) stationary cycling intervention. Cardiorespiratory fitness ($\text{VO}_{2\text{peak}}$), resting HRV and salivary biomarkers were measured at baseline 2-4 d pre-intervention and 2-4 d post the last exercise session.

RESULTS: A significant improvement ($p \leq 0.05$) was observed for $\text{VO}_{2\text{peak}}$ in the HIIT group; 19.3% ($B = 3.98$, $95\%CI = [1.89; 46.02]$) and a non-significant increase in the CMIT group; 5.6% ($B = 1.96$, $95\%CI = [-0.11; 4.03]$), compared with a 2.6% ($B = -0.64$, $95\%CI = [-2.10; 0.82]$) decrease in the CON group. Post intervention improvements in HRV markers of vagal activity ($\log(\ln)LF/HF$, $\ln\text{RMSSD}$) and sympathetic nervous system (α -amylase waking response) occurred for individuals exhibiting outlying ($> 95\%$ CI) levels at baseline compared to general population.

CONCLUSIONS: HIIT (compared to CMIT and CON) improved cardiorespiratory fitness in breast cancer survivors. Non-invasive measures of the autonomic nervous system, stress systems and mucosal immunity should be explored further to understand the individualised responses to training adaptations within the breast cancer population.

3707 Board #24

A Longitudinal Study Of Combined Exercise Intervention With Internet And Social Media For Breast Cancer Patient

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PURPOSE: Breast cancer patients in treatment suffer from long-term side effects that seriously influence their physical and mental health. The aim of this study was to examine differences in health-related outcomes between a 12-week remotely-guided combined exercise (CE) intervention group and a usual care (UC) group after one year for breast cancer patients.

METHODS: In phases I-III, 60 patients (51.2 ± 7.9 years) with breast cancer (BC) who completed chemotherapy/ postoperative radiotherapy within the previous 4 months to 2 years participated in a randomized controlled trial intervention of combined exercise with remote guidance. Eligible participants were approached to assess cancer-related quality of life (QOL), muscle strength, cardiorespiratory endurance and physical activity (PA) barriers after one year.

RESULTS: The result demonstrated that after one year the CE group reported higher in vitality-related QOL (5.776, CI 0.987, 10.565, ES=0.360), mental health-related QOL (9.938, CI 4.146, 15.729, ES=0.512), leg strength and endurance (2.880, CI 1.337, 4.423, ES=0.557), strength and endurance of upper extremities (2.745, CI 1.076, 4.415, ES=0.491), and lower physical activity (PA) hindrance (5.120, CI 1.976, 8.264, ES=0.486) than the UC group.

CONCLUSIONS: The CE group had significant differences from the UC group in quality of life, muscle strength, cardiopulmonary endurance and physical activity participation. These findings showed that the combined exercise intervention with remote guidance produce a long-term benefits for breast cancer patients.

3708 Board #25

Associations Between Physical Activity, Quality Of Life And Emotional Well-being During Active Surveillance For Prostate Cancer

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PURPOSE: The purpose of this retrospective longitudinal study was to examine the association between post-diagnosis physical activity (PA), and the change in quality of life (QoL) and emotional well-being over time in men on active surveillance (AS) for low-risk prostate cancer. **METHODS:** Our analysis included 630 participants from AS initiation until AS discontinuation or loss to follow up. A modified Godin Leisure-Time Exercise Questionnaire was used to measure post-diagnosis PA in metabolic equivalent-minutes per week (MET-min/wk). Participants were categorized based on their PA levels: inactive (<210 MET-min/wk), insufficiently active (210-499 MET-min/wk), active (500-1000 MET-min/wk), and highly active (>1000 MET-min/wk). QoL and emotional well-being were assessed by the Patient-Oriented Prostate Utility Scale. The association between post-diagnosis PA (independent variable) and QoL (dependent variable) was assessed using generalized estimated equations (GEE). GEEs were also used to determine the association between PA (independent variable) and emotional well-being (dependent variable). All models adjusted for participant's age. **RESULTS:** Compared to inactive participants, active (β1.14; 95%CI= 0.11, 2.16, $p=0.029$) and highly active (β1.62; 95%CI= 0.58, 2.67; $p=0.002$) participants had higher QOL during AS. Highly active participants were more likely to experience high emotional well-being (OR = 1.55 95%CI = 1.11, 2.16; $p=0.010$) over time compared to their inactive counterparts. In a subgroup analysis for men with low emotional well-being early on during AS, engaging in > 1000 MET-min/wk (highly active) was associated with greater odds of experiencing high emotional well-being over time (OR = 2.17; 95%CI = 1.06, 4.46, $p=0.034$) relative to lowest PA (<210 MET-min/wk). **CONCLUSIONS:** Our findings emphasize the importance of PA as a supportive care strategy during AS for low-risk prostate cancer.

3709 Board #26

Reliability Of The Athlete Diet Index: A Rapid Dietary Assessment Tool For Athletes

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Diet quality indices are a practical and inexpensive way to evaluate dietary patterns and adherence to nutrition guidelines. While the diet quality of athletes has been reported using population indices, there is currently no reliable athlete-specific diet index. **PURPOSE:** To assess the reliability of the recently developed Athlete Diet Index (ADI) in athletes. **METHODS:** Eighty-three athletes (55 female; 18.9±4.2 years) from a state-based Australian sports institute consented to complete the ADI deployed using FileMaker™ Pro 16 (FileMaker Inc., 2017, Santa Clara, USA) on a portable device (iPad mini™) on two occasions two weeks apart between June and December, 2019. Sixty-eight athletes completed the ADI on two occasions. Scoring (maximum=125) was based on population guidelines and international sports nutrition recommendations. Scored ADI items measured intake of core and discretionary foods, and markers of dietary habits relevant to athletes. Reliability was evaluated by comparing ADI scores of the first and second administrations using paired t-tests, intra-class correlation coefficients (ICC) and Bland-Altman plots (limits of agreement (LOA) set at mean±1.96SD, and bias determined via regression analysis) all conducted using SPSS Statistics version 26 (IBM Corp, Armonk, NY, USA). **RESULTS:** In preliminary analyses, the mean ADI score was 84.1±15.2 (range 42.5-114.0, median 85.0). There was no difference between ADI scores on the two occasions of administration, mean difference 1.94 (95% CI: -0.49, 4.38, $P=0.117$) (paired t-test). The ICC was very good (ICC=0.80, 95% CI: 0.69, 0.87, $P<0.0001$). Bland-Altman analysis showed a mean difference of 1.94 (LOA -17.79, 21.60) and the regression line demonstrated no indication of systematic bias ($y=4.57-0.03*x$) (95% CI: -0.19, 0.13, $P=0.701$). There were no differences in serves of fruit, vegetables and grains between

administrations; while differences were reported in serves of meat (1.69 vs 1.55, $P=0.01$) and discretionary foods (1.83 vs 1.86, $P<0.0001$). **CONCLUSIONS:** The ADI is a novel athlete-specific diet index which has demonstrated very good reliability in athletes, providing practitioners with a promising measure of usual dietary intake. Further evaluation of the ADI, including validation compared to established dietary methodology, is warranted.

3710 Board #27

Abstract Withdrawn

3711 Board #28

Effects Of Mitochondria-targeted Antioxidant Supplementation On The Transcriptional Response To Exercise And Cycling Performance

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Oral supplementation with general antioxidants has little impact on performance and, in some cases, interferes with training-induced adaptations that improve performance. This may be attributed to the non-specific nature of most antioxidant supplements. Mitochondria-targeted antioxidants are becoming popular amongst active individuals as they are specifically designed to accumulate within the mitochondria to provide more targeted protection against oxidative damage. The aim of this research was to investigate the effect of MitoQ on 1) the transcriptional response to high intensity interval exercise (HIIE) and HIIT training (HIIT) -induced changes in performance and 2) cycling performance in trained cyclists.

To understand how MitoQ supplementation during training affects the transcriptional response to HIIE and HIIT-induced changes in performance, twenty-three untrained middle-aged (age 44.6 ± 8 years) men were randomised to receive MitoQ (20 mg/d) or a placebo before completing HIIE (cycle ergometer, 10 x 60s at VO₂ peak workload with 75s rest) and HIIT (3 x wk for 3 wk). Mitochondrial and antioxidant gene expression were measured in muscle biopsies collected before, immediately and 3 hr after HIIE and VO₂ peak and 20 km time trial performance were measured before and after HIIT. To further elucidate where MitoQ could be an ergogenic aid, twenty trained (VO₂ peak 55.1 ± 13.2 ml.kg.min⁻¹), middle-aged (age 44 ± 3 years) male cyclists were randomly assigned to the order in which they received MitoQ (20 mg/d) and the placebo for 6 weeks before completing a performance test (cycling at 70% VO₂ peak for 45 min followed by an 8 km time trial). In untrained men, expression of peroxisome proliferator-activated receptor gamma coactivator 1-alpha (PGC1-α) was increased 3 hr after HIIE and this effect was increased by MitoQ (Cohen's d = 0.89). While VO₂ peak and 20 km time trial performance improved similarly in the MitoQ and placebo group after HIIT, the improvement in peak power output (PPO) achieved during the VO₂ peak test was greater in the MitoQ group (by 5.8%, $p=0.03$). MitoQ also significantly improved 8 km time trial performance in trained cyclists. These results suggest that MitoQ may augment exercise-induced increases in PGC1α expression and improve cycling performance when taken during exercise training.

3712 Board #29

Fit And Fast Versus Slow And Steady: The Relationship Between Fitness And Cognitive Performance In Males And Females

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PURPOSE: Previous research shows aerobic fitness influences attentional inhibition. However, few studies have reported a differential relationship between aerobic fitness and inhibition between males and females. This study investigated the relationship between fitness and inhibitory performance in college-aged males and females.

METHODS: Seventy-nine young adults (M: 19.90 ± 1.1 yrs; 48 females) completed measurements of physical fitness (VO₂max test) and inhibitory control (modified flanker task). Moderation analyses were conducted to determine the influence of sex on the relationship between aerobic fitness and inhibitory control.

RESULTS: RT, response accuracy, and percentage of commission errors were regressed onto mean-centered fitness (VO₂max percentiles), sex, and the interaction between fitness and sex. Fitness was significantly correlated with congruent accuracy ($p < 0.05$), but not correlated with incongruent accuracy ($p = NS$) or RT ($p = NS$). Fitness was negatively correlated with total commission errors ($p = NS$). The interaction between fitness and sex revealed males who are more fit are faster in both congruent ($p < 0.05$) and incongruent responses ($p < 0.05$), whereas fitter females are slower in both congruent ($p < 0.05$) and incongruent responses ($p < 0.05$).

Interestingly, fitter males are significantly less accurate during incongruent trials ($p < 0.005$), whereas females did not differ in accuracy based on fitness ($p = \text{NS}$). Neither males nor females differed in accuracy based on fitness for congruent trials. Similarly, fitter males have a greater percentage of incongruent commission errors ($p < 0.005$) but no differences in congruent commission errors ($p = \text{NS}$), whereas in females, fitness did not influence percentage of congruent ($p = \text{NS}$) or incongruent commission errors ($p = \text{NS}$).

CONCLUSIONS: These results suggest that aerobic fitness may differentially influence flanker performance, particularly in the more challenging condition, in males and females. Furthermore, males and females may adopt different strategies in the difficult condition to maintain performance. These results suggest that while higher fit females may slow down in order to maintain accuracy, higher fit males may have faster responses at the expense of errors.

3713 Board #30

Alzheimer's Disease-related Gene Expression Is Reduced Following Six Months Of High-intensity Exercise

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Extensive research supports the use of exercise to protect against Alzheimer's disease (AD). Nevertheless, there is limited evidence from human studies regarding the mechanisms underlying the positive effects of exercise on the brain. Gene expression determines the extent to which a gene is "turned on or off" and can be used to understand mechanistic pathways. Animal research has demonstrated that exercise influences the expression of genes related to various AD biological pathways; however, the impact of exercise on AD-related gene expression has not yet been studied in humans. **PURPOSE:** To examine changes in AD-related gene expression following a six-month high-intensity exercise intervention.

METHODS: Cognitively normal men and women (60-80y) were randomised to either six-months of work-matched high-intensity exercise ($n=33$), moderate-intensity exercise ($n=34$) or an inactive control group ($n=32$). Blood samples were collected pre- and post-intervention and expression levels from a panel of genes implicated in AD were measured. Analysis of covariance (covaried for age and gender), with adjustment for multiple comparisons, was conducted to determine group differences. **RESULTS:** Decreases in AD-related gene expression following six months of exercise, compared with the control group. More specifically, gene expression associated with cholesterol metabolism (ABCA1; $p < 0.001$), amyloid precursor protein processing (ADAM17, BACE1; $p < 0.05$) and synaptic plasticity (UCHL1; $p < 0.001$) was favourably altered in the high-intensity exercise intervention, compared with the moderate-intensity intervention and control groups. **CONCLUSIONS:** Investigation of AD-related gene expression has the potential to play an important role in understanding the biological pathways by which exercise reduces AD risk and contributes to enhanced cognitive health. The current work indicates a dose-dependent effect of exercise intensity on the expression of genes associated with AD, revealing mechanistic pathways that require further investigation.

3714 Board #31

The Role Of Apolipoprotein ε4 Allele Carriage In Exercise-induced Cognitive Change

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Emerging evidence indicates that there may be substantial individual variability in exercise-induced cognitive enhancement, which likely contributes to the inconsistent findings regarding exercise and cognition across the literature. Previous research is inconclusive with respect to how genetic risk for Alzheimer's disease (defined by apolipoprotein, APOE, ε4 allele carriage) modulates the relationship between exercise and cognitive health. **PURPOSE:** To examine the moderating effect of apolipoprotein E (APOE) ε4 allele carriage on cognition following a six-month exercise intervention. **METHODS:** Ninety-nine cognitively normal men and women (aged 60-80 years) were randomised to either six-months of high-intensity exercise ($n=33$), moderate-intensity exercise ($n=34$) or an inactive control group ($n=32$). All participants underwent verbal

learning and memory assessment using the California Verbal Learning Test (CVLT) at pre- and post-intervention. A series of linear mixed-models were undertaken to examine the effects of a group*time, and group*time*APOE ε4 interaction term on repeated CVLT assessments. **RESULTS:** No effect of group*time was observed on any of the CVLT sub-scores. However, an effect of group*time*APOE ε4 was observed for CVLT learning ($d=0.87$, $p < 0.01$) and CVLT short delay recall ($d=0.67$, $p < 0.05$). Post-hoc analyses revealed only carriers of the APOE ε4 allele received benefit from the high-intensity intervention, compared with the moderate-intensity and control groups. **CONCLUSIONS:** No changes in verbal learning and memory were observed from pre- to post-exercise intervention in the whole cohort. However, we observed that APOE ε4 carriers received benefit from the high-intensity exercise intervention in terms of improvement on tasks assessing memory and thinking. Our results indicate that individuals at greater risk of AD, and thus more likely to be experiencing a degree of cognitive decline, may benefit most from exercise.

3715 Board #32

Sex Differences In The Clinical Sequelae Of Exertional Heat Stroke In Military Servicemembers

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Exertional heat stroke (EHS) represents a significant source of morbidity and mortality for the military and other occupational and athletic populations. EHS patients tend to present with elevated biomarkers of acute liver and kidney injury, rhabdomyolysis, and altered hematological parameters. However, little is known about how men and women may respond differently to EHS, in terms of clinical severity and/or biochemical responses. **PURPOSE:** The aim of this study was to characterize clinical and biochemical differences between male and female servicemembers immediately following an EHS episode. **METHODS:** We performed a retrospective analysis of EHS patient records in all US military personnel (41% between 20-24 years old) from 2008-2014 using the Military Health Systems Data Repository. We compared diagnoses of organ failure during the course of treatment and clinical laboratory markers of end organ damage. Sex differences in clinical outcomes are presented with odds ratios, and biomarker differences are presented as the median difference with 95% confidence intervals in brackets. **RESULTS:** A total of 2,529 EHS cases were recorded with 9.8% [8.7, 11.2] occurring in women. Per patient treatment cost was lower in women by \$1110 [620, 1647]. Men were 2.35 [1.6, 3.58] times more likely to experience renal failure ($p < .001$). Blood urea nitrogen, (difference = -121.05 mg/dL [41.9, 182.28]), myoglobin (difference = 3 ng/mL [2, 4]), aspartate transaminase (difference = 7 units/L [1, 14]), and alanine transaminase (difference = 13 units/L [8.5, 15.92]) were elevated in men (all $p < .01$). Platelet count was also lower in men compared to women (difference = -22.14×10^3 per uL [-39.25, -2.99], $p = 0.03$). **CONCLUSION:** Female servicemembers appear to have a slightly less severe response to EHS compared to their male counterparts. In particular, renal failure was more common, and numerous markers of end-organ damage (hepatic, renal, and cardiovascular) were more likely to be elevated immediately following EHS in men. Supported by USAMRDC; author views not official US Army or DoD policy.

3716 Board #33

Relationship Between Body Composition And Sport-specific Performance Metrics In Ncaa Di Female Volleyball Players

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PURPOSE: The present study examined the relationship between body composition and sport-specific performance markers in NCAA Division I female volleyball players. **METHODS:** Twelve NCAA DI female volleyball players were assessed for body composition [body mass (BM), fat mass (FM), fat-free mass (FFM), body fat % (BF%)] via air displacement plethysmography (BODPOD) and sport-specific performance metrics [standing vertical jump (SVJ), pull-ups (PU), power clean (PC), back squat (BS), bench press (BP), and 5-10-5 pro agility shuttle (PA)] pre-, mid-, and post-season. Pearson and partial correlations assessed the relationships between FM, FFM, and performance metrics. **RESULTS:** FM and FFM were highly correlated ($r=0.521$, $p<0.01$). FM and PC were correlated ($r=0.405$, $p=0.01$) when assessed via Pearson correlation but no longer correlated when controlling for FFM (partial correlation, $r=0.084$, $p<0.05$). FM and SVJ were correlated when controlling for FFM ($r=-0.477$, $p<0.05$). FFM was correlated (Pearson, $p<0.05$) with BP ($r=0.335$), PC ($r=0.748$), SVJ ($r=0.659$), and PA ($r=-0.373$). When controlling for FM, partial correlations ($p<0.03$) existed between FFM and PC ($r=0.653$), SVJ ($r=0.707$), and PA ($r=-0.407$). **CONCLUSION:** SVJ was the only performance variable that correlated

with FM when controlling for FFM. FFM was positively correlated with PC and SVJ, and negatively with PA when controlling for FM. This suggests greater amounts of FFM are more advantageous for performance in the PC (lift greater amounts of weight) and PA (perform in less time) than having low FM, while having low FM or greater FFM are both advantageous for SVJ (greater jump height).

3717 Board #34

Validity And Reliability Of A Portable Metabolic Analyzer For Assessing Oxygen Consumption And Ventilation

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Metabolic analyzers are standard tools in research-based, exercise physiology laboratories in university settings. Portable, low-cost metabolic analyzers have the capacity to extend the value of metabolic gas analysis beyond the traditional laboratory setting. **PURPOSE:** This study's purpose was to assess validity and reliability of a portable, low-cost metabolic analyzer (VPRO) for assessment of oxygen consumption (VO₂) and minute ventilation (VE) during progressive cycling testing. **METHODS:** In Protocol 1, eight male participants (height: 171.9 ± 5.8 cm, weight: 79.6 ± 8.3 kg, age: 41.0 ± 12.3 years) with previous competitive cycling experience ranging from 2-40 years completed an hour-long stationary cycling protocol twice, progressing from 100-300 Watts every 10-12 minutes while wearing the VPRO and a criterion measure (PMED) for five minutes each, at each stage. In Protocol 2, 16 recreationally active male participants (height: 168.2 ± 8.4 cm, weight: 76.5 ± 13.3 kg, age: 23.0 ± 9.4 years) completed three incremental, maximal stationary cycling tests wearing one of three analyzers for each test (VPRO version 1.1.1, VPRO version 1.2.1, PMED). Mean absolute percent differences (MAPD) ≤10% were deemed acceptable validity/reliability. **RESULTS:** For Protocol 1 and convergent validity, the VPRO had mean absolute differences from the PMED of <0.3 L/min for absolute VO₂ and <5 L/min for VE overall and at each exercise stage. MAPD for VO₂ and VE were <9% overall and <12% at each exercise stage. Test-retest reliability of VO₂ and VE of the VPRO (MAPD: 8.9-11.0%) was lower than the PMED (MAPD: 4.7-7.6%). For Protocol 2, validity was similar for both VPRO versions (MAPD ~12% overall) compared to the PMED for VO₂ and VE. **CONCLUSIONS:** The VPRO had an acceptable validity and test-retest reliability for most variables and intensities tested and may be an appealing option for VO₂ and VE analysis.

3718 Board #35

The Effects Of Acute Resistance Exercise On Bioelectrical Impedance Analysis Measures Of Body Composition

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PURPOSE: The purpose of this study was to determine if acute, localized resistance exercise (RE) compromises the validity of BIA total body composition estimates. **METHODS:** In a crossover design, 16 healthy, resistance trained adults, including 7 females (age: 22.7 ± 1.9 y; height: 165.4 ± 8.4 cm; body mass: 62.1 ± 10.9 kg; body fat: 25.9 ± 7.3%) and 9 males (age: 24.3 ± 3.6 y; height: 179.1 ± 5.1 cm; body mass: 88.0 ± 7.6 kg; body fat: 18.4 ± 6.6%) completed three conditions in a randomized order: lower-body resistance exercise (RE_{LOWER}), upper-body resistance exercise (RE_{UPPER}), and no exercise (REST). A warm-up consisting of 2 sets of 12-15 repetitions of 3 upper- or lower-body exercises, followed by 5 sets of 10 repetitions per exercise, with 1-minute rest intervals. BIA (InBody 770) was completed immediately pre and post-exercise and at 15-, 30-, and 60-minutes post-exercise. BIA estimates of fat mass (FM) and fat-free mass (FFM) were analyzed using 3 x 5 (condition x time) ANOVA with repeated measures, follow-up pairwise comparisons, and evaluation of the partial eta-squared (η_p^2) effect sizes. **RESULTS:** Pre-exercise FM and FFM did not differ between conditions (0.1 to 0.4 kg; $p > 0.4$ for all). Condition x time interactions were present for both FM ($p < 0.0001$, $\eta_p^2 = 0.48$) and FFM ($p < 0.0001$, $\eta_p^2 = 0.45$). Pairwise comparisons indicated that FM was lower in the RE_{UPPER} condition as compared to both REST (1.5 kg; $p < 0.001$) and RE_{LOWER} (1.3 kg; $p < 0.001$) conditions immediately post-exercise. These differences remained at 15-, 30-, and 60-minutes post-exercise (0.6 to 1.6 kg; $p \leq 0.01$ for all). Pairwise comparisons also indicated that FFM was higher in the RE_{UPPER} condition as compared to both REST (1.3 kg; $p < 0.001$) and RE_{LOWER} (0.9 kg; $p < 0.01$) conditions immediately post-exercise. These differences remained at 15- and 30-minutes post-exercise (0.8 to 1.3 kg; $p \leq 0.02$ for all). At 60-minutes post-exercise, FFM remained higher in RE_{UPPER} as compared to REST (1.0 kg; $p = 0.005$) but no longer differed between RE_{UPPER} and RE_{LOWER} (0.4 kg; $p = 0.44$).

CONCLUSION: These data indicate that acute upper-body RE compromises the validity of BIA total body composition estimates compared to REST and lower-body RE and reinforces exercise abstinence as a pre-test consideration.

3719 Board #36

The Effects Of Acute Resistance Exercise On Dual-Energy X-Ray Absorptiometry Measures Of Body Composition

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PURPOSE: The purpose of this study was to determine if acute, localized resistance exercise disrupts the validity of DXA total body composition estimates. **METHODS:** In a crossover design, 18 healthy, resistance-trained, college-aged adults, including 7 females (age: 22.7 ± 1.9 y; height: 165.4 ± 8.4 cm; body mass: 62.1 ± 10.9 kg; body fat: 25.9 ± 7.3%) and 11 males (age: 24.2 ± 4.1 y; height: 180.0 ± 5.1 cm; body mass: 90.2 ± 9.5 kg; body fat: 18.7 ± 7.2%) completed three conditions in a randomized order: lower-body resistance exercise (RE_{LOWER}), upper-body resistance exercise (RE_{UPPER}), and rest (REST). The resistance exercise (RE) protocol consisted of a RE warm-up consisting of 2 sets of 12-15 repetitions of 3 upper-body exercises (upper), or 3 lower-body exercises (lower) or nothing (rest). The RE circuit consisted of 5 sets of 10 repetitions per exercise, with 1-minute rest intervals between circuits. A DXA scan was performed immediately before exercise and at 60 minutes post exercise. DXA estimates of fat mass (FM) and fat-free mass (FFM; calculated as lean soft tissue plus bone mineral content) were analyzed using 3 x 2 (condition x time) analysis of variance with repeated measures, follow-up pairwise comparisons, and evaluation of the partial eta-squared (η_p^2) effect sizes. **RESULTS:** Pre-exercise FM and FFM did not differ between conditions (0.2 to 0.4 kg; $p > 0.14$ for all). For FM, no statistically significant interaction or main effects were present (interaction: $p = 0.80$, $\eta_p^2 = 0.01$; time main effect: $p = 0.14$, $\eta_p^2 = 0.12$; condition main effect: $p = 0.92$, $\eta_p^2 = 0.01$). For FFM, no statistically significant interaction ($p = 0.13$, $\eta_p^2 = 0.12$) or condition main effect ($p = 0.56$, $\eta_p^2 = 0.03$) was present. However, a statistically significant time main effect was present ($p = 0.009$, $\eta_p^2 = 0.34$). Pairwise comparisons indicated that post-condition FFM estimates were 0.20 ± 0.07 kg lower than pre-condition values in all conditions combined. **CONCLUSIONS:** No differences were seen among conditions, indicating that DXA total body composition estimates may be relatively robust to the effects of acute, localized RE. However, investigation of segmental estimates is warranted due to RE-induced blood flow redistribution.

3720 Board #37

High School Basketball Coach And Player Perspectives About Warm Up Routines And Lower Extremity Injuries

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PURPOSE: To understand high school basketball coach and player routines, knowledge and attitudes relating to warm-ups and lower-extremity injuries (LEIs). **METHODS:** A prospective qualitative study using data from semi-structured interviews with high school basketball coaches and players conducted from May-October 2019, then thematically analyzed by multiple coders employing team coding. **RESULTS:** We interviewed n=12 coaches (9 male; 3 female) and n=30 players (11 male; 19 female). **Current warm-up.** Coaches and players report regular engagement in warm-up routines, but the types of exercises, time dedicated (range: 5-45 minutes) and exercise order varied. Coaches often rely on players to co-lead warm-up exercises. **Knowledge and beliefs re: LEI prevention research.** Most coaches and players believe that regularly engaging in a warm-up routine is effective at preventing injury ("...warming up is absolutely important. There's no disputing."), but lack thorough knowledge of the current evidence ("I have a general interest in sports and fitness...[but] I can't give you any specific...sources."). **Barriers.** Warm-up routines suffer at games due to limited time and space ("Game-[time] is the worst time."). Some players and coaches perceive youth as impervious to injury and minimize warm-up ("I remember being 16 and 17...[you get] out of bed and [you] just run two miles and you're fine."). Coaches face multiple demands during practice, which can impede their focus on a warm-up routine ("...as a coach, [warm-up] is hard...you don't have a lot of time...You want to get right to the point [of practice]."). Coaches also expressed concern that they lack adequate knowledge to select the best exercises and skills to teach their players how to perform them correctly ("...what stretches

are out there. I don't think I know all of them.”). **Enablers.** Players' past injury experience was a key motivator for warming-up (“I'd just put on my shoes and I'd start playing...[until I hurt]...My knee.”). Coach encouragement was also a motivator for players. **CONCLUSION:** Regular involvement in basketball warm-up routines was common among high school teams, but the methods and time dedicated to these practices varied. Players and coaches are eager for more information on warm-ups shown to reduce LEIs, as well as targeted strategies to effectively implement these routines.

3721 Board #38
Validity And Reliability Of A Lower Body Power Test In Older Adults

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Lower body power declines with age and is associated with decreased physical function in older adults. However, current tools to assess muscle power are expensive and non-portable which limits their widespread use. **PURPOSE:** The purpose of the study was to assess the validity and reliability of a functional sit-to-stand power test (STS) in older adults by comparing it with pneumatic leg press, which is widely used in clinical trials to measure lower body power. **METHODS:** A total of 51 community-dwelling adults, 65 years or older, were recruited. Lower body peak power was assessed using a portable linear transducer and a pneumatic leg press. The highest peak power across three attempts with 1 min of rest in between was used for the analysis. To assess construct validity of the STS test, the participants completed the 8-Foot Up and Go (8' UG) test, at both usual and fast pace, and the Short Physical Performance Battery (SPPB) that rates participants from 0 (worst performance) to 12 (best performance) based on balance, usual walk speed, and chair stand tests. A two-week test-retest was conducted to assess reliability in 36 participants. Pearson's correlation coefficient was used to assess construct validity while intra-class correlation (ICC) was used to assess reliability. **RESULTS:** The mean age of the sample was 71.3 yrs, with 62% females, and an average SPPB score of 10.6. Peak power assessed using STS showed a high correlation (0.88, $P < .01$) compared to the pneumatic leg press. As hypothesized in our pre-registered protocol, the STS test showed similar or greater correlation compared to pneumatic leg press for SPPB (0.30 vs. 0.40), chair stand test (-0.37 vs. -0.46), 8' UG test at usual pace (-0.28 vs. -0.37) and fast pace (-0.35 vs. -0.41) and balance (0.23 vs. 0.33). The test-retest assessment yielded an ICC of 0.99 and 0.95 for leg press and STS, respectively. All values were statistically significant ($P < .05$). **CONCLUSION:** The novel functional STS test is comparable to the pneumatic leg press in measuring lower body power. The STS test is relatively inexpensive, portable, takes less space, and should be considered for further validation and future implementation.

3722 Board #39
INFLUENCE OF GENETIC BACKGROUND ON HEART MITOCHONDRIAL DNA LESIONS AND COPY NUMBER IN INBRED MICE

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PURPOSE: The heart is a critical tissue responsible for facilitating a multitude of endurance training adaptations in aerobic capacity. Mechanisms of heart mitochondrial DNA (mtDNA) repair remain incompletely understood, and genetic susceptibility to exercise-induced mitochondrial-derived oxidative damage may be present. mtDNA damage presents as an indirect measure of mitochondrial-derived oxidative stress, while mtDNA copy number is a correlate of mitochondrial biogenesis. As two critical aspects for enhancing trainability in aerobic capacity, the purpose of this study was to characterize heart mtDNA lesions and copy number in a genetically diverse panel of male inbred mouse strains. **METHODS:** A genetically diverse panel of 34 inbred mouse strains were selected, and hearts of male mice ($n = 184$; 2 - 6 mice per strain) were removed and weighed. DNA was and a gene-specific quantitative PCR-based assay was used to measure mtDNA lesions and copy number.

RESULTS: Among the strains, we found significant interstrain variation in mtDNA lesions (range = -0.15 - 4.0 mtDNA lesions/10Kb) and copy number (range = 3682 - 111895 mtDNA copies). We observed that the wild-derived PWD/PhJ strain had the highest overall heart mtDNA lesions (PWD/PhJ = 4.31 ± 0.07 mtDNA lesions/10Kb vs all other strains = 0.25 ± 0.42 mtDNA lesions/10Kb; $p < 0.0001$), while having the lowest overall mean mtDNA copy number (PWD/PhJ = $6,538 \pm 898$ mtDNA copies vs all other strains = $54,943 \pm 27,085$ mtDNA copies; $p < 0.0001$). We did not find an association between mtDNA lesions or copy number with exercise capacity or heart

weight. **CONCLUSIONS:** Our results demonstrate that there are inherent differences in heart mtDNA damage and copy number. Interestingly, the wild-derived PWD/PhJ strain had higher overall mtDNA lesions, complemented by lower mtDNA copies, possibly suggesting the hearts of this strain undergo more significant mitochondrial-derived oxidative stress (e.g. higher fission vs fusion; mitophagy) compared to others. Thus, ongoing work aims to 1) characterize markers of mitochondrial-derived oxidative stress (i.e., fission/fusion; mitophagy), 2) sequence the complete mitochondrial genome and determine levels of heteroplasmy and indels that may associate with mtDNA damage and copy number.

3723 Board #40
Acculturation And 24-hour Behaviors In Asian American Women

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PURPOSE: Asian American (AA) women have elevated cardiovascular disease (CVD) risk but are an understudied minority group. Physical activity (PA), sedentary behavior (SB) and sleep duration are recognized as independent CVD risk factors, yet these behaviors have not been well described in this population. The study's purpose was to describe AA women's 24-hour behaviors and explore how these relate to acculturation. **METHODS:** Participants were middle-aged normotensive AA immigrant women living in New York City. They completed measures of acculturation along with 7 days of wrist and hip actigraphy to measure sleep duration, moderate-vigorous PA (MVPA), light intensity PA (LIPA) and SB. MVPA, LIPA, and SB were classified by Freedson(1998)'s cut-points and sleep duration was identified by using the Cole-Kripke algorithm and sleep diaries. Linear regression analysis was conducted to test the associations of ethnicity (East Asian vs. South Asian) and acculturation variables (age immigrated to the U.S., years of U.S. residency, English proficiency) on 24-hour behaviors, controlling for age, BMI, education, and employment.

RESULTS: Of the 94 AA women enrolled, 89% ($n=84$) completed hip and wrist actigraphy monitoring (age= 61.3 ± 7.9 , BMI= 25.4 ± 3.6 , 58.9% college or higher, 54.4% employed). Their average hours spent on 24-hour behaviors were: MVPA= 0.5 ± 0.4 , LIPA= 6.2 ± 1.6 , SB= 9.8 ± 1.7 , sleep = 5.3 ± 0.9 . More daily MVPA was related to East Asian ethnicity ($b=0.42$, $p < 0.01$), immigrating to the U.S. at an older age ($b=0.43$, $p < 0.01$), and greater English proficiency ($b=0.32$, $p=0.03$). More SB was related to South Asian ethnicity ($b=0.36$, $p=0.03$) and longer U.S. residency ($b=0.35$, $p=0.02$). Average sleep duration was below recommendations in both East and South Asian women (5.4 ± 0.8 vs. 5.1 ± 0.9), but sleep duration and LIPA were not related to any of the acculturation variables. **CONCLUSIONS:** AA women's 24-hour behaviors differed by ethnicity, and associations with some acculturation variables were observed in this study. Larger, prospective studies are needed to explore the heterogeneity in 24-hour behaviors within this growing minority group and explore both positive and negative effects of acculturation. Culturally tailored strategies may be needed to improve 24-hour behaviors and reduce CVD risk in AA women.

3724 Board #41
The Effect Of Using Electromyostimulation To Taekwondo Athletes' Brain Waves During PNF Stretching Methods

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(No relevant relations reported)

PURPOSE: The purpose of this study was to analyze the activity of brain waves depending on the different type of stretching exercise as a warm-up for Taekwondo competitions in order to find out the feasibility of using EMS during PNF-stretching method. We would like to see the difference between the stretching techniques used by Taekwondo athletes and the stretching methods using EMS. **METHODS:** A total of three method of treatments were conducted to 8 elite Taekwondo athletes (Age: 25.87 ± 0.99 , Height: 185.75 ± 11.01 , Weight: 80.87 ± 21.56) repeatedly in random order: PNF Stretching with electric stimulation (EMS+PNF), warm-up exercise with electric stimulation, and PNF stretching without electric stimulation. The EMS+PNF group's electrical treatment was 60 Hz, with five seconds of stimulation and five

seconds of rest alternately. Exercise intensity is RPE 15-16 levels. The brain wave condition of all subjects were presented in comparison before and after(post-hoc) treatment procedures. We performed Two-way Repeated Anova test at the difference of the data between the before and after the program. **RESULTS:** First, EMS part ($M = 66.73$, $SD = 7.23$), PNF part ($M = 38.02$, $SD = 7.23$), EMS during PNF stretching part ($M = 59.33$, $SD = 7.23$) were confirmed in Alpha value. So significant differences were found between warm-up exercise with EMS during PNF-stretching($p < .01$); EMS during PNF-stretching and PNF-stretching($p < .05$) in Alpha value. In addition, it showed significant increases in alpha value corresponding to duration of treatments($F = 4.851$, $p = .009$). Second, significant differences between before and after were found in beta values($F = 5.024$, $p = .026$). Third, significant differences were found between EMS ($M = 151.99$, $SD = 14.93$) and PNF-stretching($M = 84.67$, $SD = 14.93$) in theta value($p < .01$). EMS showed higher value than PNF-stretching in theta wave. **CONCLUSIONS:** This study was showed changes of an alpha wave, which reflects positive emotions, depending on presence of EMS. Thus, it can be considered as more effective method when applying EMS to conventional stretching which leads athletes to feel more effectively treated. The result of the increase in the beta wave was predicted about the difference between EMS stimulation and general stretching by reflecting the characteristics of the beta wave that is activated as cognitive processing occurs. Theta wave is activated when the influence and anxiety of a quiet environment are felt. We are guessed Player thinks that the effect of stretching is low and that the result is reflected when the traditional stretching is performed. Throughout this study, athletes can be expected to show better performance by using EMS during stretching exercise.

experimental schematic diagram

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pre-test EEG ↓
EMS EMS+PNF Stretching PNF Stretching
↓
10 min rest (Between measurements)
↓
post-test EEG

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3725 Board #42

The Effects Of Citrulline Malate Supplementation In Strength And Muscle Mass

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(No relevant relations reported)

L-citrulline (CIT) is a non-essential amino acid, found abundantly in watermelon, which has the ability to indirectly increase nitric oxide production by increasing arginine levels. A combination and the acute use of CIT with malate (intermediate of the Krebs cycle) has shown interesting results in the sports science literature, but the chronic effect of citrulline malate (CM) in the scientific literature is still unclear. **PURPOSE:** Investigate the chronic effects of citrulline malate supplementation in increasing strength and muscle mass in trained healthy adults. **METHODS:** A randomized, double-blind, crossover, placebo clinical study. Twenty four (25.96 ± 4.7 years) healthy adult men were randomly divided into 2 groups: citrulline malate group (CM = 12; 82.4 ± 10.7kgs) or placebo group (PL = 12; 82.11 ± 10.9kgs). The CM group received a sachet containing 6g of citrulline malate + 15g of maltodextrin and the PL group 6g of non-essential amino acids (NAAE) + 15g of maltodextrin. Supplementation was performed for 28 days (4 weeks) and included a wash-out week. After this week, there was an exchange of supplements in both groups. Before and after each supplementation, body composition (body weight, fat mass and muscle mass) by plethysmography (BodPod), and repetition maximum test (1RM) in the bench press were performed. Statistical analysis was performed using the covariance analysis model for crossover experiments, considering a significance level $p < 0.05$.

RESULTS: CM supplementation promoted an increase in total lean mass (67.28 ± 8.11 kgs vs 67.77 ± 7.97 kgs, $p < 0.005$) in relation to placebo (67.83 ± 7.84 kgs vs 67.43 ± 8.57 kgs) (CM vs PL $p < 0.001$), a decrease in total weight (CM 82.39 ± 10.72 kgs vs 81.63 ± 9.98 kgs and PL 82.11 ± 10.9 kgs vs 82.08 ± 9.78 kgs, CM vs PL $p < 0.05$) and an increase in the final bench press (CM 37.95 ± 7.6 kgs vs 41.55 ± 8.31 kgs, $p < 0.05$) in relation to placebo supplementation (38.26 ± 8.69 kgs vs 40.08 ± 8.19 kgs, $p < 0.05$) (CM vs PL, $p < 0.01$), regardless of the sequence in which the supplement was ingested. **CONCLUSION:** Supplementation of CM for 4 weeks proved to be effective in improve body composition (decrease in total weight and increase lean mass) and increased strength, without showing adverse effects, indicating a viable strategy for practitioners of resistance exercise.

G-32 Free Communication/Poster - Interval Training

Saturday, May 30, 2020, 8:00 AM - 10:30 AM

Room: CC-Exhibit Hall

3736 Board #53 May 30 8:00 AM - 9:30 AM

Blood Flow Restriction Compared To High Intensity Interval Training On Body Composition And Tendon Width

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(No relevant relationships reported)

Blood flow restriction (BFR) is a low load exercise modality advocated to improve body composition. **PURPOSE:** To compare BFR against high intensity interval training (HIIT) body-weight squats (BWS), and 80% 1RM squats (CON) in body composition and quadriceps tendon cross section area (QXS). **METHODS:** Thirteen subjects participated in the study (27 ± 5.8 years, BMI: 23.3 ± 3.2 , F:8). Subjects were randomly assigned to a BFR ($n = 5$), HIIT ($n = 5$), or CON ($n = 3$). Body composition was measured via air plethysmography while QXS was measured via musculoskeletal ultrasound. Subjects were tested at baseline and 6-weeks after training. BFR bands were placed at the proximal thigh and inflated to 250mmHg while performing a 30/15/15/15 repetition (rep) protocol using a metronome (1 rep/2 secs). The HIIT group completed BWS during a 20 sec on and 10 sec off protocol for 8 sets. The control (CON) group completed 3 sets of 5 reps squats of their 80% 1RM. All three groups completed their workouts 3 times a week. Due to the small sample size Kruskal-Wallis (KW) was performed for the variables of fat mass (fm;kg), lean mass (lm;kg), and QXS (cm) during baseline. If no differences at baseline were found the same analysis was performed for the 6-week follow-up. In addition, a KW analysis between groups was performed for the difference between baseline and follow-up values between variables. **RESULTS:** Although BFR showed improvements (fm: -1.1 kg, lm: +0.3kg, QXS: +.01cm) for all variables over the other groups (HIIT: fm: +1.5kg, lm: -1.2kg, QXS: -.02cm; CON: fm: -.05kg, lm: +0.4, QXS: +0.1cm) none of the two KW analytical approaches showed a statistically significant difference for any of the variables of interest. **CONCLUSION:** Although BFR showed improvements in all variables, the magnitude of these changes was not significant enough to demonstrate it is a superior modality than HIIT or 80% 1 RM or 6-weeks of training is not sufficient time to elicit changes in these outcomes.

3737 Board #54 May 30 8:00 AM - 9:30 AM

Blood Flow Restriction Compared To High Intensity Interval Training On Power Output And Muscle Strength

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(No relevant relationships reported)

Many exercise modalities are used to increase muscle strength and power output with differing load capacities. Purpose: To compare the effects of 80% 1RM (CON) squats, High Intensity Interval Training (HIIT) body weight squats (BWS), and Blood Flow Restriction (BFR) BWS on quadriceps (quads) and hamstrings (hams) strength, and power output via isokinetic testing and standing vertical jump, respectively. Methods: 13 subjects were randomly assigned to: CON, HIIT, or BFR groups. Subjects were tested on an isokinetic dynamometer at 60, 180, and 300 degrees/sec while vertical jump was performed using a vertical jump tester. The training program for the control subjects ($N = 3$) consisted of performing 3 sets of 5 repetitions (reps) at 80% of 1RM squats. The HIIT group ($N = 5$) completed a protocol of 20 seconds of squats followed by 10 seconds of rest for 8 sets. The BFR group ($N = 5$) completed a protocol of 30/15/15/15 reps with 30 seconds rest between sets with bands placed on the proximal thigh bilaterally and inflated to 250 mmHg. The squats for the BFR group were performed using a metronome set to 60 bpm with each rep for 2 seconds. Due to the small sample size, Kruskal-Wallis (KW) analyses were performed for each outcome for the baseline measures, post-training measures, and the difference between post and pre training measures. Results: Although all training modalities elicit improvements for all outcomes, 80% 1RM squats showed the greatest improvement in vertical jump (+8.59cm) while HIIT was the training program showing the greatest magnitude of improvement across all isokinetic variables (average: +0.84kg·m²/s²). However, none of the observed changes were statistically significant. Conclusion: It appears all

training modalities are viable for improvements in power and strength. Nevertheless, the small sample size of the study might be hiding if one modality is superior over the others.

- 3738** Board #55 May 30 8:00 AM - 9:30 AM
Short-Term Sprint Interval Training Increases Maximal Oxygen Uptake Without Changing Maximal Cardiac Output
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 (No relevant relationships reported)

Traditional moderate intensity continuous training increases maximal oxygen uptake ($\dot{V}O_{2max}$). This effect is primarily attributed to an increased maximal cardiac output (Q_{max}), as predicted by the Fick principle. Sprint interval training (SIT) increases $\dot{V}O_{2max}$ similar to MICT, often despite a lower training volume, but the effect on Q_{max} is unclear. **PURPOSE:** To determine the effect of 6 sessions of SIT over 2 wk on $\dot{V}O_{2max}$, Q_{max} and exercise performance in healthy, untrained adults [$n=12$ (9 females); 21 ± 2 y; mean \pm SD]. **METHODS:** Training was performed on a cycle ergometer and involved a 2-min warm-up (50 W), 3 x 20-s 'all-out' bouts interspersed with 2-min of recovery (50 W), and a 3-min cool-down (50 W). $\dot{V}O_{2max}$ was determined using a ramp test to exhaustion. Q_{max} was subsequently determined using inert gas rebreathing (Innocor) over a 2-min period of exercise performed at 90% of the peak work rate attained during the $\dot{V}O_{2max}$ test. Pilot testing confirmed this protocol elicited $\dot{V}O_{2max}$ over the 2-min period of Q_{max} measurement. The performance test was a 2 kJ/kg body weight cycling time trial. All measurements were performed twice at baseline, and reproducibility determined as a coefficient of variation (CV). The CV for $\dot{V}O_{2max}$, Q_{max} and time trial performance was 5.8, 4.7 and 4.2%, respectively. Pre- and post-training measurements were compared using a paired t-test. **RESULTS:** $\dot{V}O_{2max}$ increased after SIT from 37.0 ± 7.3 to 40.7 ± 8.3 ml/kg/min ($p<0.001$), but Q_{max} was unchanged (17.2 ± 3.8 vs 17.7 ± 4.6 L/min; $p>0.05$). Exercise performance improved after SIT from 1040 ± 247 to 938 ± 238 s ($p<0.001$). Absolute $\dot{V}O_{2max}$ was positively correlated with Q_{max} ($r^2 = 0.86$, $p < 0.001$). **CONCLUSION:** Six sessions of SIT increased $\dot{V}O_{2max}$ without changing Q_{max} in previously untrained individuals. These data support previous suggestions that the early increase in $\dot{V}O_{2max}$ after SIT may be due mainly to peripheral responses (i.e., enhanced oxygen extraction by skeletal muscle), rather than a central change in blood oxygen delivery. Supported by NSERC

- 3739** Board #56 May 30 8:00 AM - 9:30 AM
High-intensity Interval Exercise While Wearing A Sauna Suit Increases Energy Expenditure
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PURPOSE: The use of sauna suits (SS) has increased and claims to enhance weight loss and body temperature during exercise. Whether high-intensity interval exercise (HIIE) with a SS enhances energy expenditure (EE) and excess post-exercise oxygen consumption (EPOC) is unknown. The purpose of this study was to examine changes in EE and EPOC in response to HIIE while wearing a SS.

METHODS: Seven recreationally active men and women (mean age, mass, and $\dot{V}O_{2max} = 29.7 \pm 6.9$ yr, 68.8 ± 17.3 kg, and 46.2 ± 8.10 mL/kg/min, respectively) initially completed assessment of resting metabolic rate (RMR) and maximal oxygen uptake ($\dot{V}O_{2max}$). During the $\dot{V}O_{2max}$ test, exercise began at 60 W for two minutes and work rate increased 25 - 30 W/min until volitional fatigue. Heart rate (HR) and breath-by-breath gas exchange were continuously measured. At least 48 hr later, subjects completed HIIE consisting of 10 x 1 min intervals at 85% peak power output, followed by 75 s of active recovery, with or without a SS. During exercise, HR, core temperature (T_{re}), and gas exchange data were continuously measured, and thermal sensation and rating of perceived exertion (RPE) were also recorded. For 1 hr post-exercise, subjects rested while changes in EPOC, T_{re} and HR were determined. Blood lactate concentration was measured pre-exercise, 5 min post-exercise, and 1 hr post-exercise. Subjects returned 1 wk later and completed the other condition whose order was randomized

RESULTS: Compared to no SS (NSS), total $\dot{V}O_2$ (57.3 ± 13.8 L vs. 60.4 ± 13.5 L, $p = 0.028$) and EE (286.8 ± 69.2 kcal vs. 302.0 ± 67.3 kcal, $p = 0.048$) were significantly higher for SS. However, EPOC was not significantly different 1 hr post-exercise between NSS (5.1 L \pm 4.3 L) and SS (7.5 L \pm 5.1 , $p = 0.16$). End-exercise HR was not different between conditions ($p = 0.42$), but T_{re} was significantly higher ($p = 0.046$) for SS (38.6 ± 0.5 °C) compared to NSS (38.4 ± 0.4 °C). Post-exercise blood lactate concentration was not significantly different ($p = 0.20$) between conditions (9.6 ± 3.5 vs. 10.8 ± 3.4 in NSS vs. SS). End-exercise thermal sensation ($p = 0.60$) and RPE ($p = 0.17$) were not significantly different between conditions.

CONCLUSIONS: Wearing a SS during HIIE elicits greater EE and T_{re} versus not wearing a SS. Therefore, a SS may aid in weight loss by increasing the total amount of calories expended during HIIE.

- 3740** Board #57 May 30 8:00 AM - 9:30 AM
HIIT PROGRAM EFFECTS IN CAPILLARY BLOOD LACTATE LEVELS
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In the last decade, high intensity interval training (HIIT) has been shown to be an appropriate alternative to moderate-intensity, continuous exercise for improving cardiorespiratory fitness. HIIT protocols typically result in high blood lactate (La) levels. However, accumulated lactic acid is a potent metabolic stimulus, which plays a major role in the control of physiological adaptations. Therefore, it may be essential for improvements in endurance performance. The literature indicates that there is a strong positive relationship between maximum oxygen consumption ($\dot{V}O_{2max}$) and La production. Purpose: To investigate changes in La levels after 4 weeks of HIIT program. Methods: Blood samples were collected from five female and five male student-athletes ($n = 10$) ($M_{age} = 21$, $SD = 0.95$). A short-term (4 weeks) HIIT protocol used and $\dot{V}O_{2max}$ calculated through Course-Navette Test. The instruments used for this research were an Accutrend Plus-Roche lactometer and BM-Lactate test strips (Risch-Rotkreuz, Switzerland). The analysis consisted of t student tests for paired samples in IBM SPSS v.25 ($p < 0.001$). Results: $\dot{V}O_{2max}$ and blood La changed significantly in six participants (Pre-La $M = 11.65$ mmol/L; Post-La $M = 9.41$ mmol/L). The participants that achieved to increase their $\dot{V}O_{2max}$, produced lower amounts of capillary blood La. Conclusion: Using HIIT, our study results confirm the positive relationship of $\dot{V}O_{2max}$ and La. The inferences of these preliminary results could be used in future, larger-scale interventions concerning ways to affect La production through the increase of $\dot{V}O_{2max}$ using a HIIT program. Future studies should further investigate anaerobic threshold modification processes through different training programs, such as Repeated Sprint Training (RST), Sprint Interval Training (SIT) and Moderate Intensity Continuous Training (MICT). Limitations of this study include small sample size and indirect $\dot{V}O_{2max}$ estimation.

Keywords
 High-Intensity Interval Training, maximal oxygen consumption, lactate

- 3741** Board #58 May 30 8:00 AM - 9:30 AM
Effects Of High Intensity Physical Exercise On Short-term Memory In University Students
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Studies have determined that physical training provides benefits in people's physical health. Physical exercise is one of the most powerful lifestyle to positively affect the adult brain and emerging evidence points to high intensity interval training (HIIT) as an effective way to improve various aspects of brain function among them the improvement of cognition and short-term memory. Purpose: To analyze the effects of (HIIT) in university students on short-term memory. Methods: 22 university athletes ($Mage = 21.6$, $SD = 1.5$), ($n = 11$ experimental group), ($n = 11$ control group). A HIIT program of 12 sessions of short-term (3 weeks) and 6 sessions of short-term memorization was applied. Maximum oxygen consumption ($\dot{V}O_{2max}$) was estimated through the Course Navette Test and memory evaluation through a Rey Auditory Verbal Learning Test (RAVLT). The instruments used for the investigation was a Polar H10® band. A t student test for paired samples was applied by IBM SPSS v.22 ($p < 0.001$). Results: The maximum heart rate (HRmax) of the control group obtained a value of $M = 199.9$, $SD = 15$ ppm and the experimental group $M = 195$, $SD = 6.7$ ppm. In the third week of intervention results were found statistically significant. Conclusion: After twelve training sessions of high intensity physical exercise (HIIT), statistically significant results were obtained, in relation to high intensity physical effort with short-term memory. For future research it is recommended to implement a greater number of training and memory sessions. Limitations of this study include indirect $\dot{V}O_{2max}$ estimation and a small sample size.

Keywords: short-term memory, university students, high intensity interval training.

3742 Board #59 May 30 8:00 AM - 9:30 AM
Physiological Responses During High Intensity Functional Training Exercise Are Affected By Skill Level

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 (No relevant relationships reported)

Although high-intensity functional training (HIIT) is an increasingly popular exercise strategy, research describing the acute physiological responses are few and predominantly limited to novice or untrained. **PURPOSE:** To compare the cardiorespiratory responses of a bout of HIIT among individuals with varying degrees of skill. **METHODS:** Eighty-two participants (31.0 ± 7.4 years; 172.6 ± 9.6 cm; 77.9 ± 13.8 kg) with at least six-months of HIIT experience and varying skill levels were tested. Skill level was categorized by self-reported times of the benchmark workout "Fran" [Novice (NOV), n = 32; Intermediate (INT), n = 24; Advance (ADV), n = 26; (times reported = 5.3 ± 2.7 mins)]. All participants performed aerobic capacity testing to examine peak levels of oxygen consumption (VO₂), heart rate (HR), respiratory exchange ratio (RER), and lactate (LT). A week later, similar variables were measured with averages obtained for VO₂, HR, RER, and LT during a 15-minute HIIT based workout. Univariate analysis of variance (ANOVA) with Bonferroni adjustments were used to examine differences between skill category and outcome variables. **RESULTS:** During the Treadmill test, significant differences were only observed for VO₂ (ADV = 49.53 ± 5.12 ml/kg/min; NOV = 43.83 ± 6.49 ml/kg/min; p = 0.001; η² = 0.924) and LT (ADV = 12.31 ± 2.48 mmol/dL; NOV = 9.93 ± 3.33 mmol/dL; p = 0.004; η² = 0.874), with ADV athletes having greater values than NOV (p < 0.05). No significant differences were observed between ADV & INT (p > 0.05). Similarly, during the HIIT workout, differences were also observed between ADV and NOV categories, but only for VO₂ (ADV = 38.71 ± 3.47 ml/kg/min; NOV = 34.42 ± 5.20 ml/kg/min; p = 0.002; η² = 0.897) and LT (ADV = 9.04 ± 1.68 mmol/dL; NOV = 9.61 ± 2.40 mmol/dL; p < 0.001; η² = 0.946). **CONCLUSION:** These findings provide evidence regarding the impact skill level has on physiological outcomes. During a maximal effort bout of HIIT, the more advanced athletes tend to exhibit more efficient cardiorespiratory markers. Further research is necessary to elucidate how these differences impact overall performance of HIIT exercise.

3743 Board #60 May 30 8:00 AM - 9:30 AM
Energetic System Contribution According Sprint Number In Tabata High Intensity Interval Training Protocol

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PURPOSE: To analyze the contribution of energetic systems in Tabata's high intensity-interval training (HIIT) protocol according sprint number
METHODS: Sixteen physically active males attended to two experimental sessions. In the first one was performed an incremental test to identify the maximum oxygen uptake (VO_{2max}) and power output (pVO_{2max}). At the second visit, participants performed HIIT session composed by sprints lasting 20s at 170% of pVO_{2max} followed by 10s rest until volitional fatigue. For the aerobic system estimative, difference between relative rest VO₂ and its values during the activity was used. For the lactic system, the peak of blood lactate ([La-]) after the session was considered. The rapid phase of excess of post-exercise oxygen consumption (EPOC_{fast}) was used for alactic system contribution. Participants were allocated in three groups, considering the number of sprints performed (G23 = 2 to 3, G45 = 4 to 5 or G67 = 6 to 7 sprints). Relative (%) energetic contribution were analyzed using two-way ANOVA (group x energetic system)
RESULTS: Participants exhibited 24.9±6 years old, 1.67±2.7 cm, 55.6±8.7 kg and a VO_{2max} = 55.6±8.7 mL/kg/min, with [La-] = 13.2±1.7 mmol/L and maximum heart rate = 184±9.3 bpm. For relative energetic contribution (% of aerobic, lactic and alactic respectively), G23 showed 32.3±11.9% (CI95% = 25.5 - 39.2), 24.2±3.9% (CI95% = 17.3 - 31.0) and 43.5±15.4% (CI95% = 36.6 - 50.3); G45 showed 46.3±7.9% (CI95% = 39.4 - 53.1), 22.7±3.9% (CI95% = 15.8 - 29.5) and 31.0±7.2% (CI95% = 24.2 - 37.9), and; G67 showed 60.2±2.3% (CI95% = 51.8 - 68.6); 19.2±2.1% (CI95% = 10.8 - 27.6) and 20.6±3.4% (CI95% = 12.2 - 28.9), with no differences between groups (F=0.0; p=1), differences between systems (F=33.30; p<.001) and statistical significant interactions (F=11.77; p<.001)
CONCLUSIONS: Performing 2 to 3 sprints was found higher anaerobic contribution and performing 6 to 7 sprints, higher aerobic contribution in Tabata's protocol. No participant performed eight sprints.

3744 Board #61 May 30 8:00 AM - 9:30 AM
Effect Of High Intensity Interval Training On Body Composition In Overweight And Obese Sedentary Adults

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 (No relevant relationships reported)

Only ~20% of adults adhere to physical activity guidelines. Thus, exercise programs that require less time, such as high intensity interval training (HIIT), need to be investigated. Recent studies suggest HIIT incorporating body weight exercises result in increased exercise capacity (VO_{2peak}) and leg muscle endurance in healthy adults. **PURPOSE:** It is unclear if HIIT incorporating body weight exercises influences body composition and exercise capacity in overweight/obese, sedentary adults. We hypothesized that HIIT will 1) increase lean mass and decrease body fat and 2) increase VO_{2peak} to a greater extent than moderate intensity continuous training (MICT) in sedentary, overweight/obese adults. **METHODS:** Eleven participants (10 women) were randomized and have completed all study components (6 HIIT vs. 5 MICT; Age: HIIT 39±7 vs. MICT 42±12 yrs; BMI: HIIT: 30±1 vs. 32±3 kg/m² (both, p>0.05). Exercise capacity (VO_{2peak} -cardiopulmonary exercise testing) and body composition (via dual energy X-ray absorptiometry) were measured at baseline and after 12 weeks of training. The HIIT group performed 5 body weight exercises (squats, pushups, lunges, mountain climbers, and plank) 3 days/week for 12 weeks at an intensity equal to a rating of perceive exertion (RPE) >17. The MICT group performed 150 min of MICT/week for 12 weeks at a RPE between 12-14. **RESULTS:** Percent (%) lean mass increased from baseline following HIIT (p<0.05), but not MICT (HIIT: 54.4±3.4 vs. 55.5±4.0 %; MICT: 52.5±3.9 vs. 51.7±4.3 %). Body fat % significantly decreased from baseline following HIIT (p<0.05), but not MICT (HIIT: 43.9±3.5 vs. 42.7±4.1 %; MICT: 45.9±4.1 vs. 46.7±4.7 %). BMI was not different from baseline following HIIT or MICT (HIIT: 32 ±3 vs. 31±3 kg/m²; MICT: 30±1 vs. 30±3 kg/m²; both, p>0.05). VO_{2peak} significantly increased from baseline following HIIT (p<0.05), but not MICT (HIIT: 23.7 ±0.9 vs. 25.0±0.9 mL/kg/min; MICT: 22.2±6.1 vs. 23.1±6.1 mL/kg/min). **CONCLUSIONS:** These preliminary data support the hypotheses that non-traditional aerobic HIIT (e.g., HIIT incorporating body weight exercises) leads to more advantageous changes in body composition and exercise capacity compared to MICT alone.

3745 Board #62 May 30 8:00 AM - 9:30 AM
COMPARISON OF MODERATE INTENSITY CONTINUOUS TRAINING VERSUS HIIT ON AEROBIC PERFORMANCE USING STATIONARY AIR BIKE

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 (No relevant relationships reported)

Stationary bikes are known as effective tools to improve physical fitness. Unlike most types of exercise bikes, a stationary air bike handles that move synchronously with the pedaling action, creating wind resistance via a large fan. Although several studies have been conducted on benefit of exercise bikes, there has been a relative absence of studies using stationary air bikes in order to compare the effects of high intensity interval training (HIIT) and moderate intensity continuous training (MICT) protocols. **PURPOSE:** The purpose of this study was to compare the effects of stationary air biking, utilizing MICT, ultrashort-HIIT (UH), and short-HIIT (SH) protocols on aerobic performance. **METHODS:** Thirty-two recreationally active participants were randomly assigned to MICT (n = 11), UH (n = 11), and SH (n = 10) groups. The intervention consisted of 3 d/wk for 4 wks. MICT sessions included 30 min of cycling at 75% of maximal heart rate reserve, while the HIIT protocols (i.e., UH, SH) consisted of 3 sets of 8 intervals at all-out intensity. SH and US protocols were performed with 20s:10s and 10s:5s work-to-rest ratios, and provided with 5- and 2.5-min recovery periods between sets, respectively. Maximal oxygen uptake was assessed via a cycle ergometer using a ramp protocol before and after the intervention. Absolute VO_{2max} (A-VO_{2max}) and time to exhaustion (TTE) were measured and analyzed with 2-way mixed factorial ANOVAs. Additionally, total work (TW) during 12 sessions was recorded and analyzed with one-way ANOVA. **RESULTS:** There were significant (p < 0.05) differences in TW (MICT: 2263.0 ± 897.0 cal., UH: 907.3 ± 332.0 cal., SH: 1230.0 ± 188.1 cal.) between groups. While, all groups significantly (p < 0.05) improved A-VO_{2max} (MICT: 2663.6 ± 764.6 to 3017.5 ± 833.4 ml/min, UH: 2652.6 ± 502.3 to 3017.5 ± 606.4 ml/min, SH: 2259.3 ± 281.3 to 2530.1 ± 406.8 ml/min), as well as TTE (MICT: 13:35 ± 02:39 to 14:41 ± 02:46 min, UH: 14:06 ± 02:02 to 15:09 ± 2:20 min, SH: 12:30 ± 01:29 to 13:33 ± 01:27 min). **CONCLUSION:** Despite the significant group differences in TW, all groups similarly improved aerobic performance

(i.e., A-VO₂max, TTE) following training. These findings suggest that performing HIIT on a stationary air bike at a 10s:5s work-to-rest ratio can improve aerobic fitness with a shorter time commitment compared to SH and MICT groups.

3746 Board #63 May 30 8:00 AM - 9:30 AM
Metabolic And Hemodynamic Responses To High Intensity Interval Training With Various Recovery Intervals

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(No relevant relationships reported)

For more than twenty years, the Tabata protocol has provided the basis for high intensity interval training (HIIT). Although the improvements associated with the protocol are laudable, an intensity of 170% of max VO₂, is difficult for even highly motivated athletes to achieve. A repeated bout HIIT protocol at 100% of Max VO₂ may be a more tolerable option, if it achieves a similar metabolic stress. **Purpose:** The purpose was to determine the metabolic cost of 8 repetitions of HIIT at a workload equivalent to 100% Max VO₂ (HIIT) for 20 sec with recovery intervals of 10, 20, 30 and 40 sec at 20% of Max VO₂. **Methods:** 14 recreationally active college-age students (age: 21.6±1.1 yrs., height: 171.41±0.5 cm, body mass: 75.0±10.6 kg, max VO₂ 2.89±.67, 8 ♂) volunteered to participate in a randomized, single-blind crossover design study with a minimum of 4 days between trials. A max VO₂ ramp protocol on a Lode Cycle ergometer preceded the HIIT trials and established the max workload. VO₂ was obtained by continuous open circuit spirometry and blood lactate by finger puncture. Excess Post Exercise O₂ Consumption (EPOC) was obtained for 20 min. **Results:** Statistical analysis by ANOVA with repeated measures (P<.05) was applied to the following data.

HIIT Trial	10	20	30	40
VO ₂ % max	90.2±4.5	87.9±6.4	86.9±6.8	81.6±7.2*
VO ₂ max L/min	2.59±0.6	2.52±0.5	2.49±0.6	2.33±0.5
HR b/min	181.1±7.0	179.8±8.2	176.0±7.8	173.4±6.5
LA mmol	15.0±2.9	14.7±3.3	15.2±3.6	14.2±2.6
20 min EPOC (L)	2.66±1.0	2.52±0.7	2.82±0.7	2.47±0.9

(*P<.05: 10, 20, 30 vs 40)

Conclusion: The prescribed HIIT work intervals provide ample metabolic stimulus, however recovery intervals in excess of 30 seconds substantially attenuate the oxygen uptake, while still requiring a strong anaerobic contribution. The use of eight repeat bouts of HIIT at a workload equivalent to 100% of max VO₂ may be a viable alternative to the traditional Tabata protocol.

3747 Board #64 May 30 8:00 AM - 9:30 AM

A COMPARISON OF INTERNAL TRAINING LOADS BETWEEN OBJECTIVELY-VERSUS SUBJECTIVELY-DETERMINED HIGH-INTENSITY INTERVAL TRAINING

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(No relevant relationships reported)

High-intensity interval training (HIIT) is an effective and time-efficient method of aerobic training. Most HIIT programming relies on objectively determined work rate, velocity, or heart rate targets. There is very little evidence comparing HIIT that is programmed using objective measures and HIIT that is programmed using subjective ratings to determine the work and recovery intensities, even though subjectively-determined HIIT may have more real-world applicability. **PURPOSE:** To evaluate the internal training load generated by single treadmill sessions of objectively-determined HIIT (HIIT-Obj) and subjectively-determined HIIT (HIIT-Sub). **METHODS:** Thirteen (female n=7, male n=6) young (age 19.8 ± 2.0 years), healthy participants completed a baseline testing session to determine peak VO₂ and HR, followed by two HIIT sessions on a treadmill in a randomized order. Both HIIT sessions consisted of 10x1-min work intervals, interspersed with 1-min recovery intervals, with the work rate obscured from participants' view. HIIT-Obj session work intervals used the work rate associated with 90% of VO₂max, with recovery intervals completed at 4 km/hr. For HIIT-Sub sessions, participants were instructed to reach an RPE of 8-9 on the Borg CR-10 scale during work intervals and drop to an RPE of 3-4 during the recovery intervals. Internal training load calculations included Training Impulse (TRIMP) and HR zone methods. **RESULTS:** There were no significant differences in internal training load between HIIT-Obj and HIIT-Sub as determined via TRIMP (45.8 ± 12.3 vs. 47.8 ± 15.9 a.u., ES=0.03, p=0.59) and HR zones (57.9 ± 14.7 vs. 66.8 ± 22.6 a.u., ES=0.28, p=0.06) methods, though participants spent significantly less time in

the lowest intensity HR zone (zone 1) while completing HIIT-Sub (HIIT-Obj = 3.57 ± 0.93 min; HIIT-Sub = 2.43 ± 1.13 min, ES=0.48, p=0.01). Peak HR reached during the sessions was also not statistically different (186 ± 12 vs. 188 ± 16 bpm, ES=0.07, p=0.38). **CONCLUSION:** Participants are able to generate similar internal training loads using real-time subjective measures of intensity during HIIT compared to objectively-regulated HIIT. This indicates that this simpler, more applicable method of HIIT programming may generate the desired training stress for a client or athlete without rigid work rate or HR targets.

3748 Board #65 May 30 8:00 AM - 9:30 AM

The Oxidative Contribution Of Eight Repeat Bouts Of High Intensity Interval Training

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The oxidative contribution to eight repeat bouts of high intensity interval training

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Interval training requires bouts of work followed by recovery intervals. The intensity of the work interval impacts the metabolic response of the recovery interval. **Purpose:** The purpose was to determine the oxidative cost of both the work (W) interval and the recovery (R) interval during 8 continuous repetitions of high intensity interval training (HIIT) at a workload equivalent to 100% Max VO₂. **Methods:** All 20 second work intervals were followed by recovery intervals of 10, 20, 30 and 40 sec at 20% of Max VO₂. 14 recreationally active college-age students (age: 21.6±1.1 yrs., height: 171.41±0.5 cm, body mass: 75.0±10.6 kg, max VO₂ 2.89±.67, 8 ♂) volunteered to participate in a randomized, single-blind crossover design study with a minimum of 4 days between trials. A max VO₂ ramp protocol on a Lode Cycle ergometer preceded the HIIT trials and established the max workload. VO₂ was obtained by continuous open circuit spirometry. **Results:** Statistical analysis by ANOVA with repeated measures (*P<.05) was applied to these data.

% max VO ₂	10 W	10 R	20 W	20 R	30 W	30 R	40 W*	40 R*
Interval 1	78.3	74.0	73.3	72.6	72.8	73.2	67.9	73.4
Interval 2	96.6	87.2	96.8	85.1	93.9	83.5	83.6	77.1
Interval 3	98.5	88.7	95.9	84.1	92.6	83.3	85.9	80.0
Interval 4	96.0	88.0	94.7	82.5	92.6	83.7	86.5	80.2
Interval 5	95.1	88.8	92.3	85.6	91.1	85.4	85.5	81.7
Interval 6	96.7	89.4	93.2	87.0	92.0	87.6	87.8	80.8
Interval 7	98.5	89.1	95.9	86.2	93.8	85.8	86.9	82.1
Interval 8	99.1	84.7	97.0	83.4	95.2	83.7	89.3	77.6

With the exception of interval one, recovery protocols of 10, 20 and 30 sec sustained significantly greater oxygen requirements during W & R vs the 40 sec trial. W was in excess of 90% of max VO₂ for 10, 20 & 30 trials, while the 40 sec recovery bout HIIT protocol provided significantly less oxidative requirements and never achieved 90%. **Conclusion:** Short recovery intervals of 30 seconds or less provide the greatest oxidative stress during interval training, which may be attributed to insufficient phosphagen resynthesis during recovery.

3749 Board #66 May 30 8:00 AM - 9:30 AM

Effects Of Elevation Training Mask In Conjunction With High Intensity Interval Training On Lung Function

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(No relevant relationships reported)

A recent training tool, the elevation training mask (ETM) is a commercially available simulated altitude training device with claims to increase lung function and aerobic capacity by incorporating valves to create respiration resistance. Previous studies have resulted in conflicting conclusion regarding the effectiveness of the ETM with respect to lung function. **PURPOSE:** To compare the effects of the ETM in conjunction with high intensity interval training (HIIT) and HIIT alone (i.e., using mask with no resistance) on lung function. **METHODS:** Sixteen healthy adults (control group, n=8 & experimental group, n=8) participated in this study. Pre- and post-test consisted of lung function (FEV₁ & FVC) using spirometry, time to exhaustion (TTE) using the

Bruce protocol on treadmill, and body mass index (BMI). Training was completed on a cycle ergometer on 3 nonconsecutive days per week (MWF), for 4 wks. Participants exercised at 85% of HR_{max} using heart rate monitor, with a pedal rate of 100-120 rpm at individually set resistance levels. Each training session consisted of 10 bouts of 30s exercise followed by 30s of active recovery for a total time of 10 min. The respiratory resistance on the ETM for the experimental group was progressively increased from 915.4 m-2,743.2 m (3,000 ft-9,000 ft.) during wks of training, while the control group used ETM with no resistance. **RESULTS:** Following training, a significant difference in FVC between the groups was found ($F(1, 4) = 7.486, p = 0.016$). In addition, no significant ($p > 0.05$) differences between the groups in FEV₁ (experimental: 3.78 ± 0.94 L; control: 3.83 ± 0.59 L), TTE (experimental: $11:30 \pm 1.92$ min; control: $12:23 \pm 1.60$ min) and BMI (experimental: 23.01 ± 3.24 kg/m²; control: 24.25 ± 2.97 kg/m²) was noted. However, the experimental group yielded a greater increase in FEV₁ compared to the control group (experimental: 3.40%; control: 2.42%). **CONCLUSION:** In the present study, the ETM resulted in a small increase in FEV₁ and significantly improved FVC more than HIIT alone. Using the ETM in conjunction with HIIT may significantly improve lung function compared to HIIT only. When used in conjunction with HIIT, the ETM appears to create sufficient resistance to strengthen the muscles in respiratory ventilation and improve respiratory efficiency.

3750 Board #67 May 30 8:00 AM - 9:30 AM
Effects Of Deep Slow Breath Training On Performance And Recovery During High Intensity Interval Cycling
 Andrew Brown. *Western Washington University, Bellingham, WA.* (Sponsor: Dr. Lorrie Brilla, FACSM)
(No relevant relationships reported)

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 Voluntary alterations in components of the respiratory cycle have been utilized for centuries in yogic, qigong, and other meditative practices, and represent a fertile area of research within the context of sport performance. Changes to acid-base balance, vagal tone, and subsequent exercise performance following breath training have been demonstrated acutely and chronically. The efficacy of breath training in improving repeated glycolytic sprints has yet to be fully elucidated. **PURPOSE:** To delineate the effects of a six-week deep slow breathing (DSB) program on measures of cycling performance (mean power), recovery (heart rate recovery: HRR), and expired carbon dioxide: VCO₂, and pulmonary capacities (maximum voluntary ventilation and forced expiratory volume). **METHODS:** Twenty male cyclists were divided into training (n=10) and control (n=10) groups, where the training group completed a six-week DSB program. Inclusion criteria included a minimum of 180-minutes of cycling volume per week for the previous 6 months. DSB was an app-driven program to extend expirations and post-expiratory breath holds to enhance vagal tone and endogenous buffering capacity. Participants completed two testing sessions, one before and one after the six-week period. Testing sessions involved three repeated 30-second Wingate Anaerobic Tests (WAnT) with three minutes of passive recovery between each interval. MP was recorded for each WAnT while measures of VCO₂ and HRR were taken immediately following each WAnT. **RESULTS:** No significant differences ($p > 0.05$) were found between groups for any of the variables measured, while both groups exhibited increased MP in the second WAnT following the six-week training period (Treatment: pre: 516.30 ± 20.82 W versus post: 536.38 ± 20.62 W; $p = 0.010$; $\eta_p^2 = 0.382$; Control: pre: 549.93 ± 18.66 W versus post: 567.83 ± 18.44 W; $p = 0.010$; $\eta_p^2 = 0.382$). **CONCLUSIONS:** The results presented here suggest DSB provides no performance relevant to recovery or pulmonary capabilities during high intensity interval cycling, beyond those which are incurred via endurance training.

3751 Board #68 May 30 8:00 AM - 9:30 AM
The Effects Of Rich Hydrogen And Oxygen Mixed Gas Inhalation After High Intensity Exercise Influence On Exercise Performance
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(No relevant relationships reported)

PURPOSE: Both hydrogen-rich and normobaric hyperoxic gas exposure during exercise recovery is thought to promote ergogenic and therapeutic effects on the whole body physiological function and exercise performances. However, the synergistic intervention of high concentrations of hydrogen and oxygen mixture gas (HO gas) inhalation on these indexes have been poorly investigated. Therefore, we examined acute HO gas inhalation during exercise recovery on subsequent oxidative stress, inflammation, and exercise performance. **METHOD:** According to a two-trial, double-blind, crossover, repeated measures design, eight physically males inhaled HO gas (67 % of hydrogen and 32 % of oxygen) or Placebo gas (ambient air) during 60-min recovery after completion of oxidative stress-inducing exercise protocol consisting of 30-min treadmill running at 75 % of

participant's maximal oxygen uptake (VO_{2max}) and 5 × 10 repetitions of squat jump exercise. Before oxidative stress-inducing exercise and 10-min after post exercise gas inhalation, blood and urine samples were obtained and exercise performance (jumping ability, pedaling power output, muscle strength) were evaluated. **RESULTS:** A post-exercise HO gas inhalation attenuated the increase 8-OHdG excretion rate ($p < 0.05$), known as one of DNA oxidation markers, and the reduction in the jumping ability evaluated by the height of countermovement jump ($p < 0.05$) compared with Placebo gas inhalation. Moreover, the increase in urinary 8-OHdG excretion rate was significantly associated with the reduction in countermovement jump performance ($r = -0.78, p < 0.01$). **Discussion:** These suggested that HO gas inhalation during post exercise recovery might, at least in part, improve exercise performance via reducing systemic oxidative damage.

3752 Board #69 May 30 8:00 AM - 9:30 AM
Comparison Of Interval Exercise And Continuous Exercise On Excess Post-exercise Oxygen Consumption: Matched For Duration
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(No relevant relationships reported)

PURPOSE: Compare the excess post-exercise oxygen consumption (EPOC) after duration-matched bouts of high-intensity (HIIT) and sprint interval (SIT) exercise to moderate-intensity continuous (MCT) exercise. **METHODS:** Recreationally active men (n=7; 22±3 yrs; 180.4±4.7 cm; 77.8±9.3; 13.4±3.4 %BF; 44.7±2.6 ml·kg⁻¹·min⁻¹) completed a maximal graded exercise test (VO_{2max}) and three exercise trials (HIIT, SIT, and MCT) in a randomized, counterbalanced fashion on a cycle ergometer. HIIT consisted of 15 × 90-sec bouts at 85% VO_{2max} and 90-sec active recovery periods. SIT consisted of 15 × 20-sec bouts at 130% maximum wattage and 160-sec active recovery periods. MCT was continuous bout at 65% VO_{2max}. Each trial lasted 53 min, including a 5-min warm-up and a 3-min cool-down. Oxygen consumption (VO₂; ml·kg⁻¹·min⁻¹) was measured after bouts 1 (B1), 5 (B5), 10 (B10), 15 (B15), and cool-down (CD) which corresponded with min 0-3, 12-15, 27-30, and 42-45 of MCT, respectively. VO₂ was also measured for 30 min prior to exercise (PRE) and during 1 h of recovery. EPOC (L of O₂) was measured by the area under the curve with respect to increase (AUCi) from PRE VO₂ during the first 20 min of recovery. Trial effects were assessed via one-way analyses of variance. **RESULTS:** VO₂ was lower in SIT compared to MCT after B1 ($p = 0.002$; 17.6 ± 4.6 ml·kg⁻¹·min⁻¹; 24.2 ± 1.8 ml·kg⁻¹·min⁻¹, respectively), B5 ($p = 0.007$; 21.8 ± 4.8 ml·kg⁻¹·min⁻¹, 29.1 ± 3.4 ml·kg⁻¹·min⁻¹, respectively), B10 ($p < 0.001$; 21.8 ± 2.6 ml·kg⁻¹·min⁻¹, 30.0 ± 2.5 ml·kg⁻¹·min⁻¹, respectively) and B15 ($p < 0.001$; 21.8 ± 2.6 ml·kg⁻¹·min⁻¹, 29.3 ± 3.3 ml·kg⁻¹·min⁻¹, respectively). SIT was also lower than HIIT at B5 (27.5 ± 3.4 ml·kg⁻¹·min⁻¹; $p = 0.021$), B10 (28.2 ± 2.9 ml·kg⁻¹·min⁻¹; $p < 0.001$) and B15 (28.8 ± 3.7 ml·kg⁻¹·min⁻¹; $p = 0.001$), while MCT was higher than HIIT at B10. After CD, VO₂ was higher in MCT (19.0 ± 2.9 ml·kg⁻¹·min⁻¹) compared to SIT (16.4 ± 2.6 ml·kg⁻¹·min⁻¹; $p = 0.015$) and HIIT (15.5 ± 2.0 ml·kg⁻¹·min⁻¹; $p = 0.007$). EPOC was lower following SIT (5.5 ± 1.1 L) compared to MCT (7.4 ± 1.6 L; $p = 0.005$) and HIIT (6.7 ± 0.8 L; $p = 0.006$). **CONCLUSION:** EPOC was similar following both HIIT and MCT, but not SIT, when matched for duration. Of note, despite identical duration, the MCT protocol involved more total work when compared to both HIIT and SIT.

G-33 Free Communication/Poster - Monitoring
 Saturday, May 30, 2020, 8:00 AM - 10:30 AM
 Room: CC-Exhibit Hall

3753 Board #70 May 30 8:00 AM - 9:30 AM
Global Positioning System Analysis Of Positional Locomotive Training Demands In Women's Varsity Rugby Union
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(No relevant relationships reported)

Rugby union is a full contact, intermittent-intensity sport that requires a combination of power, agility, speed and endurance. In positional gameplay, forwards compete in high force-plays (scrums, rucks, mauls), while backs typically execute sprint and agility focused activities. **PURPOSE:** To determine the locomotive demands of female varsity rugby union athletes in regular season training, and to assess positional dissimilarities in these demands, using global positioning system (GPS) technology. **METHODS:** Wearable GPS technology was used to collect spatial and temporal data of female varsity rugby athletes (20.2 ± 2.4 yr) during three regular season

training sessions, each ~2 hr in length. Sessions were categorized as endurance training (ET), skill training (ST) or game-based training (GBT). Movements were catalogued into 5 speed zones. Player positions were classified as forward (n=14) or back (n=15). **RESULTS:** Backs traveled greater total distances on all practice days than forwards, and in ET backs traveled greater distances per minute than forwards (50.07 ± 6.67 m; 47.95 ± 16.64 m, $p < 0.01$). Positional work-to-rest ratio was higher in forwards vs. backs in ET only (0.244 ± 0.158 ; 0.230 ± 0.051 , $p < 0.05$). Backs traveled greater total distances in high-intensity zones than forwards (7.23 ± 4.34 %; 4.32 ± 2.50 %, $p < 0.05$) during GBT. In all practice sessions, significant differences between positions were observed in time spent and distance traveled within the 5 speed zones. **CONCLUSION:** Locomotive training demands for back positions are of higher intensity in GBT, and greater volume on all practice days, compared to forward positions. ET was the only session that exhibited a significantly higher work-to-rest ratio for forwards. Though GPS technology is effective for quantifying linear movements, it is not capable of quantifying athlete exertion in low-speed, high-power movements, performed by forwards in rugby union. Research funded by a grant from NSERC, Canada.

3754 Board #71 May 30 8:00 AM - 9:30 AM
Associations Between Two Athlete Monitoring Systems Used To Quantify External Training Loads In Basketball Players

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 (No relevant relationships reported)

Quantifying external training load (eTL), referred to as the biomechanical load during training, is becoming increasingly popular for team sport in an effort to manage fatigue, optimize performance, and guide return-to-play protocols following injury. During indoor team sport play, eTL can be measured via Inertial Measurement Units (IMUs) which incorporate accelerometers, gyroscopes, and a magnetometer to characterize an athlete's movement signature, while Indoor Positioning Systems (IPS) are also common, which use Ultra-wideband (UWB) to detect player positioning and their subsequent movements. **PURPOSE:** The purpose of this study was to assess the association between a commercially available IMU and IPS used to monitor eTL in team sport. **METHODS:** A retrospective analysis was performed on 13 elite male NCAA Division I basketball players from three practices during the off-season training phase. A Pearson's correlation was used to examine the association between the Distance traveled during practice captured by IPS system compared to PlayerLoad (PL), PlayerLoad per Minute (PL/Min), 2-Dimensional PlayerLoad (PL^{2D}), 1-Dimensional PlayerLoad Forward (PL^{1D-FWD}), Side (PL^{1D-SIDE}), and Up (PL^{1D-UP}) captured from the Catapult Sport IMU. **RESULTS:** There were significant ($p \leq 0.001$) positive correlations between Distance and PL ($r=0.891$), PL/Min ($r=0.891$), PL^{2D} ($r=0.863$), PL^{1D-FWD} ($r=0.799$), PL^{1D-SIDE} ($r=0.879$), and PL^{1D-UP} ($r=0.887$) during Practice 1. Practice 2 revealed significant ($p \leq 0.001$) positive correlations between Distance and PL ($r=0.947$), PL/Min ($r=0.947$), PL^{2D} ($r=0.901$), PL^{1D-FWD} ($r=0.819$), PL^{1D-SIDE} ($r=0.944$), and PL^{1D-UP} ($r=0.972$), while Practice 3 also displayed significant ($p \leq 0.001$) positive correlations between Distance and PL ($r=0.858$), PL/Min ($r=0.872$), PL^{2D} ($r=0.809$), PL^{1D-FWD} ($r=0.810$), PL^{1D-SIDE} ($r=0.761$), and PL^{1D-UP} ($r=0.891$). **CONCLUSION:** These data suggest a strong association between parameters captured by the two systems used to monitor eTL, however coaches and performance practitioners should be aware that each system may potentially provide unique information used to monitor and track eTL of athletes during basketball play.

3755 Board #72 May 30 8:00 AM - 9:30 AM
Using A 3d-accelerometer To Enhance Task Assessment

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PURPOSE: Traditional fitness assessments use a standard test battery to gather outcome values that quantify movement capacity in terms of a generalized rating. While valuable, such assessments overlook the process-oriented aspects of a task performance. Triaxial accelerometers (TA) may help provide more process-oriented tracking of human movements by recording acceleration values. The purpose of this comparative analysis was to establish how TA's may provide more robust measures of task performance. **METHODS:** Male subjects (N=10) wore TAs while performing 2 tasks (squat (SQ) & pushup (PU)) at a moderate task workload. Using acceleration data, variables of amplitude (AMP) and frequency (FQ) per repetition were determined for each task. For each, mean (m), STDV, ANOVAs, and post hoc tests for significant differences were compiled. **RESULTS: AVG Subject Parameters: AGE:** 41.7y.o., **BW:** 84kg, **HT:** 185.0cm. **Means & STDV:**

	SQ				PU			
	AMP		FQ		AMP		FQ	
	μ (g)	STDV (+/-)	μ (s)	STDV (+/-)	μ (g)	STDV (+/-)	μ (s)	STDV (+/-)
S1	1.02	.05	1.94s	.06	1.13	.06	1.14	.03
S2	1.04	.05	1.89s	.12	1.18	.09	1.08	.04
S3	0.88	.08	2.69	.12	0.84	.07	2.19	.12
S4	0.64	.07	3.03	.17	1.03	.11	1.90	.07
S5	0.32	.70	2.89	.33	0.97	.05	2.04	.08
S6	0.60	.08	2.21	.09	0.74	.07	1.63	.28
S7	0.59	.04	3.10	.34	0.81	.09	2.02	.18
S8	0.49	.04	2.30	.16	1.32	.99	0.81	.03
S9	0.56	.05	3.39	.36	0.99	.07	2.10	.10
S10	1.40	.09	1.59	.05	0.99	.07	1.11	.04

ANOVA: SQ: AMP (F-critical 2.0): **F-value** 251.4 **Tukey** (7 out of 46 mean differences), **FQ: F-value** 79.8, **Tukey** (12 out of 46 mean differences). **PU: AMP** (F-critical 1.98) : **F-value** 30.1 **Tukey** (23 out of 46 mean differences) **FQ: F-value** 50.3, **Tukey** (18 out of 46 mean differences). **CONCLUSION:** Task measures of acceleration (AMP and FQ) revealed that subject results varied significantly. These findings suggest individuals rely on varying solutions to movement, and performance outcomes may be partially attributable to these differences. Assessments relying on both measurement types may provide more robust performance information.

3756 Board #73 May 30 8:00 AM - 9:30 AM
The Effects Of Home Versus Away Travel On Urine Specific Gravity In NCAA DII Volleyball Athletes

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 (No relevant relationships reported)

Urine specific gravity (USG) has historically been utilized to classify an individual's hydration status. Road trips, with decreased willingness to drink and increased "road food" selection, may affect athletes' hydration status. Athletic performance has been shown to be affected by hydration status.

PURPOSE: To compare urine specific gravity of home versus away weekends for DII volleyball athletes.

METHODS: Fourteen NCAA Division II female collegiate volleyball athletes (Red-shirt = 2, Freshmen = 1, Sophomore = 7, Junior = 1, Senior = 1) participated in this study. Urine was collected in sterile cups in the hours preceding games. Collections were conducted over two weekends of play with a total of five samples being collected. All samples were collected prior to the competitions. Home competitions (HM) were Friday and Saturday. Collections for away competitions (AW) were pre-trip Friday, post-trip/pre-game Friday, and post-trip/pre-game Saturday. Participants competed against the same two teams for home and away weekends. Urinalysis was conducted via reagent strips, according to manufacturer's instructions. Data were analyzed via repeated measures ANOVA with an a priori level of 0.05.

RESULTS: USG during HM Friday and HM Saturday were 1.015 ± 0.008 and 1.013 ± 0.006 , respectively. USG from AW pre-trip Friday, AW post-trip Friday, and AW post-trip Saturday were 1.011 ± 0.007 , 1.012 ± 0.005 , and 1.014 ± 0.003 , respectively. Post hoc analysis revealed no significant findings (range in p-values were 0.144-0.845). While no statistical significance was shown from the data analysis, there were some interesting trends. Overall, USG decreased during the HM weekend and gradually increased over the AW weekend. Only 17% of the athletes increased USG during HM weekend. However, 75% of the athletes showed an increase in USG from the time they showed up to travel Friday until pre-game on Saturday.

CONCLUSION: Following a two-hour road trip, USG did not differ significantly between home and away games. However, some athletes showed varying changes in USG across collection time points. Further analysis has yet to be done to determine the effect on game statistics and performance.

3757 Board #74 May 30 8:00 AM - 9:30 AM
Accuracy Of 5k Race Time Using A Gps Sports Watch
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(No relevant relationships reported)

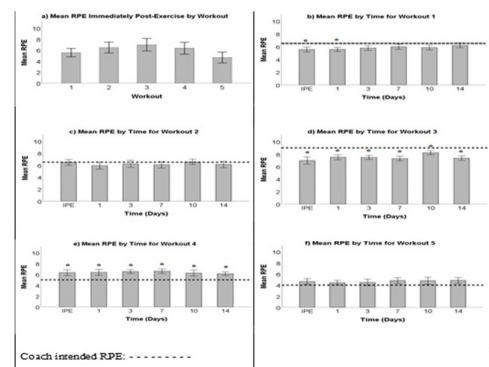
GPS sports watches are a convenient tool used to monitor improvement and predict race performance. Ensuring these watches are accurate allows runners to specifically plan out training to reach a desired race time. However, if predicted race time is inaccurate, an athlete may become frustrated during training or not reach their goals. **PURPOSE:** The purpose of this study was to determine if a GPS sports watch accurately predicts 5k race time. **METHODS:** Nineteen participants (26.8 ± 7.9 years) were recruited for this study. Eligibility included participants running at least 30 minutes a day, three times a week. Participants were required to visit the EMU Running Science Laboratory on two separate occasions. During the initial visit, participants completed a VO_{2max} test on a treadmill. Participants ran at a self-selected speed while grade increased 2% every two minutes until volitional exhaustion. Following the VO_{2max} test, participants were shown how to use a GPS sports watch and instructed to run three days a week for at least 30 minutes for two weeks. After two weeks, participants returned for their second visit and predicted 5k time was recorded from the GPS sports watch. Participants then completed a 5k race time trial on a 200m indoor track (measured 5k). A paired samples t-tests was used to compare predicted 5k to measured 5k ($p < 0.05$). **RESULTS:** Three participants were excluded due to failure to return for the second visit. The remaining 16 participants (5 female, 11 male) had an average VO_{2max} of 54.0 ± 9.1 ml/kg/min, height of 172.9 ± 7.0 cm, and weight of 69.5 ± 9.0 kg. There was a significant difference between measured 5k race time (25.3 ± 4.7 min) and predicted 5k race time (21.1 ± 2.5 min) indicating that the GPS watch underpredicted 5k time. **CONCLUSION:** The GPS sports watch underpredicted 5k time by approximately four minutes. The prediction from the GPS sports watch was based on factors such as speed, heart rate, and distance measured while participants wore the watch for two weeks. Failure to accurately measure heart rate at the radial pulse, inaccuracy associated with GPS, and varied training intensity while wearing the watch could explain some of the error.

3758 Board #75 May 30 8:00 AM - 9:30 AM
The Application Of Statistical Process Control In Athlete Monitoring: Case Study Series
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To optimize sport performance, it is important for practitioners to assess training loads (TLs) and subsequent responses within individual athletes. Published research pertaining to athletes often report group or aggregate data. Investigations that present data from individual athletes are rare, particularly in a team setting. However, statistical process control (SPC) is often used in case studies of individual athletes where SPC is used to identify variances outside of normal ranges. **PURPOSE:** To determine the efficacy of using SPC to assess subjective measures of perceived wellness (PW) scores coupled with session rating of perceived exertion (sRPE) and global positioning system (GPS) derived TLs among soccer players. **METHODS:** Five NCAA Division I female soccer players (21.0 ± 1.3 yr, 165.7 ± 4.3 cm, 60.4 ± 5.2 kg) participated in this study. Each athlete played as a starter on the university team and on their respective senior or under-aged national teams. All PW and TLs were collected across 14 weeks of the competitive season. A customized questionnaire was used for players to report PW consisting of six subscales ranging from 1 (poor) to 5 (excellent). The athletes completed the questionnaire by noon seven days per week. PW subscales were summed and used for assessment. TLs including sRPE and total distance (TD) measured via GPS were collected for each practice and match. SPC was used to identify meaningful changes of the summed PW scores relative to individual mean. Means (M) and standard deviations (SD) of the PW scores were calculated for each player. SPC limits were set at $M \pm 1.0$, ± 1.5 , and ± 2.0 SD. **RESULTS:** There were 3.4 ± 1.9 scores of PW below -2.0 SD out of 91.4 ± 2.5 data. Additionally, 6.4 ± 2.8 data of PW were placed between -1.5 and -2.0 SD. SPC also identified 0.4 ± 0.5 PW data between 1.5 and 2.0 SD. However, no scores above 2.0 SD were observed. After matches, abnormal scores (PW scores $< M-2$ SD) appeared from accumulated spikes of TD and increased sRPE. **CONCLUSIONS:** Based on the current analysis, each athlete appeared to respond differently to TLs despite having similar playing status. Thus, sport performance practitioners may consider incorporating SPC into an on-going athlete monitoring program to accurately access each athlete's recovery rate so that sport performance can be optimized across a given season.

3759 Board #76 May 30 8:00 AM - 9:30 AM
Temporal Robustness Of The Srpe Method Of Monitoring Training
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(No relevant relationships reported)

Introduction: Session Rating of Perceived Exertion (sRPE) has been used to monitor training as an alternative to traditional measures such as heart rate, blood lactate and VO_{2} . sRPE has traditionally been measured ~30 min post exercise, although recent data suggest that it is temporally robust in the 5-min to 24 hr post exercise window. The goal of this study was to analyze the post-exercise on temporal robustness of sRPE as well as the difference between coach-intended RPE and athlete-reported sRPE. **Methods:** Collegiate swimmers ($n=15$) (NCAA Division III) completed 5 training sessions at different coach intended levels of sRPE. The subjects reported sRPE ~30 min post-exercise and then 5 more times in the subsequent two weeks following each training session. **Results:** Athletes reported similar sRPE over all times post-exercise for all workouts, suggesting that sRPE is a viable method of monitoring training up to 14 days post-exercise. The sRPE reported by the athletes were significantly lower than coach intended when the intended RPE was high (sRPE~9.0), and significantly higher than coach's when intended sRPE was lower (~4.0-5.0). **Conclusions:** The findings suggest that sRPE is very temporally robust, but that there is a mismatch between coach and athlete related to training intensity.



3760 Board #77 May 30 8:00 AM - 9:30 AM
Field-based Validation Of An Epifluidic Colorimetric Patch For On-skin Analysis Of Regional Sweat Chloride Concentration
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Reported Relationships: **K.A. Lee:** Salary; *Gatorade Sports Science Institute, PepsiCo Inc.* The views expressed in this abstract are those of the authors and do not necessarily reflect the position or policy of PepsiCo, Inc.

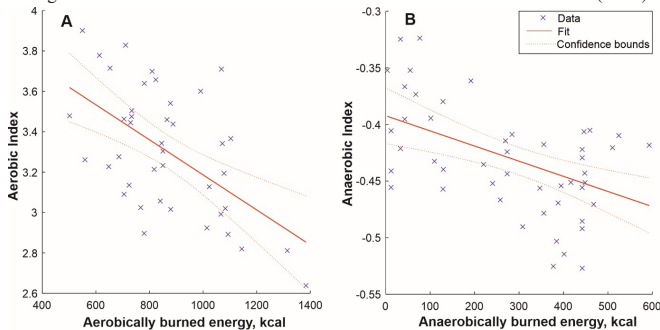
Sweat analysis via epidermal microfluidic (Epifluidic) patches may be a more practical alternative to standard sweat analysis techniques, offering users real-time feedback of sweat electrolyte concentrations. These patches have previously been validated in controlled, lab-based conditions for measuring regional sweat [Cl⁻]. However, research in the field is needed to determine Epifluidic patch validity in real-world, sport-specific conditions. **Purpose:** To determine the accuracy of an Epifluidic patch with built-in colorimetric assay to measure regional sweat [Cl⁻] during exercise in sport-specific conditions. **Methods:** Forty-six subjects (17 male, 29 female; 17.1 ± 0.8 y; 64.2 ± 10.2 kg) from five sports (tennis, soccer, lacrosse, basketball, and track & field) participated in coach-led training sessions ($22-34^{\circ}C$, $50-82\%$ RH; 39-127 min patch duration) while sweat was collected from the right and left ventral forearms with an Absorbent patch (3M Tegaderm+Pad) and Epifluidic patch (Epicore Biosystems, Inc.), respectively. Immediately after removal of the Absorbent patch, an image was taken of the Epifluidic patch on-skin with a 12MP smartphone camera (iPhone 8, Apple Inc.) for analysis of [Cl⁻] via colorimetry. Sweat from the Absorbent patch was extracted via

centrifuge and subsequently analyzed for [Cl⁻] by ion chromatography. Data are shown as mean±SD. **Results:** There was no difference in sweat [Cl⁻] between Absorbent and Epifluidic patches (21.1±13.8 vs. 19.9±12.2 mmol/L, $p=0.14$). Bland-Altman Limits of Agreement between methods was -9.3 to 11.6 mmol/L with a mean bias of 1.2 mmol/L. There was a significant correlation between patches ($r=0.92$, $p<0.0001$) and the coefficient of determination (r^2) for predicting Absorbent from Epifluidic patch [Cl⁻] was 0.85. Based on Deming regression analysis, the slope and intercept of the regression line describing Absorbent vs. Epifluidic patch sweat [Cl⁻] were not different than 1 and 0, respectively. **Conclusions:** The Epifluidic patch provides accurate data for forearm sweat [Cl⁻] estimation during exercise in sport-specific conditions during live indoor and outdoor training. Future research is needed to evaluate the Epifluidic Patch in other sports (beyond those investigated) as well as for on-skin analysis of sweat [Cl⁻] at other regional sites.

3761 Board #78 May 30 8:00 AM - 9:30 AM
ECG-derived Aerobic And Anaerobic Indices For Training Efficiency Tracking

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 (No relevant relationships reported)

There is a continuous search for indirect methods and simple criteria to evaluate physiological effects of training. ECG analysis provides a relevant option for routine monitoring as it can be supported in real-time mobile or wearable device applications. Determination of the optimal ECG features is essential for monitoring and assessing systems. **PURPOSE:** To introduce ECG-derived aerobic index (AI) and anaerobic index (ANI) which could determine training effects and indicate subject's metabolic state. **METHODS:** A healthy, physically active subject performed endurance and strength trainings 3 times a week. He fulfilled 55 ECG measurements using single-lead wrist-wearable device before and after 28 trainings. ECG signals were processed with detection of QRS-complex. AI and ANI were calculated as R-peak normalized to S-R complex slope and as S-T complex slope normalized to R-S slope. Correlations of AI and ANI with training load were calculated using Pearson correlation coefficient (r) with p value. **RESULTS:** Correlations between AI and aerobic load as well as ANI and anaerobic load were identified. The more energy was burned during training, the lower indices were registered. As shown in Figure, maximum of negative correlation between AI with aerobic load was in 60 min after training ($r=-0.57$, $p<0.01$). ANI showed negative correlation with anaerobic load ($r=-0.35$, $p<0.01$) in 30 min after training. **CONCLUSION:** Proposed ECG-derived aerobic and anaerobic indices showed statistically significant correlations with training load and could be used as assessed individual parameters of the degree of training in fitness and sport medicine. Figure. Dependences of ECG-derived aerobic (A) and anaerobic (B) indices on energy, burned during aerobic and anaerobic load. Correlation curves with confidence bounds (95 %).



3762 Board #79 May 30 8:00 AM - 9:30 AM
VALIDATION OF HEART RATE MONITORING OF FENIX 5 DURING MOUNTAIN BIKING

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 (No relevant relationships reported)

The availability of fitness trackers have increased in recent years. These trackers claim to accurately depict Heart Rate - among other factors. Little if any studies have looked into the accuracy of the HR sensor within these systems. **Purpose:** The Garmin Fenix 5 watch boasts about its performance tracking capabilities, claiming that it will accurately track heart rate, this study aims to assess its accuracy using the Polar H7. **Methods:** Sixteen participants (males = 8, females = 8, 24.69±4.44yrs, 171.45±8.9cm, 74.23±21.07kg) rode a mountain bike a total of 3.22km along the McCullough hills trail (Henderson, NV) while simultaneously wearing both the Garmin Fenix 5 and the Polar H7. Participants rode the same trail twice, each ride was 1.61km (round trip), with a 10-minute break in between rides. Validity was determined using the Mean Absolute

Percent Error (MAPE), Bland-Altman analysis with accompanying bias and Limits of Agreement (LoA), and single measures Intraclass Correlations (ICC). Prior to testing, the benchmark for validity was established as $mAPE < 10\%$ and $anICC > 0.7$ ($p < 0.05$), with the lower limit of the ICC 95% confidence interval (CI) set at > 0.7 . **Results:** During mountain biking the MAPE was 13.30%. The single measures ICC was 0.16 with a 95% confidence interval of .068 to .243 ($F(17142, 17142) = 1.495$, $p < 0.000$). **Conclusion:** This data shows that the Fenix 5 does not produce a valid measure of heart rate while mountain biking due to the MAPE being above 10% and the ICC being well below .7.

3763 Board #80 May 30 8:00 AM - 9:30 AM
Confounding Variables Influence Utility Of Heart Rate Measures In Collegiate Athletes.

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 (No relevant relationships reported)

Heart rate is easy to measure and a useful variable for determining training intensity, training status and fitness levels. The downward rate of the heart following a standardized stressor (heart rate recovery; HRR) and resting heart rate (RHR) are autonomic-mediated and can be used to detect training distress. However, confounding variables can limit the usefulness of heart rate when criteria for rate changes are not individualized, especially when applied to entire sporting teams. **PURPOSE:** To determine influences of sex, training status, player position and season duration have on the RHR and the HRR response following a standardized physical stressor. **METHODS:** Subjects were male ($n=17$) and female ($n=26$) collegiate soccer players aged 17 to 22 years. RHR (taken in the morning just after waking) and the HRR following a 300-yard shuttle run and maximal treadmill test were collected four times during one entire season: Beginning of August (pre-season), September (mid-season), October (mid-season), and end of November (post-season). Polar monitors were used to record heart rate. **RESULTS:** A comparison between shuttle run times showed men had faster times ($p<0.001$) and higher VO_{2max} ($p<0.05$) than women. Shuttle run performance and athlete's class standing were not found to be significantly different but trended towards significance ($p=0.052$). HRR examined by sex found that men had a faster HRR time than women ($p=0.010$). A multivariate analysis examining RHR and player position found that there was a statistically significant difference ($p=0.015$): The forward players had higher RHR compared to defenders ($p=0.051$) and midfielders ($p=0.049$). **CONCLUSION:** Player fitness, sex, position and year in school should be considered when establishing guidelines for using heart rate information.

3764 Board #81 May 30 8:00 AM - 9:30 AM
The Accuracy Of Heart Rate Monitors And Determination Of Heart Rate Percentages At Anaerobic Threshold

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 (No relevant relationships reported)

PURPOSE: To examine the heart rate percentage (HR%) at the Anaerobic Threshold (AT) in order to determine the appropriate exercise intensity below or above the AT. A second goal was to assess the accuracy of different types of wearable heart rate monitors (HRMs) during a graded exercise test. **METHODS:** Thirty healthy individuals ($n=21$ male & $n=9$ female; aged 24.5 ± 3.5 years) participated in a single incremental exercise protocol on a cycle ergometer (CE). AT was detected through a metabolic cart by using V-slope method, which determined the point of a nonlinear increase in carbon dioxide output (VCO_2) against oxygen uptake (VO_2). HR was measured each minute of exercise test via two optical-based monitors (Cellular Watch [IW] & Fitness tracker [FB]) and two electrical-based monitors (traditional monitor [ECG] & heart rate monitor [PL]). Electrocardiography (ECG) was used as a "Gold Standard" for comparison in this study. **RESULTS:** AT was reached at the mean and standard deviation (SD) of 130 ± 16 bpm. HR% at AT was observed $67 \pm 8\%$ of HRpeak, Heart Rate Reserve Percentages (HRR%) at AT were observed at $42 \pm 15\%$ of HRpeak. Across all exercise testing stages (Stage 1 [S1], Stage 2 [S2], Stage 3 [S3], etc.), no significant differences were found in HR values between ECG and PL. The most statistical differences were found in HR between ECG and IW, $S6=[p=0.018]$, $S6=[p=0.041]$ and $S7=[p=0.005]$, respectively. As intensity increased, FB and IW underestimated the HR values throughout all stages when compared with the ECG. **CONCLUSIONS:** Analysis of HR% at AT was estimated at approximately 67% of participant maximum effort as well as HRR% at AT was estimated at 42%. At the light-intensity, accurate outcomes of HR values were observed from all wearable HRMs. However, with increased intensity, the accuracy of wearable devices was varied at moderate and high-intensity exercise testing. The PL had the greatest agreement with

ECG when compared to other devices. This might be due to the fact that both HRMs utilize a similar mechanism of measurement. The electrical-based HRM was found to be more accurate in comparison to the optical-based HRMs.

3765 Board #82 May 30 8:00 AM - 9:30 AM
Effect Of Practice And Game-Related Impacts On Common Indicators Of Concussion: A Pilot Study

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Previous studies have suggested that football players not clinically diagnosed with concussion may still demonstrate differences in balance and neurocognitive performance by end of season. Clinically this is important as it indicates the athlete with sub-clinical injuries that may contribute to long-term deficits.

Purpose: A pilot study to determine if non-concussive impacts sustained during normal play at NCAA Division I football practices and spring season scrimmage are sufficient to elicit detectable changes in oculomotor (OM) and balance performance. **Methods:** 23 NCAA Division I football players were recruited to this pilot study during the 2019 spring football season. Questionnaires were used to collect demographic information. Portable virtual reality equipment was utilized to measure OM performance of smooth pursuit, saccade, and vestibular ocular reflex (VOR). BESS was utilized to measure balance performance. Assessments were administered at baseline, 24-48 hours after 3 practices, and the spring season scrimmage. Shapiro-Wilkes analysis was used to assess changes in balance and OM skills in subjects across the pilot project.

Results: Of the 23 recruited subjects, 7 (30%) completed all assessments; however, there were missing data observations for the 7 subjects who completed all 5 assessment points. There was no significant change in balance performance ($p = 0.375$); one variable of smooth pursuit testing (mean phase error of left eye) demonstrated near significant changes ($p = 0.0625$). There was no significant change in any variables for horizontal or vertical VOR, while, one variable of horizontal and vertical saccade testing (accuracy x of left eye) demonstrated near significant changes ($p = 0.0625$). **Conclusion:** We found no significant detectable changes in balance and OM performance in this pilot study.

G-34 Free Communication/Poster - Performance

Saturday, May 30, 2020, 8:00 AM - 10:30 AM
 Room: CC-Exhibit Hall

3766 Board #83 May 30 8:00 AM - 9:30 AM
Internal Load In Football Players: Can The Mind See What The Heart Says?

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Rating of perceived exertion (RPE) is a simple, validated, measure of physical effort, largely reflecting heart rate (HR). However, RPE is being replaced by continuous HR monitoring to quantify internal loads which maximize performance and enhance recovery. **Purpose:** Primary aim: assess relationships between RPE (athlete and coach) versus HR during football practice. Secondary aims: quantify internal load via HR assessments of training impulse (TRIMP) and recovery. **Methods:** Data represents pre-season testing, in an ongoing study. Twenty-nine collegiate male football players (age=20±2years; body mass index= 34±6kg/m²; weight=118±20kg) and 3 coaches volunteered to participate. Each athlete was pre-assigned a HR monitor for the first 7 days of football camp. All participants underwent a 3-minute quick recovery test (QRT). HR monitors were then worn during practice. Athlete HR, TRIMP, %heart rate reserve (%HRR), %heart rate max (%HRmax) were recorded and visible only to researchers. Immediately following practice, all athletes and coaches were asked to assess RPE for the entire training session (sRPE) using the Borg CR-10 scale. %HRmax and %HRR were transformed to scale from 1-10, to match the Borg CR-10. Significance set at $p < 0.05$. **Results:** Training sessions over this 7-day period, lasted 145.8±33.7 minutes. When weekly data were combined, significant overall correlations (pairwise; N=187) were noted between %HRR versus: %HRmax ($r = 0.84; p < 0.0001$), athlete sRPE ($r = 0.30; p < 0.0001$) and

head coach RPE ($r = 0.30; p < 0.0001$). Athlete sRPE was correlated with one coach sRPE ($r = 0.30; p < 0.0001$). Athletes were then subdivided into Big, Combo, and Skill position groups. Two-way ANOVA for sRPE between athletes, coaches and %HRR demonstrated a significant interaction effect ($F = 15.2; p < 0.0001; 22.8%$), time effect ($F = 36.4; p < 0.0001; 13.6%$), and position effect between groups ($F = 26.1; p < 0.0001; 6.5%$). TRIMP decreased over time, with a significant time effect ($F = 23.7; p < 0.0001; 33%$) and position effect ($F = 5.4; p = 0.005; 2.5%$). Trend for QRT to dip on Day 2, then increase over time. **Conclusions:** Athletes and one coach significantly predicted training effort (HR) during practice. However, the variance was small (9%) and sRPE remained steady despite decreased training load and increased QRT scores (trend) over time.

3767 Board #84 May 30 8:00 AM - 9:30 AM
Abstract Withdrawn

3768 Board #85 May 30 8:00 AM - 9:30 AM
Isometric Mid-thigh Pull Correlates With Power, Sprint, Agility And Smash Performance In Junior Female Badminton Players

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 (No relevant relationships reported)

Purpose: Badminton is a racket sport characterized by high-intensity, intermittent actions. Some of the most important aspects of fitness required for badminton highlighted in the literature include speed, agility, strength, and power. Traditional strength testing such as one repetition maximum (1RM) squat can be time-consuming and inaccurate. As an alternative choice, the isometric mid-thigh pull (IMTP) has been shown to be related to performance variables such as vertical jump, strength, sprint, and agility in various sports. There are two primary variables for IMTP, the first is to quantify the athlete's maximal force-generating capacity, known as peak force, and the second is to assess the rate at which force can be applied during a maximal effort muscle contraction, called as the rate of force development. This study aimed to examine the relationship among IMTP, vertical jump, sprint, agility and smash performance in elite junior female badminton players.

Methods: Twenty-three national level junior female badminton players (Age: 15.21 ± 0.89 y; Height: 1.71 ± 0.06 m; Body mass: 58.54 ± 6.90 kg; Training age: 7.32 ± 1.95 y) participated in this investigation. The participants performed IMTP, vertical jump, 10-m sprint, badminton-specific change-of-direction testing, and forehand smash velocity testing. Bivariate correlation analysis (Pearson product-moment correlations) was used to examine the relationship between IMTP kinetic variables and sprint, agility and smash performance.

Results: Peak force had a significant negative correlation with 10-m sprint time ($r = -.582, p = .004$), left ($r = -.662, p = .001$) and right ($r = -.664, p = .001$) pro-agility time. Peak force also had a significant positive correlation with smash velocity ($r = .418, p = .047$) and vertical jump power ($r = .514, p = .012$). Rate of force development had a significant negative correlation with 10-m sprint time ($r = -.636, p = .001$), left ($r = -.575, p = .004$) and right ($r = -.546, p = .007$) pro-agility time, as well as a significant positive correlation with vertical jump power ($r = .534, p = .009$).

Conclusions: Results from this investigation demonstrate that IMTP variables such as peak force and rate of force development are associated with jump, sprint, agility and sport-specific performance in elite junior female badminton players.

3769 Board #86 May 30 8:00 AM - 9:30 AM
Ankle Proprioception And Sport-specific Performance In Professional Youth Table Tennis Players

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 (No relevant relationships reported)

Purpose The current study aimed to investigate the relationship between ankle proprioception and sport-specific performance in professional youth table tennis players. **Methods** 14 players competed nationally and internationally (Level 1, age=14.29±1.75 yrs, training years=7.36±1.84yrs) and the other 14 players competed regionally (Level 2, age=11.14±1.46 yrs, training year=4.11±0.97yrs) were recruited. All players had no lower limb injuries in the past 3 months. The dominant ankle proprioception was tested by using the active movement discrimination extent apparatus (AMEDA) under three randomized conditions: 1) single AMEDA (Single-A); 2) dual task AMEDA tested while performing forehand attack (Dual-FA), and 3) performing forehand loop (Dual-FL) to hit the topspin into a designated corner on the table, with their hitting rates (HR) recorded. The mean Area Under the ROC

Curve (AUC) was calculated for ankle proprioceptive discrimination sensitivity score. 2-way repeated measures ANOVA was performed to determine the differences among the 3 AMEDA tests for players between 2 levels, and Pearson's correlation evaluated among the measures. **Results** Repeated measures ANOVA showed significant main effects for task load AMEDA tests ($F=46.30, p<0.01$) and competition levels ($F=19.95, p<0.01$), with no significant interaction ($p>0.05$). A significant linear effect was found across the 3 task load conditions ($F=64.97, p<0.01$). Pearson's correlation showed that the HR for both Dual-FA and Dual-FL were significantly correlated with all 3 AMEDA scores (r ranged from 0.38 to 0.66, all $p<0.05$). In addition, years of training was significantly correlated with both HR for Dual-FA ($r=0.46, p=0.02$) and Dual-FL ($r=0.61, p<0.01$), as well as the proprioceptive AUC scores of both Single-A ($r=0.45, p=0.02$) and Dual-FA ($r=0.64, p<0.01$), but was not significantly correlated with the AUC scores of Dual-FL ($p>0.05$). **Conclusion** Ankle proprioception may be an essential ability underpinning sport-specific performance and was significantly impaired under the dual tasks in youth table tennis players. Testing ankle proprioceptive ability during Dual-FL may place demand on central resources not developed by training. These findings have implications for ankle injury prevention, table tennis training and talent identification.

3770 Board #87 May 30 8:00 AM - 9:30 AM

Predictors Of Obstacle Course Racing (OCR) Performance

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Reported Relationships: W. Titus: Other (please describe): I was an employee of the gym where participants were recruited from and where data were collected at the time of this study (Fall 2018). I am no longer an employee at this facility.

Purpose: Obstacle course racing (OCR) has become a popular recreational activity in the last ~10 years, with more than 8.5 million participants. Despite the popularity, little is known about predictors of performance in OCR; research to date has focused on injury prevalence. The purpose of this study was to conduct laboratory and field tests of athletic performance in OCR athletes and examine their relationships to performance in a simulated OCR. **Methods:** Thirty-two men and women (mean \pm standard deviation (SD) age: 42 ± 10 years; OCR experience: 2.8 ± 2.3 years) completed laboratory testing for $\dot{V}O_{2\max}$, anaerobic power (Wingate), vertical jump, flexibility, and body composition. Additional field tests were completed for 400 meter and 1 mile running time, muscle strength (back squats and deadlifts) and endurance (bucket carry for distance), grip strength, and burpees. Participants also completed a 3-mile simulated OCR. Independent t-tests examined differences between sex and bivariate regressions were conducted between testing variables and OCR performance. **Results:** For the combined sample, the best individual predictors were mean relative power from the Wingate tests ($\beta \pm$ standard error (SE): -6.47 ± 1.12 minutes) and mile run time ($\beta \pm$ SE: 6.43 ± 0.71 minutes). Multivariable analysis controlling for age, sex, and mile run time found an independent association between bucket carry for distance and race time ($\beta \pm$ SE: -0.04 ± 0.01 minutes), but mile run time was still the best predictor ($\beta \pm$ SE: 6.33 ± 0.97 minutes). **Conclusions:** Data from the present study suggest that aerobic and anaerobic fitness have important contributions to OCR success.

3771 Board #88 May 30 8:00 AM - 9:30 AM

Relationship Between Seated Single Arm Shot Put And Isokinetic Shoulder Flexion And Elbow Extension Strength

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PURPOSE: Previous studies have demonstrated a strong correlation between isokinetic pushing force and seated single-arm shot-put (SSASP) test performance. However, there is limited research on the contribution of shoulder flexion and elbow extension strength on SSASP test outcomes. Therefore, the purpose of this study was to examine the relationship between isokinetic shoulder flexion and elbow extension strength and SSASP test performance and compare limb symmetry indexes (LSI) between the two tests. **METHODS:** Healthy, physically active men ($n=16$, ages=21-34 yrs) and women ($n=15$, age=18-29 yrs) performed dominant (DOM) and nondominant (NDOM) shoulder flexion and elbow extension isokinetic tests (System 4, Biodex, Shirley, NY) at $60^\circ/s$ (5 repetitions) and $180^\circ/s$ (10 repetitions) to determine peak torque production. The average horizontal range from three SSASP (2.0kg ball) trials were computed separately for each limb. In addition to conducting correlational analyses between the

peak torques and SSASP distances, the differences in LSI computed between each of the peak torques and SSASP distances were statistically compared at each velocity by joint analysis of variance.

RESULTS: Significant ($P<0.001$) relationships were revealed between DOM and NDOM SSASP performance and shoulder ($r=.819$ to $.853$) and elbow ($r=.803$ to $.820$) peak torques at both velocities. LSI for the SSASP ($104.4 \pm 7.1\%$) were similar to the isokinetic LSI at both $60^\circ/s$ (Elbow: $101.3 \pm 10.2\%$, Shoulder: $102.2 \pm 13.8\%$) and $180^\circ/s$ (Elbow: $100.4 \pm 9.7\%$, Shoulder: $103.5 \pm 12.8\%$), with no statistically significant differences ($P=.364$ to $.844$, $\eta_p^2=.001$ to $.028$).

CONCLUSIONS: Results demonstrate shoulder and elbow isokinetic torques are strongly associated with SSASP distances. Moreover, LSI for both tests were not significantly different from each other, thereby supporting the utilization of the SSASP for making bilateral comparisons in healthy individuals.

3772 Board #89 May 30 8:00 AM - 9:30 AM

Evaluating The Impact Of Competition On Vertical Jump Performance

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PURPOSE: The vertical jump (VJ) test is used in athletic populations to assess lower body power and this value can be utilized as a predictor for sports performance. Incidentally, athletes have often elevated their level of performance in competitive environments. However, competition during assessment tests has not been widely examined. It is logical to assume that conducting the VJ test where subjects compete against each other may contribute to higher jumps. The purpose of this study was to determine if a competitive environment would have an impact on VJ performance in females.

METHODS: Twenty-six no less than averagely fit college females (age = 21 ± 1.86 years, Ht. = 166.53 ± 7.30 cm, Wt. = 64.47 ± 11.84 kg, BF% = $23.55 \pm 6.22\%$) completed a dynamic warm up followed by four minutes of passive recovery (PR). After the completion of familiarization jumps and a four-minute PR period, subjects completed two jump series (in a counterbalanced order, solo and competitive) consisting of six jumps per series. The competitive series consisted of two subjects jumping side by side against one another simultaneously. The highest jump, second highest jump, and average jump heights of the solo (SFHJ, SSHJ, SAJ) and competitive (CFHJ, CSHJ, CAJ) jumps were compared and analyzed using a paired-samples T-test ($p \leq 0.05$).

RESULTS: Significant differences occurred between: CFHJ (54.61 ± 1.31 cm) and SFHJ (53.34 ± 1.27 cm) ($p=0.001$); CSHJ (53.68 ± 1.32 cm) and SSHJ (52.27 ± 1.34 cm) ($p<0.001$); and CAJ (52.97 ± 1.31 cm) and SAJ (51.45 ± 1.33 cm) ($p<0.001$).

CONCLUSIONS: The results of this study suggest that a competitive environment for the VJ test does have an impact on VJ performance. Future research may need to assess the impact of a competitive environment on the VJ test utilizing athletes from sports where jumping actions are of extreme importance. Furthermore, an evaluation of the competitive environment on other power tests, such as the broad jump, should occur.

3773 Board #90 May 30 8:00 AM - 9:30 AM

Audience Presence Prolongs Maintenance Of Peak Power In Maximal Anaerobic Activity

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Sport participation commonly occurs in front of an audience. It is important to know if the presence of that audience influences the force profile of the performer. **PURPOSE:** To examine the influence of spectator presence on power output in a short-duration, high-intensity activity. **METHODS:** We tested 15 men and 28 women, ages 18-25, on a 30-second Wingate cycle ergometer test. All subjects were tested twice, separated by 72 hours. During one trial, performance took place in front of the test administrator; during the other trial, the administrator was accompanied by an audience. Spectators observed but did not interact with the subjects. Testing conditions (e.g., time of day, instructions provided, and verbal encouragement) were identical in the two trials. The order of tests was assigned in a counter-balanced design. Mixed ANOVA with repeated measures was used to compare peak power (PP), duration of peak power (DPP), and mean power (MP) between the two trials overall and by sex. **RESULTS:** Subjects were 20.4 ± 1.4 years of age; across all testing, PP 1.7 ± 1.3 w/kg, DPP was 2.6 ± 3.5 seconds, and mean power was 1.2 ± 0.3 w/kg. There was no effect of test order on performance ($p=0.199$). Similarly, there was no effect of audience presence on PP ($p=0.348$) or an interaction effect with sex ($p=0.406$). There was an increase

in MP in the audience trial; subjects were 0.1 w/kg higher, corresponding to a 6.5% increase ($p=0.003$; 95% CI: 0.03 to 0.13 w/kg). There was no interaction effect with sex ($p=0.416$). The increase in MP was the result of an increase in DPP, which was 1.6 seconds longer in the audience trial, corresponding to a 91.6% increase ($p=0.002$; 95% CI: 0.61 to 2.49 seconds). There was no interaction effect with sex ($p=0.418$). **CONCLUSIONS:** The presence of an audience influenced power output on the Wingate test. Although peak power was unaffected, the duration peak power was maintained nearly doubled, indicating endurance at peak performance may be sensitive to arousal.

3774 Board #91 May 30 8:00 AM - 9:30 AM
Combined Driving: Task-specific Position Impacts Grip Strength Of Equestrian Athletes

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Equivalent to a human triathlon, combined driving is an equestrian sport designed to test ability to navigate horses and carriage during three phases. Drivers control up to four horses at a time relying heavily on hand strength. **PURPOSE:** to 1) establish baseline data on grip strength and endurance of combined drivers in standing and task-specific positions; and 2) compare grip values to normative data by driver age. **METHODS:** Drivers were included if medically cleared to actively compete, and free from current injury. Fifty-one combined drivers (9 males, 42 females) ages 21-78 participated during two nationally recognized events. All drivers were right hand dominant. 63% of drivers were over 50 y/o. 22% of drivers reported having arthritis in their hands/wrists. Drivers completed a demographics and sport-specific survey, and three grip tests in two positions: standing and task-specific (sitting). Measures included peak values and endurance. Peak grip was recorded into four categories based on normative values.

RESULTS: Females with more than 30 yrs of driving experience had higher strength in the non-dominant hand ($p=0.0345$). There was a significant difference between strength based on position for both sexes (Table 1). Over 45% of females were stronger than normative data for both dominant and non-dominant hand, while only 22% of males fell in the stronger category. Female drivers average hand grip strength was 1.25 times greater than the normative population. The endurance for all subjects was significantly higher for the right hand ($p=0.002$). **CONCLUSIONS:** This study is the first to establish standing and task-specific grip strength in combined drivers. Female drivers over 50 y/o demonstrated greater hand strength in their non-dominant hand, suggesting continuous use of hands for driving promotes strengthening muscle and maintaining hand function regardless of reported arthritis. Results demonstrated equestrian driving is beneficial to hand grip strength.

Table 1. Average peak grip strength while standing and sitting by sex.

	Average Standing Peak - Right (kg)	Average Standing Peak - Left (kg)	Average Sitting Peak - Right (kg)	Average Sitting Peak - Left (kg)
Males	43 ± 5.1	44 ± 6.9	38 ± 7.5 ^b	36 ± 9.3 ^b
Females	32 ± 6.5 ^a	30 ± 6.2 ^a	25 ± 8.3 ^{a,b}	23 ± 8.1 ^{a,b}

Note: Values are displayed as mean ± SD.

^adenotes significant difference ($p<.05$) between right and left

^bdenotes significant difference ($p<.05$) between sitting and standing

3775 Board #92 May 30 8:00 AM - 9:30 AM
Differences In Player Metrics Between Lacrosse Games And Practices

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Lacrosse participation in the United States has rapidly increased in recent years, however there is minimal research related to the sport. Existing research has mainly utilized laboratory-based testing procedures. There is a need to understand the physiological demands of players during live play to assist coaches with the training and conditioning necessary for improved player performance. **PURPOSE:** To compare player metrics of high school male lacrosse players during games and practices.

METHODS: A team heart rate monitoring system with an internal global positioning system and gyroscope was used to record internal player metrics (heart rate [HR], calories) and external player metrics (duration, distance, speed, sprints). Participants in the study consisted of 13 male high school club lacrosse players (16.2 ± 1.5 yr; 175.3 ± 7.7 cm; 69.9 ± 13.6 kg). Subjects were monitored during two practices (130.9 ± 5.2 minutes) and one game (39.58 min). Differences in player metrics were compared by session, as well as by position: attack, midfield, defense, and face-off-get-off (FOGO). Game and practice data were compared utilizing paired samples *t*-tests, while individual position metrics were analyzed by independent sample *t*-tests. A standard

$p \leq .05$ was used to determine significance for the analyses. Effect sizes (*r*) were also calculated for each comparison. **RESULTS:** Significant differences and large effect sizes were found for average HR, total calories, and caloric expenditure ($t \geq 4.2$, $p \leq .003$, $r \geq .590$). Significant differences and large effect sizes were also found for duration, total distance covered, and number of sprints between game and practice sessions ($t \geq 2.32$, $p \leq .049$, $r \geq .253$). Positional comparisons identified significant differences and large effect sizes between midfield and FOGO positions for maximum HR ($t = 2.411$, $p = .028$, $r = .525$) and number of sprints ($t = 3.242$, $p = .005$, $r = .745$). **CONCLUSION:** The results of the study suggest that both internal and external metric requirements differ between high school lacrosse practice and game sessions, as well as across varying positions. This data could be used to alter practice sessions to better mimic the higher intensities of games and provide coaches the ability to train athletes at game-like and position-specific intensities.

3776 Board #93 May 30 8:00 AM - 9:30 AM
Performance Profile Of International Male Lacrosse Players

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PURPOSE: Even with its rising participation numbers worldwide, there has been little quantitative analysis on the activity profile of Lacrosse players. Therefore, this study aimed to determine (a) the overall activity profile and differences over the course of play, and (b) differences between players position.

METHODS: Data involved eight World Championships games of the male Austrian lacrosse national team using micro technological devices. Assessed parameters included total distance covered (m), mean heart rate (%HR_{mean}), time spent in four different HR-zones (HRz) (<75; 75-84.9; 85-89.9; ≥90%), distance covered (m) in five different Speed-zones (Sz) (0.0-0.2; >0.2-1.8; >1.8-3.3; >3.3-5.7; >5.7m/s), and mean respiratory frequency (RF). Additionally to total game values differences between quarters and players position were analyzed. Statistical significance was set at $p \leq 0.05$ and for an estimate of effects Cohen's ES was calculated.

RESULTS: Overall activity results show a total distance covered of 4,511.6 ± 1,151.3m, a RF of 25.4 ± 1.7bpm, and a HR_{mean} of 72.3 ± 5.1%. Greatest distance was covered in Sz 2 (1,578.4 ± 627.2m), and most of the time spent in HRz 1 (3,028.4 ± 714.2s). Comparison between quarters showed lower HR_{mean} values ($p=0.00$; $n^2p=0.08$), more time spent in HRz 1 ($p=0.00$; $n^2p=0.12$) and less in HRz 3 ($p=0.03$; $n^2p=0.03$) and HRz 4 ($p=0.00$; $n^2p=0.09$), and a lower RF ($p=0.00$; $n^2p=0.09$) over the course of play. Regarding players position, attackers showed more time spent in HRz 2 compared to other positions (1,482.3 ± 51.2s; $p=0.00$; $n^2p=0.69$), and covered greater distance in Sz 2 (2,275.8 ± 149.4m; $p=0.01$; $d=3.10 \pm 1.55$) compared to midfielders. On the other hand, midfielders showed greater distance covered in Sz 4 (1,334.0 ± 320.9m; $p=0.05$; $d=1.32 \pm 1.15$) compared to defenders.

CONCLUSIONS: Players' profile data are in agreement with recent research. Furthermore, results indicate a reduction of activity along with an increase of physical stress over the course of play. Regarding players position our findings support the hypotheses that midfielder are exposed to higher intensity bouts with longer rest periods compared to other positions. Overall, findings will be of interest for coaches and practitioners for a deeper understanding of demands players are exposed to in lacrosse match-play.

3777 Board #94 May 30 8:00 AM - 9:30 AM
An Evaluation Of Internal And External Load Metrics In Games In Women'S Collegiate Lacrosse

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PURPOSE: There is little published data to guide coaches and sport scientists about important variables for measuring game and training load in sports outside of soccer and rugby. The purpose of this study was to statistically evaluate the relationship of internal and external load metrics in women's collegiate lacrosse games.

METHODS: Twelve Division I collegiate female lacrosse players wore a heart rate (HR) monitor and global positioning system (GPS) during 17 intercollegiate games. Seven measures determined training load: two internal measures [mean HR and training impulse (TRIMP)] and five external measures [total distance, high-intensity distance (HID), distance rate, accelerations, and decelerations]. The training load measures were analyzed for the whole game and by first and second halves. Principal component analysis (PCA) was used to determine which internal and external load variables were most associated with each portion of the game. A paired samples *t*-test was used to compare differences in first and second half metrics.

RESULTS: The whole game and each half extracted only one principal component. For the whole game, HID, decelerations, accelerations, TRIMP, and total distance

explained 58% of the variance ($p < .001$). The same metrics explained 55% of the variance for the first half ($p < .001$). For the second half, the same metrics with the addition of distance rate explained 57% of the variance ($p < .001$). Interestingly, the distance rate measure was only significant in the second half, although total distance contributed the most to the component, as it did in the first half and whole game data. The paired samples t-test showed differences between first and second halves for HID ($p < .001$), accelerations ($p < .001$), decelerations ($p < .001$). In all cases, there was greater distance and more intense efforts in the first half than the second.

CONCLUSIONS: These results show that a combination of internal and external load measures should be used to determine load during games. The loaded metrics should be compared to a complimentary analysis for drills to ensure that training load metrics are similar. These data also support the concept of reduced high-intensity performance in the second half. This information should be used to bolster appropriate training methods to improve second half fitness.

3778 Board #95 May 30 8:00 AM - 9:30 AM
Cut-Off Values In The Prediction Of Success In Olympic Distance Triathlon

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PURPOSE: To determine cut-off values to reach a Top-3 position in an Olympic distance triathlon by investigating which discipline has the most influence in overall race performance, and whether or not this has changed over the decades.

METHODS: Data from 1989 to 2018 of 33,099 men and 18,928 women ($n=52,027$) who competed in the Triathlon World Cup, World Triathlon Series, and Olympics race events were included. In addition to exploratory data analyses, linear regressions were applied for performance trends in overall and top-3 of each race. A t-test for independent samples was applied for sex comparison. Multivariate analysis was performed to assess which discipline may have the greater influence. The cut-off value to achieve a top-3 position was calculated.

RESULTS: The cut-off values for Men were: swimming=19.5min; cycling=60.7min; running=34.1min. Women's cut-off values were: swimming=20.7min; cycling=71.6min; running=38.1min. Based on this analysis, it was shown that running is the discipline with the most influence on overall race time for men, while swimming is the discipline with most influence for women. Cycling is the discipline with least influence on overall race performance for both men and women.

CONCLUSIONS: In conclusion, the established cut-off values were set in order to increase the chances of achieving a successful rank in an Olympic distance triathlon. In summary, swimming split seems to be the better predictor of overall race performance in women, while running time is a better predictor for men. Our analyses showed that this influence pattern has not changed in the last three decades.

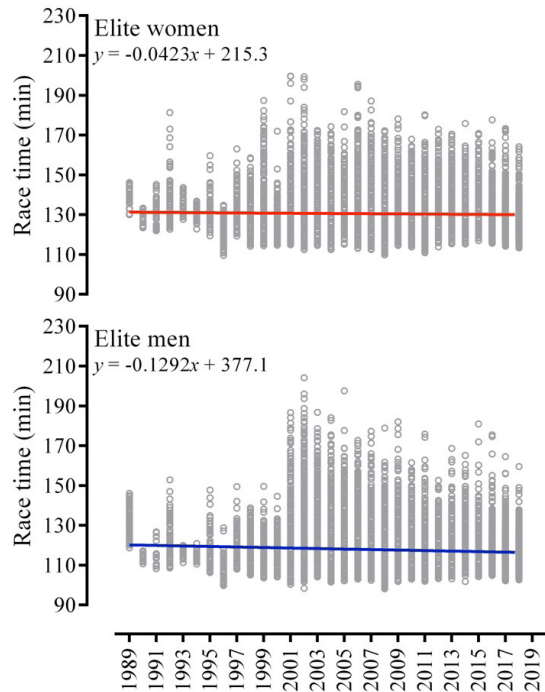


Figure 1. Performance trend of overall race time in Olympic distance triathlon from 1989 to 2018 in men and women.

3779 Board #96 May 30 8:00 AM - 9:30 AM
Abstract Withdrawn

3780 Board #97 May 30 8:00 AM - 9:30 AM
Differences In Mechanics Between First And Second Drop Vertical Jump Landings
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PURPOSE: A drop jump and landing, followed by another maximal jump and landing, has been used when assessing injury risk using the Landing Error Scoring System (LESS). The LESS provides a way to measure frontal and sagittal plane alignment during landing and has traditionally used the first, but not the second, landing for assessment. Additionally, vertical ground reaction force (vGRF) and knee excursion are commonly analyzed during a drop vertical jump. The purpose of this study was to investigate whether there was a difference in LESS scores, vGRF, and knee excursion between the first and second landings of the drop vertical jump.

METHODS: Forty healthy subjects performed a drop vertical jump from a 30 cm box with an initial landing (L1) immediately followed by a second maximal jump and landing (L2). Three trials were scored using the LESS. Subjects were dichotomized as "high risk" on the LESS if they had a score greater than 5 (including moderate and poor scores) and "low risk" (including good and excellent scores) if they scored 5 or under. Jump height, peak vGRF, and knee excursion were recorded using an in-ground force plate and a 3-D motion analysis system. To further analyze the data, subjects were separated into "high" and "low" jumpers by dichotomizing the average jump height. Statistical analysis was performed with SPSS (version 25.0) to identify whether there were significant differences in LESS scores, peak vGRF, and knee excursion between landings for all subjects and "high" and "low" jumpers.

RESULTS:

Table 1. Comparisons of Average Total LESS Score, Peak vGRF and Knee Excursion Between L1 and L2 for "All Subjects" and "Low" and "High Jumpers."

	All Subjects				Low Jumpers				High Jumpers			
	L1	L2	p-value (alpha=.05)	n	L1	L2	p-value (alpha=.05)	n	L1	L2	p-value (alpha=.05)	n
LESS score	4.46 ± 2.12	6.25 ± 3.04	0.001	40	5.03 ± 2.31	7.49 ± 2.73	0.001	21	3.82 ± 1.73	4.88 ± 2.83	0.071	19
Peak vGRF (N/kg)	1.98 ± 0.59	2.57 ± 0.74	0.001	39	2.08 ± 0.63	2.50 ± 0.74	0.003	21	1.86 ± 0.54	2.66 ± 0.76	0.001	18
Knee excursion (degrees)	66.13 ± 17.07	72.39 ± 26.21	0.051	39	60.41 ± 17.08	63.63 ± 27.55	0.41	21	72.8 ± 14.86	82.6 ± 20.93	0.067	18

CONCLUSIONS: The significant increase in LESS scores and peak vGRF between landings suggests that the second landing may be more indicative of injury risk when using the LESS. Low height jumpers had greater injury risk due to significantly higher LESS scores and minimal changes in knee excursion from landing one to landing two.

3781 Board #98 May 30 8:00 AM - 9:30 AM
"Critical Oxygenation Model": A Novel Approach To A Classical Fatigue Threshold

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Reported Relationships: A. Feldmann: Industry contracted research; Idiaz AG. Ownership/interest/stock; Moxy Monitor.

PURPOSE: The critical power (CP) model identifies a performance-based fatigue threshold which can be effectively used to predict time to task failure (TTF). The model's hyperbolic form identifies a clear asymptote (CP) which determines an over-under threshold with which an athlete can perform a task. Tasks over CP result in a depletion of work potential (W') which ultimately results in failure when W' is depleted. CP and W' are performance characteristics and the physiological mechanism behind this phenomenon remain difficult to pinpoint. Nonetheless, performance above CP is characterised by unsustainable metabolic process which are a potential explanation for failure. A physiological measure that could represent CP and W' would enhance the model's effectiveness for athletics. Muscle oxygenation (SmO2) as measured by Near-infrared spectroscopy (NIRS) offers itself as a potential physiological surrogate for CP and W', through a time-SmO2 integral (O') identifying unsustainable metabolic process.

METHODS: Eighteen participants (age: 21±1.7; weight: 68±11.1 kg) performed three trials of single-leg knee extensions, at 5%, 10% and 20% 1-RM, to exhaustion in order to evaluate individual power-duration curves. In order to eliminate the effect of blood flow knee extension trials were performed in occluded conditions (pressure cuff >300mmHg). NIRS and EMG sensors were placed on the vastus lateralis, vastus medialis and rectus femoris. O' of the NIRS curve was calculated for each trial.

RESULTS: The CP model predicts that W' is constant across tasks to failure. The same prediction was made for O'. The results suggest that this assumption is correct and O' remains constant for TTF; 5% 1-RM: M = -43.85, SD = 17.93, [95% CI: -35.3, -52.5]; 10% 1-RM: M = -44.75, SD 17.76, [95% CI: -36.2, -53.3]; 20% 1-RM M = -44.79, SD 16.16 [95% CI: -37.0, -52.5]. **CONCLUSIONS:** SmO2 represents a dynamic balance between O2 supply and O2 demand in real-time. An imbalance between O2 supply and O2 demand effects local muscle metabolism resulting in accumulating fatigue which if not restored results in specific TTF. The consistency between O' and TTF over the power-duration curve suggest potential for a physiological approach to a classical performance threshold. This knowledge could be invaluable to TTF prediction at an individual physiological level.

3782 Board #99 May 30 8:00 AM - 9:30 AM
Effects Of Different Intensity And Duration Of Warm-up On Hemodynamics, Jump Power, And Flexibility.

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PURPOSE: Tabata protocol (TP), usually consisting of eight to nine bouts of 20-sec of maximal exercise with 10-sec rest, is time-efficient intervention with both aerobic and anaerobic benefits. This study investigated the effectiveness of different variations of TP as a warm-up procedure.

METHODS: Twenty-five healthy subjects (13 females and 12 males) participated in this study. Participants performed 6 randomized exercise sessions separated by at least 48 hours. The exercise sessions involved 3-min (TP3-20:10; TP3-30:10), 5-min (TP5-20:10; TP5-30:10) or 8-min (TP8-20:10; TP8-30:10) consecutive bodyweight squats

of either 20-sec workout with 10-sec rest (20:10) or 30-sec workout with 10-sec rest (30:10). Heart rate (HR), blood pressure (BP), thigh skin surface temperature (TT), vertical jump performance (VJ), and flexibility (F) were measured before and after execution of the protocols. Countermovement jump was used to measure VJ and sit-and-reach test was used for measuring F.

RESULTS: Two-way ANOVA demonstrated significant condition*time interaction (p<0.01) and time main effect (p<0.01) for F. Significant condition*time interaction (p<0.01) and condition (p<0.01) and time main effects (p<0.01) were observed for HR. There were significant main effects for time with the post-test demonstrating higher values than the pre-test values for both SBP and DBP (p<0.01). Significant time main effect (p<0.01) was also noted for TT indicating reduction in TT following exercise bouts.

CONCLUSIONS: The findings are suggestive of a decrease in F following a higher duration of exercise (TP8-20:10 and TP8-30:10). This may be ascribed to greater accumulation of metabolites (lactic acid, ammonia, and hydrogen ion) in the working muscles, which may alter Type III and IV afferent neural activity to increase pain perception. Local tissue acidosis also stimulates bradykinin release, which may contribute to the transmission of nociceptive signals from skeletal muscle. Additionally, higher duration of exercise may increase cortisol level that decreases the pain threshold level. Therefore, the decreases in flexibility may be explained by one or a combination of metabolic, hormonal, and neurobiological changes stimulating the brain to inhibit the muscular response.

3783 Board #100 May 30 8:00 AM - 9:30 AM
Is Better Freestyle Swimming Technique Associated With Better Performance?

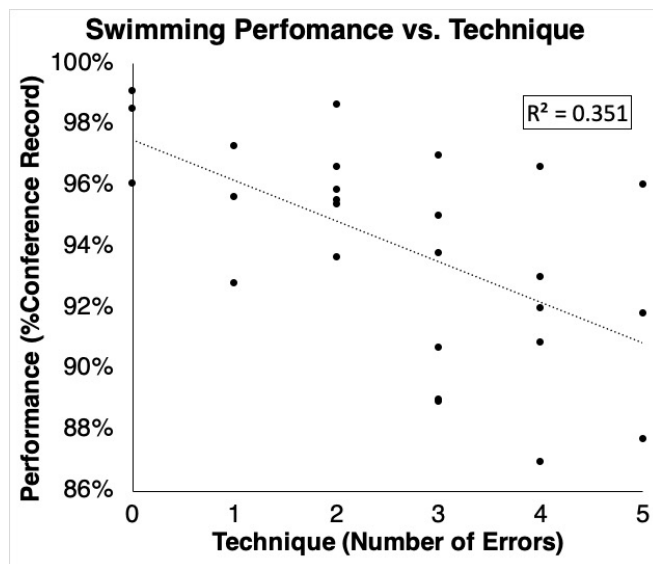
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Swimming technique is widely believed to influence performance, but few studies have quantified this relationship using an objective, pool-side technique assessment.

PURPOSE: To determine the relationship between freestyle swimming technique and swimming performance using a poolside technique assessment. **METHODS:** Freestyle swimming was assessed for technique errors during normal practice near the beginning of the season in 27 Division III college swimmers (16 females, 19±1 years, 1.75±0.11 m, 71.0±10.4 kg). Seven freestyle swimming techniques were considered errors: (1) hand crossing the midline of the body at entry, (2) straight-arm recovery, (3) hand entering with the thumb first, (4) inadequate or excessive shoulder roll, (5) hand crossing the midline of the body during the underwater pull-through, (6) elbow dropping during the pull-through, and (7) excessive neck flexion/extension. Six of the errors were assessed bilaterally, resulting in a maximum possible score of 13 errors. Swimming performance was determined by each participant's best freestyle event from the end-of-season meet as a percentage of the conference record. The correlation between errors and performance was assessed with Pearson's r. One participant was removed due to a late-season injury that affected their ability to train and compete.

RESULTS: Participants averaged 2.7±1.7 errors (range: 0-5). Their performance averaged 94±3% of the conference record (range: 87-99%). There was a significant negative correlation of moderate strength between number of errors and performance: r = -0.59, p = 0.01, R² = 0.35 (Figure). Fewer errors corresponded with better performance. **CONCLUSION:** The fewer freestyle technique errors a swimmer made, the faster their best freestyle race time was as a percentage of the conference record. Technique explained 35% of the variance in performance. This study is one of the first to demonstrate this relationship using objective, pool-side assessment criteria.



3784 Board #102 May 30 8:00 AM - 9:30 AM

Acute Effects Of Squat Position And Whole-body Vibration Frequencies On Muscular Function And Jump Performance

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PURPOSE: To determine the acute effects of different whole-body vibration (WBV) frequencies and squat depths on lower extremity isometric and isokinetic muscle function and vertical jump performance.

METHODS: Thirteen healthy male (age = 23.8 ± 5.3 years) and fifteen healthy female subjects (age = 22.45 ± 3.04 years) performed six randomized sessions of vibration protocols (VPs) in different squat positions with 90° (low-squat) and 140° (high-squat) knee flexion angle at 30 Hz (30Hz90°; 30Hz140°), 40 Hz (40Hz90°; 40Hz140°) & 50 Hz (50Hz90°; 50Hz140°). Each subject performed 5 sets x 1-min of static squats with 30-sec rest between each set. Then they rested for 5-min and repeated 5 more sets. Once completed, vertical jump performance was measured. Furthermore, subjects were tested for maximum 5-sec right knee extensor isometric contractions at 60° of knee flexion, and isokinetic concentric knee extension and flexion at 180°/sec, utilizing standard Biodex protocol. All VPs were performed on the same commercial side to side alternating vibration platform and foot placement for all squats was recorded to ensure consistency.

RESULTS: Two-way repeated measures ANOVA indicated a significant condition main effect in average jump height ($p < .01$) and average jump time ($p < .001$), denoting enhanced jump performance following 40Hz140° ($p < .05$) and 50Hz140° ($p < .01$) compared to 50Hz90°. A significant condition main effect was found in peak-torque during the isokinetic test, where observed changes were greater for both 30Hz140° and 40Hz140° compared to 30Hz90° ($p < .05$) and 50Hz90° ($p < .01$). Lastly, the best performance on peak-torque during the isometric test was significantly higher after 30Hz140° ($p < .05$) and 40Hz140° ($p < .05$) compared to 50Hz90°.

CONCLUSIONS: The findings are suggestive of greater muscular strength and explosive power production following a high-squat WBV warm-up compared to low-squat WBV warm-up. This can be attributed to augmented muscle fatigue and/or increased muscle length due to the plasticity of skeletal muscle while performing low-squat WBV warm-up, resulting in impaired ability to produce muscular force.

3785 Board #102 May 30 8:00 AM - 9:30 AM

Circulating Brain Derived Neurotrophic Factor (BDNF) In Response To Three-day Ultra-endurance Racing

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Cardiovascular exercise is known to exert a variety of positive physiological and psychological benefits on neurocognitive function, glucose and fatty acid metabolism, and muscle recovery. Many of these effects are thought to be mediated by brain derived neurotrophic factor (BDNF), a neurotrophin produced both centrally and peripherally. The fate of BDNF during prolonged endurance exercise is unknown and may be implicated to mitigate potential negative consequences to ultra-endurance racing.

PURPOSE: To investigate the effects of a three-day ultra-endurance triathlon on serum BDNF concentrations pre- and post-race. **METHODS:** Twenty triathletes (age: 40 ± 8.8 yrs) who competed in the 2015 (N=13 men, 3 women) and 2017 (N=3 men, 1 woman) Ultraman Florida triathlon participated in the present study. Blood samples were collected 24-36 hrs pre-race and within 12 hrs post-race. Serum BDNF levels were measured via ELISA. A paired sample t-test was used to evaluate differences between pre- and post-race BDNF concentrations. Values are reported as mean ± SD with significance accepted as $p < .05$. **RESULTS:** BDNF significantly increased from pre- to post-race (0.17 ± 0.9 pg/mL vs. 0.23 ± 0.14 pg/mL; +9.6%; $p < .05$).

CONCLUSIONS: For the first time, BDNF is shown to significantly increase after a three-day ultra-endurance race. These findings may indicate that BDNF concentrations are elevated to potentially counteract any negative consequences derived from ultra-endurance exercise. The influence of both duration and intensity of exercise on BDNF concentrations need to be further elucidated due to its array of positive implications on cognitive and physical function and recovery from prolonged endurance exercise. Supported by the International Society of Sports Nutrition and Florida State University.

3786 Board #103 May 30 8:00 AM - 9:30 AM

Analyzing The Impact Of Body Composition On Vertical Jump Performance In Collegiate Female Volleyball Players

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The vertical jump (VJ) test is often used in sport and recreational performance sectors. Prior studies have examined the effects that anthropometric and body composition values have on VJ performance in no less than averagely fit populations. Yet, it appears that no study has evaluated the relationship between body fat percentage (BF), body mass index (BMI), lean leg mass (LLM), and trunk lean mass (TLM) on VJ performance using collegiate female volleyball players. **PURPOSE:** To assess the relationship between BF%, BMI, LLM, and TLM on VJ performance in collegiate female volleyball players. **METHODS:** After having descriptive data recorded, 12 female collegiate volleyball players had their BF%, BMI, LLM, and TLM assessed via dual-energy x-ray absorptiometry. Subjects had their reach height measured, participated in an 8 min dynamic warm-up, were then given a 4 min passive recovery (PR) period after the warmup, and then completed three familiarization jumps (ie. trials) using a VJ measurement device. After another 4 min PR period, subjects completed one series of six jumps with 30 secs of PR between each jump. Pearson Correlations were then performed between BF%, BMI, LLM, TLM, and VJ (ie. the highest of the six jumps) with significance differences determined at $p \leq 0.05$.

RESULTS: A non-significant low negative correlation existed between BF% and VJ ($r = -0.350$, $p = 0.132$), yet a non-significant low correlation occurred between BMI and VJ ($r = 0.371$, $p = 0.117$), TLM and VJ ($r = 0.265$, $p = 0.202$), and LLM and VJ ($r = 0.372$, $p = 0.117$). **CONCLUSIONS:** BF% appears to have a low negative relationship with VJ performance in collegiate female volleyball players, while TLM, BMI, and LLM have a low relationship with VJ performance. Having a lower BF% may not necessarily predict higher jumping performance in collegiate female volleyball players. Further research may be required to determine if gender, fitness level, or a different type of body fat percentage measurement technique may play a factor when considering if BMI, BF%, LLM, and TLM have a relationship with VJ performance in athletes who specialize in sports with repetitive jumping movements.

3787 Board #104 May 30 8:00 AM - 9:30 AM
Effect Of A 2-km Swim On The Cycling Power-Duration Relationship

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PURPOSE: Triathlon combines three sports (swimming, cycling, and running) into a single race and, because triathletes must cycle after the swimming, it is important to understand how cycling power may be affected by prior swimming. Therefore, the purpose of this study was to determine the effects of a 2-km swim at a self-selected race pace intensity on the cycling power-duration relationship measured during a 3-min all-out cycling test (3MT). **METHODS:** Eighteen trained triathletes (12 M, 6 F; 37.1 ± 10.6 years, $\dot{V}O_{2max}$ 54.8 ± 10.1 ml·kg⁻¹·min⁻¹) performed two 3MTs on separate days with one 3MT immediately following a 2-km swim (swim-bike; SB) and one without prior swimming (bike only; BO). The power-duration relationship was expressed as the total work done and subdivided into the end-test power (EP) and work done above EP. To assess swimming intensity, heart rate (HR) was continuously monitored during the swim and blood lactate was assessed immediately following the 2-km swim. **RESULTS:** End-swim lactate was 4.2 ± 1.8 mM and mean swimming heart rate was 147 ± 18 bpm. The 2-km swim decreased total work done during the 3MT by 6% (BO: 62.8 ± 12.7 kJ; SB: 58.9 ± 13.4 kJ; p = 0.001) though neither EP (BO: 281 ± 65 W; SB: 269 ± 68 W; p = 0.102) nor work done above EP (BO: 12.1 ± 3.8 kJ; SB: 10.5 ± 4.2 kJ; p = 0.096) differed between trials. Peak power was also assessed during the 3MT and did not differ between trials (BO: 552 ± 142 W; SB: 541 ± 147 W; p = 0.097). The change in EP was inversely correlated to the change in work above EP (r = -0.624; p = 0.006). **CONCLUSIONS:** Total work done while cycling decreases following a 2-km race pace swim, although neither EP nor work above EP changed significantly. Triathletes may want to determine race cycling power following swimming because prior swimming affects performance during the 3MT. Future studies should look at how different swim pacing strategies affect the cycling power-duration relationship.

3788 Board #105 May 30 8:00 AM - 9:30 AM
The Effect Of Team Winning Percentage On BCS Football Recruit Strength And Speed Characteristics

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Due to the volatility of NCAA Division I BCS Football coaching and support staffs, it is difficult to collect reliable, longitudinal data using consistent physical performance tests on players entering the program. The data set in the current study represents a twenty-nine - year period collected by the same Head Strength and Conditioning Coach in the same football program. **Purpose:** The purpose of the study was to compare the physical testing of the players entering the program in the early years, (1987 -1998) of the Head Football Coach's tenure, when the team studied winning percentage was (56.5%) to a later period (1999-2014) when the team's winning percentage improved to (73.3%). **Methods:** A cohort of 1094 NCAA Division I BCS level football players that played at the same institution under the same Head Football Coach and Head Strength and Conditioning Coach during the years of 1987-2104 were divided into two groups depending on the era in which they played. Group One (G1 n=581) played between 1987 and 1998 (12 year period). Group One's win/loss record was 77-59, with a (56.5% winning percentage). Group 2 (G2 n=513) played between 1999 and 2014 (16 year period) the team win/loss record was 154-56 during this period representing a (73.3% winning percentage). Data were collected when each athlete joined the team in the following areas across the entire twenty-nine-year period. Measurements were collected in Height (HT), Body Mass (BM), One Repetition Maximum (1RM) in the Bench Press (BP), the Vertical Jump (VJ), and 40-yard dash (40YD). All data were collected by the same Head Strength and Conditioning Coach. All data were analyzed using paired t-tests for each parameter tested. **Results:** G2 had significantly better initial test results in each of the following tests: BM (106.9 vs 101.7 kg.; P<0.01), BP (133.3 vs 124.9 kg.; P<0.01), VJ (30.1 vs 27.0 in.; P<0.01), and 40YD (4.8 vs 5.0 sec.; P<0.01). **Conclusions:** The results suggest that having a successful football program at the Division I BCS level may attract recruits that are bigger, stronger in the upper body, with greater lower body power and running speed. Although it may not be the only thing that affects the decision of 4 and 5-star athletes to sign with a Division I BCS football team, it appears to be a major factor.

3789 Board #106 May 30 8:00 AM - 9:30 AM
Predicting Success In NCAA Division I Football Linemen Based On Physical Performance Test Results

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A recent study looked at the relationship between performance variables and success in the NFL among players who participated in NFL combine events, which featured college seniors aspiring to make an NFL roster in different positions. To date no studies have looked at a similar relationship among college football players, who aspire to make an NCAA Division I football starting roster. **Purpose:** The purpose of the study was to identify performance variables that predict success among aspiring Division I (D-I) college football Linemen. **Methods:** Archival data were analyzed from 403 college football linemen, which focused on their best physical test results, who played during a period from 1987-2015 at a highly ranked NCAA D-I university. Players were categorized by position either as offensive linemen (OL; n=246) or defensive linemen (DL; n=157). Data were collected at various intervals throughout each athlete's playing career, and included personal best measures in included height (HT), body mass (BM), 1 repetition maximum (1RM) in the squat (SQ), bench press (BP), power clean (PC), push jerk (PJ), vertical jump (VJ), sit and reach test (SR), 40-yard dash (40YD), 10-yard dash (10YD), and 20-yard shuttle (20YS). All data were collected by the same strength coach over the 29-year period. Success was determined by three criteria: level 1 included players who never made the starting line-up in their college careers, level 2 were players that made the starting line-up but never made it to the NFL, and level 3 were player that played at least one full year in the NFL. Data were analyzed using ordinal regression analysis. **Results:** The statistically significant predictors by position were as follows: for OL, BM (P<0.01), BP (P<0.01), PC (P< 0.05) and 40YD (P<0.01); for DL, BM (P<0.05), 40YD (P< 0.05) and VJ (P< 0.05). **Conclusions:** These results suggest that it may be possible to predict the success of NCAA Division I football linemen in the positions tested, by looking at selected performance parameters. Our data suggests that for OL a large body mass combined with speed, upper body strength and explosive hip extension is important. For DL, a large body mass combined with speed and lower body power are good predictors of success.

3790 Board #107 May 30 8:00 AM - 9:30 AM
Predicting Success In NCAA Division I Football Skill-players Based On Physical Performance Test Results

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A recent study looked at the relationship between performance variables and success in the NFL among players who participated in NFL combine events. Our aim was to look at a similar relationship among college football players in skill-positions, who aspire to make an NCAA Division I football starting roster. **Purpose:** The purpose of the study was to identify performance variables that predict success among aspiring Division I (D-I) college football skill-position players. **Methods:** Archival data were analyzed from 712 college football skill-position players, which focused on their best physical test results, who played during a period from 1987-2015 at a highly ranked NCAA D-I university. Players were categorized by position either as offensive skill-position players (OSP which includes running backs, quarterbacks and wide receivers; n=311); defensive backs (DB; n=157); or linebackers, tight ends and fullbacks (LTEFB; n= 244). Data were collected at various intervals throughout an athlete's playing career, and included personal best measures in height (HT), body mass (BM), 1 repetition maximum (1RM) in the squat (SQ), bench press (BP), power clean (PC), push jerk (PJ), vertical jump (VJ), sit and reach test (SR), 40-yard dash (40YD), 10-yard dash (10YD), and 20-yard shuttle (20YS). All data were collected by the same strength coach over the 29-year period. Success was determined by three criteria: level 1 included players who never made the starting line-up in their college careers, level 2 were players that made the starting line-up but never made it to the NFL, and level 3 were player that played at least one full year in the NFL. Data were analyzed using ordinal regression analysis. **Results:** The statistically significant predictors by position were as follows: for OSP, VJ (P<0.01), PC (P<0.05), and 40YD (P<0.01); for DB, BM (P< 0.05), and 40YD (P< 0.01); and for LTEFB, BM (P<0.05), 40YD (P< 0.01), and PJ (P< 0.05). **Conclusions:** These results suggest that it may be possible to predict the success of NCAA Division I football skill-position players in the positions tested, by looking at selected performance parameters. For OSP, lower-body power and explosive hips combined with speed are important; for DB it's large body mass combined with speed; and for LTEFB, explosive hips combined with body size and speed are important.

3791 Board #108 May 30 8:00 AM - 9:30 AM
Physical Demands Of Professional Golf Caddy: A Case Study

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Few studies have investigated the physical demands of golf caddying during high-level golf competitions, yet recent fatalities have raised questions regarding demands relative to physical fitness. **PURPOSE:** The purpose of this study was to examine the physical demands of a professional golf caddy during a single round of a European Tour Tournament. **METHODS:** A professional male golf caddy with 27 years of caddying experience (age=47 yrs, HRmax=161 bpm, VO₂max=29 ml/kg/min) volunteered for this study. During the first round of 2018 Irish Open, the caddy wore a global positioning system (GPS) device and a heart rate (HR) monitor continuously throughout the round of golf for the recording of displacement and HR responses, respectively. **RESULTS:** The total time (TT) of the round was 226 min with 53.5% walking and 46.5% standing, and the total distance covered by the caddy was 8.63 km, with mean and peak traveling speeds by of 2.3 km/h and 9.7 km/h respectively. The mean HR was 110 bpm (68.3% HRmax), with a peak of 136 bpm (84.5% HRmax). The caddy spent most (62.3%) of the TT at moderate intensity (64-<77% HRmax; ACSM's guidelines, 2013), 27.5% of the TT at light intensity (50-<64% HRmax), and only 10.2% of the TT at high intensity (77-<94% HRmax). In general, uphill movements elicited a higher HR response. **CONCLUSIONS:** These results suggest that cardiovascular demands of golf caddying were primarily moderate intensity activity during the round of elite golf. However, high intensity activity was also observed when the caddy climbed hills continuously. These findings may provide useful information for justifying the need for aerobic training programs for a professional golf caddy, relative to a low current cardiovascular fitness level.

3792 Board #109 May 30 8:00 AM - 9:30 AM
Effect Of Aikido, Brazilian Jiu Jitsu, And Yoga On Functional Movement

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PURPOSE: To identify the impact of Brazilian Jiu Jitsu (BJJ), aikido and yoga on functional movement. **METHODS:** One hundred seven college students completed 22 fifty-minute sessions of one of 3 possible modes of exercise (aikido- N=31, BJJ- N=38- & yoga- N=38) over a 12-week period. Aikido is a throwing and pinning martial art that focuses primarily on standing movements. Classes include meditation, breathing exercises, stretching and strengthening exercises. In addition, students will be introduced to Aikido stances, footwork, handwork, and partner practices, while connecting the study and practice of Aikido with their path toward optimum wellness across the lifespan. BJJ is primarily a ground based martial arts system where students learn to effectively control an opponent on the ground. Yoga is a movement based exercise where postures are practiced to align, strengthen and promote flexibility in the body. Breathing techniques and meditation are also integrated, with an emphasis on simplicity, repetition, and ease of movement. The Functional Movement Screen (FMS) and Mobility, Activation, Posture, and Symmetry (MAPS) assessments were administered at baseline and following 12 weeks of exercise participation to determine functional movement. A repeated measures ANOVA was used to determine if there were differences in body weight and functional movement status (p < 0.05). **RESULTS:** No statistical differences in body mass were observed for either exercise type (Table 1). FMS and MAPS scores improved from pre to post for Aikido and FMS scores improved in yoga. No statistical differences were observed in BJJ.

Table 1: Weight, FMS, and MAPS scores pre and post (mean ± SE)

Exercise	Assessment	Body mass (kg)	FMS	MAPS
Aikido	Pre	76.5 ± 4.9	14.6 ± 0.4	47.8 ± 2.1
	Post	77.4 ± 4.6	15.5 ± 0.5 *	51.9 ± 9.3 *
BJJ	Pre	70.9 ± 2.6	15.1 ± 0.4	46.5 ± 1.7
	Post	71.2 ± 2.5	14.9 ± 0.3	48.3 ± 2.0
Yoga	Pre	64.3 ± 2.4	14.4 ± 0.4	43.1 ± 1.6
	Post	65.1 ± 2.6	15.5 ± 0.4 *	44.8 ± 1.7

* p ≤ 0.05

CONCLUSION: Twelve weeks of Aikido or yoga exercises improved functional movement. Brazilian Jiu Jitsu did not have a significant impact on functional movement.

3793 Board #110 May 30 8:00 AM - 9:30 AM
Influence Of Prior 3-min All-out Exercise On The Power-duration Relationship

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PURPOSE: To evaluate the parameters of the power-duration relationship (i.e., critical power, CP; curvature constant, W') derived from the performance of two 3-min all-out tests (3MT) separated by 60 s passive recovery. We aimed to: 1) establish the effect of a prior 3MT on CP and W'; 2) examine whether current models accurately predict inter-bout W' reconstitution; and 3) determine the physiological factors that are related to W' reconstitution. **METHODS:** We analysed 19 datasets from 17 participants (age, 22 ± 3 years; body mass 82.2 ± 13.6 kg) who took part in two separate studies, and 10 datasets have previously been published (Black et al. 2018 *Front Physiol.* 9:11). Datasets included a ramp incremental test and the performance of two 3MT separated by 60 s passive recovery. Paired samples *t*-tests were used to assess differences in: peak power; end test power (EP, indicative of CP); work performed above bout 1 end test power (W>EP1), indicative of W', and; total work done (TWD), between bouts 1 and 2. Reconstitution of W' between exercise bouts was estimated using: the intermittent CP model (W'_{INT-CP}); a differential equation (W'_{BAL-DIFF}); and; a continuous integrating equation (W'_{BAL-INT}). Differences between the actual and predicted reconstitution of W' were evaluated using paired samples *t*-tests and limits of agreement were determined via Bland-Altman analyses. **RESULTS:** EP and W>EP1 were significantly reduced in bout 2 compared to bout 1 (Bout 1: EP 273 ± 43 W, W' 17.0 ± 3.3 kJ; vs. Bout 2: EP 258 ± 39 W, W' 4.3 ± 2.8 kJ; both P<0.05). The W' reconstitution was significantly overestimated (P>0.05) and was not significantly correlated with the predictions provided by W'_{INT-CP} (16.4 ± 2.6 kJ, r = -0.42), W'_{BAL-DIFF} (9.6 ± 1.2 kJ, r = -0.22) or W'_{BAL-INT} (7.2 ± 1.7 kJ, r = -0.11). Inter-bout W' reconstitution was correlated with relative VO_{2max} (r=-0.66, P=0.002) and power output at the gas exchange threshold (r=-0.57, P=0.012). **CONCLUSIONS:** The powerduration relationship (i.e., CP and W') is adversely impacted by prior all-out exercise, and current models do not adequately describe the subsequent rate of W' recovery. These results have important implications for the design and use of mathematical models describing the energetics of exercise performance.

3794 Board #111 May 30 8:00 AM - 9:30 AM
Effects Of Exercise Modality And Structure On Physiological And Perceptual Responses To Exercise

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Moderate intensity continuous training (MICT) and high intensity interval training (HIIT) in the form of cycling and running, are effective types of exercise for improving fitness and health. However, cycling may cause higher levels of local muscle fatigue due to the greater contribution of anaerobic metabolism, while more muscle mass is active during running, resulting in higher oxygen uptake (VO₂) and energy expenditure.

PURPOSE: To examine the effects of exercise modality (cycling vs. running) and structure (continuous vs. interval exercise) at an individualized exercise intensity, on physiological and perceptual responses. **METHODS:** Seven healthy young individuals (3 M and 4 F, age = 21 ± 1 years) performed four 20 min trials in random order: continuous cycling and running (MICT) at an intensity corresponding to 80% of the individual ventilatory threshold (VT) and intermittent cycling and running (HIIT) including 10 x 1 min bouts at 120% VT, with 1 min active recovery at 60% VT. Blood lactate concentration was measured at rest, midway during exercise and 3 min after exercise, while VO₂, heart rate (HR) and rating of perceived exertion (RPE) were measured continuously. Data were analyzed using 3-way repeated measures ANOVA. **RESULTS:** VO₂max (40.0 ± 5.8 vs. 36.0 ± 5.3 ml/kg/min, p<0.001) and VT (70.8 ± 7.6 vs. 51.4 ± 4.2 %VO₂max, p<0.001), were higher in running than cycling. This resulted in energy expenditure that was highest in HIIT and MICT during running (217 ± 47 and 199 ± 61 kcal, respectively, p<0.001) and lowest in HIIT and MICT during cycling (142 ± 19 and 142 ± 17 kcal, respectively). Average HR was higher in running versus cycling (159 ± 15 and 138 ± 9 bpm, p=0.008) and in HIIT versus MICT

(155 ± 10 and 142 ± 11 bpm, $p=0.03$), but there was no 3-way interaction ($p=0.79$). In contrast, blood lactate concentration was not different between cycling and running ($p=0.44$), while RPE was slightly higher during running than cycling (2.75 ± 1.15 and 2.10 ± 1.0 units, $p=0.03$)

CONCLUSIONS: Running, especially in the form of HIIT at an individualized intensity close to VT, results in greater energy expenditure, while blood lactate and RPE are similar to cycling HIIT or MICT. Thus, HIIT running at this intensity may be used as an effective and tolerable exercise modality for healthy individuals when available time is limiting.

3795 Board #112 May 30 8:00 AM - 9:30 AM
Relationship Between Weighted Standing Long Jump And 20 Meters Sprint Performance

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The standing long jump (SLJ) is intensively used in fitness preparation as a measure of lower limb power. The SLJ has also been shown to be related to maximal sprint speed. The power deployed during a SLJ can be calculated, but it is unknown what the effect of body weight has on the relationship between sprint speed and power. **PURPOSE:** Explore the relationship between a 20m sprint and the SLJ under 5 loading conditions (0%, 1%, 3%, 10% and 15% of bodyweight). **METHODS:** Anthropometric measures ($n=13$) were taken prior to testing sessions (Age 16.0 ± 0.7 years; Height 1.80 ± 0.10 m; weight, 90.4 ± 20.0 kg). The loads used during different loading conditions were confirmed using a bodyweight scale (Omron, Canada). SLJ distances were measured from toes (starting line) to the closest heel using a jump mat (Javy Sports, Singapore). Peak velocity (PV), peak power (PP) and relative power (RP) to body weight were measured using a linear transducer (TENDO SPORTS MACHINES, London, UK) for each loading condition. The protocol consisted of 2 sprints of 20m with 3 minutes of recovery between sprints. The best of 2 completed attempts per loading condition was retained same for the best sprint time. The time at 10m and 20m were measured with photocell timing gates (Brower Timing System, Utah, USA). Linear regressions and 2-tailed Pearson correlations were calculated (SPSS Ver 26). **RESULTS:** Multiple significant ($p<0.05$) correlations were observed ($r=0.573$ to 0.892). Findings show that PV ($r=-0.640$, $r=-0.619$, $r=-0.646$) with a load of 3, 10 and 15% respectively, RP ($r=-0.635$) with a load of 3%, and SLJ distance ($r=-0.573$, $r=-0.736$) with a load of 10 and 15% respectively were significantly correlated with the 10m during sprint time. Also, PV ($r=-0.577$, $r=-0.892$) with a load of 1 and 15% respectively, PP ($r=-0.656$) with a load of 15%, RP ($r=-0.859$) with a load of 15% were significantly correlated with the 20m sprint time. **CONCLUSION:** Weighted SLJ using 15% of bodyweight is better correlated to 10m or 20m sprint times than a standard SLJ. We propose different formulas to predict peak velocity, 10m and 20m sprint time all based on SLJ distance. Peak velocity(m/s) = (Distance(m) x 2.50) - 0.88 $R^2=0.601$, $p \leq 0.01$, SEE=0.38 10m time(s) = 2.98 - (SLJ15% distance(m) x 0.55) $R^2=0.541$, $p \leq 0.01$, SEE=0.08 20m time(s) = 4.89 - (SLJ15% peak velocity(m/s) x 0.54) $R^2=0.796$, $p \leq 0.01$, SEE=0.10

3796 Board #113 May 30 8:00 AM - 9:30 AM
Acute Differences Of Passive Myofascial Release And Dynamic Stretching On Lower Body Explosive Power

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Passive myofascial release using a steel roller (PMRS), popularized as body tempering, is an emerging modality for performance enhancement and injury rehabilitation. Currently no evidence exists showing its effectiveness for performance or injury rehabilitation. **PURPOSE:** To determine the acute differences between a dynamic stretching protocol (DS), PMRS, and a combination of PMRS and DS on lower body explosive power.

METHODS: Fourteen recreationally active subjects (height = 163.5 ± 2.5 cm, weight = 68.3 ± 3.9 kg) were recruited from the University of Texas Rio Grande Valley. Once informed consent was obtained, subjects were familiarized with the testing protocol. Subjects were asked to refrain from participating in exercise for 48 hours before each testing session. Three randomized sessions consisted of a five-minute light treadmill warm up, followed by one of three different modalities; DS only, PMRS only, or a combination of PMRS and DS (COMB). DS protocol consisted of five exercises (forward leg swings, twisting reverse lunges, lateral lunges, bent knee leg swings, and plantar flexion/extension). PMRS protocol consisted of rolling the hamstrings and

quadriceps for 2.5 minutes each. Following the protocol, lower body explosive power was tested using a countermovement vertical jump and standing long jump. The best of three trials was recorded.

RESULTS: Repeated measures ANOVA found significant condition main effects for the ($p=0.01$) countermovement jump and ($p<0.001$) standing long jump. Post-hoc pairwise comparisons, using Bonferroni adjustment for multiple comparisons, found COMB (45.9 ± 3.2 cm) to have a significantly ($p<0.05$) greater vertical jump height than DS (42.1 ± 3.0 cm) alone. PMRS (179.91 ± 11.1 cm) and COMB (177.9 ± 9.9 cm) had significantly ($p<0.005$) longer standing long jumps than DS (166.1 ± 10.3 cm) alone.

CONCLUSIONS: The current data demonstrated that passive myofascial release with a steel roller or in combination with a dynamic stretching routine may increase lower body explosive power when compared to a dynamic stretching routine alone. Further research should use an athletic population to determine its efficacy in highly trained individuals.

3797 Board #114 May 30 8:00 AM - 9:30 AM
Acute Differences Of Passive Myofascial Release And Dynamic Warm Up On Lower Body Anaerobic Muscular Endurance

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Body tempering is a form of passive myofascial release used amongst athletes, physical therapists and trainers, and is a hands-on application of pressure to the muscles using a heavy steel roller. There is little to no evidence in the literature showing its effectiveness for performance or injury rehabilitation.

PURPOSE: To determine any acute differences between passive myofascial release with a steel roller (PMfR) and a dynamic warm up (DWU) on lower body anaerobic muscular endurance.

METHODS: Ten participants, 5 females (23.0 ± 1.3 years; 75.5 ± 5.2 kg; 159.8 ± 1.2 cm) and 5 males (24.6 ± 2.1 years; 82.5 ± 3.8 kg; 168.0 ± 2.8 cm), were asked to participate in this study. The first session was a familiarization session to test leg press one repetition maximum (214.3 ± 32.7 kg). The following two randomized sessions, separated by at least 72 hours, began with a five-minute cycle ergometer warm-up at 1.0kP for females and 1.5kP for males at 50RPM. Subjects performed a PMfR protocol or a lower body DWU prior to beginning a leg press specific warm-up. The PMfR protocol involved rolling the quadriceps and hamstrings for approximately two minutes each. The DWU protocol involved ten repetitions of six exercises (inchworms, hip-bridges, side-lying hip abduction, mountain climbers, lateral lunges, and squat jumps). Subjects then performed a set of ten repetitions at 25% and 50% and six repetitions at 75%. After a three-minute rest period, subjects performed repetitions to failure at 85%. One-way Analysis of Variance (ANOVA) was used to determine significant differences in repetitions.

RESULTS: Repetitions were significantly ($p<0.002$) different between protocols. Subjects performed more repetitions following the PMfR (25.4 ± 7.0 repetitions) condition than the DWU condition (16.8 ± 4.5 repetitions).

CONCLUSIONS: The current pilot data demonstrates that PMfR may be an effective warm up modality in combination with a specific warm up to assist in lower body anaerobic endurance. Precaution must be taken with the current data, as some subjects had as many 40 repetitions at 85%, which is not congruent with that percent 1RM. The current DWU protocol seems to have possibly decreased performance due to fatigue. Further studies should use a multi-set approach with a resistance trained population approach to better determine its efficacy.

3798 Board #115 May 30 8:00 AM - 9:30 AM
Metabolic And Perceived Exertion Outcomes During Maximal Runs At Ends Of The Day

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Training programs may be individualized to the particular needs and preferences of the exerciser. Controlling training and exercise characteristics, such as morning versus night, may alter exercise-related outcomes. **PURPOSE:** The purpose of this project was to investigate metabolic and perceived exertion outcomes during maximal runs at ends of the day (early morning and late-night) following a standardized, pre-run meal. **METHODS:** Thirteen participants (females: 8, males: 5, age: 20.7 ± 1.4 yrs., BMI: 24.9 ± 3.0 kg/m²) volunteered to complete two, randomized maximal runs, separated by 24-72 hours (condition 1: 06:00-09:00 and condition 2: 21:00-24:00). The starting

treadmill speed (perceived effort of 12-13 on the Borg 6-20 RPE) for each condition was determined during a familiarization trial. Pre-run nutrition was standardized with use of a yogurt-based smoothie drink prepared based on each individual's body mass and activity level (approximately one-quarter of their total daily calories as 80% carbohydrate, 3% fat, and 17% protein). Drinks were ingested 2 hours prior to the testing. During the maximal runs, speed was maintained at the previously described intensity, and grade was increased 2% every 2 minutes until volitional fatigue. Metabolic data were gathered via a metabolic cart using a 15-breath moving average. Paired sample *t*-tests were used to compare appropriate data with significance accepted at $p < .05$. Total fat oxidation during the tests was derived from VO_2 and RER. **RESULTS:** The morning and night runs lasted 10.2 ± 2.3 and 9.9 ± 2.6 minutes, respectively. No statistical difference was found between morning and night runs for relative $\text{VO}_{2\text{max}}$ (47.0 ± 7.0 vs. 47.3 ± 8.0 ml/kg/min, $p = .721$), total fat oxidation (24.8 ± 16.7 vs. 27.7 ± 22.3 kcal, $p = .597$), or maximal RPE (18.9 ± 1.1 vs. 18.8 ± 1.5 , $p = .794$). **CONCLUSIONS:** Relative $\text{VO}_{2\text{max}}$, total fat oxidation, and RPE did not differ between maximal runs performed early morning and late-night. Running maximally at ends of the day may not elicit any differences in these variables among a group of younger, recreationally active adults provided a standard, pre-run meal.

3799 Board #116 May 30 8:00 AM - 9:30 AM
Effects Of Pilates Exercise On Core Stability And Joint Flexibility In College Athletes

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Although Pilates improves flexibility, balance, and posture of symptomatic elderly or sedentary middle-aged adults, there has been little focus on studying the effect of Pilates in young athletes. **PURPOSE:** This study aimed to examine whether Pilates exercise improve core stability and joint flexibility in college athletes. **METHODS:** Fifteen healthy college students (control group) and 15 female college athletes (athlete group) participated in this study. Each student engaged in a 30-min Pilates session with a licensed instructor once a week over 12 weeks. The Functional Movement Screen (FMS) was used to evaluate core stability and joint flexibility before and after this intervention. The FMS focuses on seven fundamental movements: shoulder mobility (SM), hurdle step (HS), in-line lunge (ILL), active straight leg raise, trunk stability push up, rotary stability (RS), and deep squat. A repeated-measures ANOVA was performed to compare the groups (control group vs. athlete group). **RESULTS:** Although there were no significant between-group differences, the results indicated significant main effect for the Pilates intervention ($F = 62.5$, $p < 0.001$, $\eta^2 = 0.82$), Pilates intervention \times FMS interaction ($F = 35.6$, $p < 0.001$, $\eta^2 = 0.72$), and FMS ($F = 2519.6$, $p < 0.001$, $\eta^2 = 0.99$). After 12-week intervention, SM (before: 2.37 ± 0.2 vs. after: 2.73 ± 0.1 , $p < 0.05$), HS (before: 2.30 ± 0.1 vs. after: 2.70 ± 0.1 , $p < 0.01$), ILL (before: 2.10 ± 0.1 vs. after: 2.30 ± 0.1 , $p < 0.01$), RS (before: 2.13 ± 0.1 vs. after: 2.63 ± 0.1 , $p < 0.001$), and total score (before: 16.17 ± 0.4 vs. after: 18.13 ± 0.3 , $p < 0.001$) had significantly improved. **CONCLUSION:** Pilates exercise is effective for improving FMS scores, strengthening core stability, and flexibility for healthy controls and college athletes. Supported by JSPS KAKENHI Grant Number JP18K10973.

3800 Board #117 May 30 8:00 AM - 9:30 AM
Effect Of Eccentric Overload Training On Change Of Direction Performance: A Meta-analysis

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Effect Of Eccentric Overload Training on Change of Direction Performance: A Meta-Analysis

PURPOSE: This study systematically reviewed and quantified the scientific evidence regarding the effectiveness of EOT on COD performance. **METHODS:** Keyword and reference search of EOT interventions was conducted in eight bibliographic databases (i.e., SPORTDiscus, PubMed, Web of Science, Academic Search Complete, Cochrane Library, Scopus, CINAHL, and Google Scholar) for studies published until October 1, 2019. Meta-analysis was conducted to estimate the standardized pooled effect of EOT on COD performance. **RESULTS:** Twelve studies, including nine randomized controlled trials, two pre-post studies, and one randomized crossover trial, met the eligibility criteria and were included in the review. Time of overall COD task completion among the EOT group was 0.34 standard deviations (95% confidence interval [CI] = -0.49, -0.19; $I^2 = 98.8\%$) shorter than that in the control group (Table 1). Among the interventions employing the T-test, time of task completion among the EOT group was 0.81 standard deviations (95% CI = -1.51, -0.11; $I^2 = 98.7\%$) shorter than that in the control group. Among the interventions employing the 180° COD task, time of task completion among the EOT group was 0.24 standard deviations (95% CI =

-0.53, -0.05; $I^2 = 97.5\%$) shorter than that in the control group. There was no evidence of publication bias based on the Egger's test and Begg's test. **CONCLUSIONS:** EOT was found effective in improving COD performance. Future studies should adopt a randomized experimental design, recruit large and representative samples from professional team sports, and examine the effect of EOT on various measures of COD performance among population subgroups.

Table 1 Results from meta-analysis and publication bias tests

Measure	First author, year	P index	Pooled effect size (95% CI)	Model	Publication bias test	
					P-value for Egger's test	P-value for Begg's test
Overall COD task	Coratella, 2019; Sanchez-Sanchez, 2019; Chaabene, 2019; Siddle, 2019; Coratella, 2018; Maroto-Izquierdo, 2017; Bourgeois, 2017; Gonzalo-Skok, 2017; Tous-Fajardo, 2016; de Hoyo, 2015; Lockie, 2014	98.8%	-0.34 (-0.49, -0.19)	Random-effect	0.15	0.48
180° COD task	Coratella, 2019; Siddle, 2019; Bourgeois, 2017; Gonzalo-Skok, 2017	97.5%	-0.24 (-0.53, -0.05)	Random-effect	0.26	1.00
T-test task	Coratella, 2019; Chaabene, 2019; Coratella, 2018; Maroto-Izquierdo, 2017; Lockie, 2014	98.7%	-0.81 (-1.51, -0.11)	Random-effect	0.55	1.00

3801 Board #118 May 30 8:00 AM - 9:30 AM
Differences In Heart Rate And Pedal Frequency On A Cycle Ergometer With And Without Music

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Research has demonstrated the effects of music on exercise performance such as heart rate, cadence, and rate of perceived exertion. Specifically, music tempo is considered a significant factor influencing physiologic changes and is measured in beats per minute (bpm). The preference for music with fast tempos may be due to a stimulus that increases physiological arousal. However, results have differed depending on population, exercise modality, and experimental protocol. **PURPOSE** The purpose of this study was to determine the differences in heart rate and pedal frequency on a cycle ergometer with and without music. **METHODS** Participants ($N = 20$) were collegiate level students who were recreationally active and met physical activity standards. Each participant completed two 20 minute cycle sessions, one while listening to a predetermined music playlist and the second without any music. The predetermined music playlist included 4 songs at tempos of 77 bpm, 132 bpm, 82 bpm, and 126 bpm. Participants pedaled at a self-selected frequency. Heart rate and pedal frequency were recorded for each minute of exercise. A paired T-Test was used to determine statistical significance between variables ($p < 0.05$). Analysis of Variance was also used to determine statistical significance between heart rate and music tempo ($p < 0.05$). **RESULTS** Results from this study show average heart rate with music at 140 ± 15.7 bpm and without music 130 ± 15.7 bpm. Pedal frequency averaged 62.7 ± 10.7 and 57.8 ± 7.5 revolutions with music and without respectively. There was a statistically significant difference between heart rate ($p < 0.01$) and pedal frequency ($p = 0.01$) from music to no music. A statistically significant difference in heart rate was observed between the music tempo groups, $F = 24.51$, $p = 0.001$, with a large effect size, $\eta^2 = 0.304$. Bonferroni post-hoc tests indicated the heart rates for 77 bpm (126 ± 19), 132 bpm (140 ± 16), and 82 bpm (145 ± 17) was significantly higher than each other ($p < 0.01$). **CONCLUSION** The results indicate that music increased heart rate and pedal frequency significantly compared to no music. Additionally, there was a significant difference in music tempo on heart rate. The results from this study support the notion that music does increase physiologic changes during exercise.

3802 Board #119 May 30 8:00 AM - 9:30 AM
Relative Contributions Of Strength, Anthropometric, And Demographic Characteristics To Rock Climbing Performance
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PURPOSE: The purpose of the present study was to determine the relative contributions of handgrip and individual finger strength, body size, climbing experience, and training habits for the prediction of climbing performance in a bouldering competition.

METHODS: Sixty-seven climbers (males: $n = 46$, females: $n = 21$; mean age \pm SD = 21.1 ± 4.0 yrs; body mass = 69.5 ± 9.8 kg; height = 173.5 ± 8.3 cm; climbing experience = 2.7 ± 2.6 yrs; climbing frequency = 3.0 ± 1.2 sessions-wk⁻¹) volunteered for this study. Data collection occurred immediately before an indoor bouldering competition and involved the assessment of handgrip and individual finger maximal force production using an electronic handheld dynamometer. Individual finger strength was defined as the maximal force generated using a tip-to-tip pinch between each finger and the thumb. All measures of strength were normalized to body mass (kg). Subjects also completed a questionnaire to determine climbing experience and training habits (i.e. climbing frequency). The bouldering competition consisted of 70 routes graded V0 (easiest) - V8 (most difficult) with higher point values awarded for completing more difficult routes. Stepwise multiple regression analyses were used to examine the relative contributions of handgrip and individual finger strengths, body mass, height, climbing experience, and climbing frequency to the prediction of performance scores in the competition.

RESULTS: The results indicated there were significant [$F(3, 63)=12.499, p < 0.001$] predictors of climbing performance in our model. Specifically, ring finger pinch strength, climbing experience, and climbing frequency significantly ($p < 0.05$) contributed to the model ($R^2 = 0.373$), whereas body mass, height, full handgrip strength as well as index, middle, and little finger pinch strengths did not. The β -weights showed that ring finger pinch strength ($\beta = 0.430$) was the most significant contributor followed by climbing experience ($\beta = 0.331$) and climbing frequency ($\beta = 0.244$).

CONCLUSIONS: These findings illustrated the importance of ring finger pinch strength on climbing performance in a bouldering competition. Our results also suggested that increasing climbing experience and frequency of training may contribute to greater ring finger pinch strength and overall climbing performance.

3803 Board #120 May 30 8:00 AM - 9:30 AM
Gender Differences In Time-trial Based Predictions Of Vo2max And Training Paces For Collegiate Track Athletes
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 (No relevant relationships reported)

PURPOSE: Compare the accuracy of predicted $\dot{V}O_{2max}$, interval pace, and threshold pace from Jack Daniels' VDOT Running Calculator between male and female NCAA Division 1 track athletes. **METHODS:** Male ($n = 10$) and female ($n = 8$) athletes completed an indoor 5k time-trial used to obtain predicted data from the VDOT calculator. Predicted variables were compared to laboratory tested $\dot{V}O_{2max}$, $\dot{V}O_{2max}$ pace, and lactate threshold pace. Follow-up analyses were conducted to compare predicted-actual difference scores between groups. **RESULTS:** $\dot{V}O_{2max}$ was underestimated by the VDOT calculator in males ($t(9) = -5.90, p < .001, d = .65$) but not females ($t(7) = -1.44, p = .19, d = .31$). No difference was found between predicted and laboratory tested interval pace for males ($t(9) = 1.90, p = .09, d = .18$) or females ($t(7) = 1.44, p = .19, d = .45$). Predicted and laboratory tested threshold pace were also similar for men ($t(9) = -0.41, p = .68, d = .07$) and women ($t(5) = 1.39, p = .23, d = .91$). Follow up analyses indicated that the difference between VDOT and $\dot{V}O_{2max}$ was significantly greater for male athletes ($p = .025, d = .33$). However, between-groups differences scores were similar for interval ($p = .94, d = .01$) and threshold paces ($p = .15, d = .28$). **CONCLUSION:** The VDOT Calculator may underestimate $\dot{V}O_{2max}$ for male track athletes. However, practitioners can be confident in the accuracy of interval and threshold training paces provided by the VDOT running calculator irrespective of an athlete's sex.

3804 Board #121 May 30 8:00 AM - 9:30 AM
Assessing Performance Variability Across Two Major National USA Powerlifting Competitions
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 (No relevant relationships reported)

National level USA Powerlifting (USAPL) raw powerlifters typically compete at two major competitions (COMP): Raw Nationals (COMP1) and The Arnold Classic (COMP2). Small performance changes may have a large impact on a powerlifter's national level eligibility. Further, typical variation in powerlifting COMP performance is needed to determine meaningful changes in response to training and gauge athlete's progression. **PURPOSE:** To determine the typical COMP performance variation amongst raw powerlifters and assess differences between sexes. **METHODS:** Data was gathered from 2013-2019 on USAPL powerlifters competing at COMP1 and COMP2 successively (<8mon apart). After removing outliers ($\pm 3IQR$), 140 males and 123 females were included in the analysis. Paired sample t-tests, coefficient of variation (CV) and smallest worthwhile change (SWC) were calculated to assess differences between COMP1 to COMP2 for back squat (BS), bench press (BP), deadlift (DL), powerlifting total (PT), and Wilks Score (WS) for each sex. Percentage change for absolute difference in each variable from COMP1 to COMP2 was compared between sexes using an independent samples t-test with criterion alpha <0.05. **RESULTS:** Typical variation in COMP performance was small and similar for each sex: BS (CV: 2.8%; SWC: 0.84%), BP (3.1%; 0.93%), DL (3.1%; 0.92%), PT (2.1%; 0.62%) and WS (2.1%; 0.64%). There were significant differences between COMP1 and COMP2 for each variable within each sex ($p < 0.05$); however, the magnitude of difference was small (percent change <4.5% for all variables). There was a significant difference in relative performance change for females compared to males on BP (4.4% vs 3.1%, $p = 0.001$), and a near significant difference for PT (2.6% vs 2.2%, $p = 0.070$). Relative changes were similar between sexes for BS (3.3% vs 2.9%), DL (3.3% vs 3.4%), and WS (2.5% vs 2.2%). **CONCLUSIONS:** Consistent performances were expected considering the caliber of powerlifters. Importantly, the data from this study indicate that changes greater than ~1% on COMP lifts are meaningful in raw powerlifters. However, it is apparent for female powerlifters, the limiting factor for maintaining or improving national level performance may be BP. Thus, female powerlifters and their coaches may consider emphasizing BP training to improve consistency in COMP.

3805 Board #122 May 30 8:00 AM - 9:30 AM
The Role Of The Coach In Determining Success At A National Powerlifting Competition
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Purpose: To compare rates of success in coach- versus self-supervised performance at the USA Powerlifting Collegiate National Championships from 2016-2019.

Methods: Using a repeated measures ANOVA design with specific post-hoc analysis, 88 members of the powerlifting team at a United States Service Academy had individual performances tracked during the annual USA Powerlifting Collegiate National Championships from 2016-2019. Performance metrics included: number of successful and non-successful attempts, total weight lifted, and Wilks total (a relative strength metric used in powerlifting).

Results: A total of 88 competitors were tracked over the duration of this investigation. Successful attempts (7.9 ± 1.2 vs. 5.4 ± 1.2), total weight lifted (530.2 ± 146.9 kg vs. 416.8 ± 235.0 kg), and Wilks total (408.9 ± 86.0 vs. 352.3 ± 186.7) were significantly greater in the coach-supervised versus self-supervised population. Lifters following a coach-supervised versus self-supervised competition plan performed significantly better across all performance metrics ($p < 0.001$).

Conclusion: The coach plays a significant role in determining performance outcomes during powerlifting competition. An abundance of research exists on the importance of a coach in developing long-term, periodized strength training for improving strength outcomes, but minimal research exists on the role of the coach in predicting success in individual competitions. These findings support the notion that supervisory mentorship is integral to the success of athletes during both training and competition.

3806 Board #123 May 30 8:00 AM - 9:30 AM

The Impact Of Sleep Deprivation On Agility Performance And Pattern RecallCarolyn Albright, Laura Lupin. *Chestnut Hill College, Philadelphia, PA.*

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(No relevant relationships reported)

PURPOSE: With sleep having the potential to affect both memory and physical performance associated with learning and performing sport related tasks, this study sought to determine the effects of sleep deprivation and college athletes on their ability to remember and perform agility drills similar to that which would be performed in practice or game. **METHODS:** Ten physically active college athletes (21-26 years) participated in the study (5 males and 5 females). Participants were tested under two conditions, 2-4 hours and 7-9 hours of overnight night sleep. The night before each test day, participants were instructed in detail about a four-part agility pattern they had to recall and perform the following morning. The agility drill included: forward sprinting, back pedaling, in and out box stepping drills, Icky Shuffle, and a vertical jump. For each testing day participants performed a warm-up and then the agility drill three times. They rated their perceived exertion (RPE) for each trial, and the best time for each drill was used for analysis. **RESULTS:** Completion speed was not significantly different after 2-4 hours sleep (26.9 ± 2.0 sec) compared to 7-9 hours sleep (26.1 ± 2.6 sec). RPE was also not significantly different for 2-4 hours sleep (8.4 ± 2.2) compared to 7-9 hours sleep (7.9 ± 1.3). There was also no gender difference for speed or RPE. However, participants who were instructed to undergo 2-4 hours of sleep for their first test took significantly longer to perform the drill for the first testing day compared to those who received 7-9 hours of sleep for their first testing day, taking on average 2.2 ± 1.7 sec longer. **CONCLUSION:** Although no difference was seen overall in agility performance times when comparing prior sleep, there was a difference in performance times when comparing the ordering of learning a new task. Learning a new agility pattern when sleep deprived first resulted in slower agility times than when seeing the new pattern for the first time with a full night sleep. Physically active college students are at risk of decreased performance times for drills they are seeing for the first time on minimum sleep. Coaches often stress getting good sleep prior to competition but it may be important for adequate sleep prior to practice sessions where new play routes are being taught.

3807 Board #124 May 30 8:00 AM - 9:30 AM

The Acute Effects Of External Pneumatic Compression On Anaerobic Performance And Blood Lactate ConcentrationGovindasamy Balasekaran, FACSM, Nurul Shafiqah Binte Mohamed Saiful. *Nanyang Technological University, Singapore, Singapore.*

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The use of External Pneumatic Compression (EPC) among athletes as a recovery modality is rising. However the evidence supporting efficacy of EPC on recovery and performance is limited thus it warrants for further investigation. **PURPOSE:** To determine the acute effects of EPC on anaerobic performance and blood lactate (BLA) concentration following a fatigue protocol. **METHODS:** In a randomized, counterbalanced cross-over study design, 10 healthy university male athletes, aged (25.2 ± 1.1 yrs), were recruited to complete 3 experimental sessions with two 30-second trials of maximum effort Wingate Anaerobic Test (WAnT)(T1 & T2) on a cycle ergometer with a constant load of .075 kg per kilogram of body mass, separated by a 20-min recovery period where either passive recovery (PR), active recovery (AR) or EPC treatment were administered. BLA levels, heart rate and ratings of perceived exertion were recorded. Power output in Watts (PO), fatigue index in %(FI) and total work in Joules(TW) were examined. **RESULTS:** Mean power output (MP) in Watts following AR (T1: 634.90 ± 81.18 , T2: 638.06 ± 99.98)($p = .022$) and EPC (T1: 642.55 ± 78.38 , T2: 637.85 ± 95.62)($p = .020$) were significantly higher than PR (T1: 623.21 ± 91.08 , T2: 620.38 ± 103.03). However, MP between AR and EPC treatment were not significant ($p = .567$). Similarly, TW were significantly higher following AR (T1: 19.09 ± 2.54 , T2: 19.02 ± 2.97)($p = .028$) and EPC treatment (T1: 19.14 ± 2.33 , T2: 19.04 ± 2.83)($p = .013$) than PR (T1: 18.58 ± 2.73 , T2: 18.47 ± 3.03) but mean differences were minimal between AR and EPC treatment. PO (PR T1: 954.90 ± 206.78 , T2: 890 ± 178.42 , AR T1: 1001.60 ± 187.16 , T2: 928.50 ± 172.46 , EPC T1: 970 ± 135.71 , EPC T2: 943.00 ± 152.58)($p = .481$) and FI (PR T1: 62.23 ± 17.05 , T2: 57.40 ± 15.98 , ER T1: 64.80 ± 17.41 , T2: 59.42 ± 17.78 , EPC T1: 63.40 ± 18.03 , T2: 56.86 ± 15.15)($p = .780$) were not significant. BLA concentration decreased significantly from peak BLA at 5 minute post-WAnT to 20 minutes post-WAnT in all trials (PR: $p = .000$, AR: $p = .000$, EPC: $p = .000$). However the mean difference in BLA (mmol·L⁻¹) levels at 20 minutes post-WAnT and 5 minutes post-WAnT were 2.6 in PR, 4.0 in AR and 2.7 in EPC. **CONCLUSIONS:** Results indicated performance was better maintained with the use of EPC and AR. Therefore, the use of EPC may be a feasible alternative method when static recovery is desired.

3808 Board #125 May 30 8:00 AM - 9:30 AM

Analysis Of The Water Polo Shots In Positions 1 And 2 In The Simple Temporal Numeric Inequality With Possession During The 15th Fina World Championship In Barcelona 2013Yurema Sabio Lago¹, Myriam Guerra-Balic², Josep Solà², Josep Cabedo-Santomà². ¹*Tecnocampus, Mataro, Spain.* ²*FPCEE-Blanquerna, Barcelona, Spain.*

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(No relevant relationships reported)

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Introduction: The Simple Temporal Numeric Inequality With Possession (FJs) is defined as a concrete micro-situation of the Water Polo, which after the amount of players (+1) in favor of the team that owns the ball. Left-handed (LH) players may have an important role.

Aim: First, to know if the LH players were more effective in the goal categories and getting positive actions in position 1 and 2 than the right-handed (RH) in the FJs; second, to know if the shots in position 1 and 2 were less effective than the rest of the positions in the goal categories.

Methods: An observational, multidimensional, nomothetic and punctual study was developed, following Anguera (2003). The sample consisted on all the throws during 24 games, including male and female teams (n=127) corresponding to the 15th FINA World Championship using an *ad hoc* instrument for observation through SportCode software. Games were recorded with a video camera (SONY, FDRAXP33B.CEN). Descriptive of all variables and Chi-square test were obtained to compare throws.

Results: The LH players performed from position 1 more total shots compared to the RH players. Adding the categories related to the goal, the LH got 30.8% and the RH 23.1%. When adding the categories related to positive actions (exclusion, penalty, rebound and corner), the LH got 42.3% while the RH 25%. From position 2 the RH players make more shots compared to LH players (50 vs 25). Adding the categories related to the goal, the LH got 10.7% and the RH 26.7%. If we add the categories related to positive actions, the LH got 16% while the RH 38.7%. The Specific Position (PE) and Player's Laterality (LJ) of the shots from position 1 and 2 that finish in goal in FJs, there were significant differences ($p < .05$).

Conclusions: The LH players were more effective in the goal categories and getting positive actions in position 1 than the RH, but not in position 2. Only the shots in position 1 were less effective than the rest of the positions in the goal categories.

3809 Board #126 May 30 8:00 AM - 9:30 AM

Physiologic Evaluation Of A Collegiate Mascot During Football Games And Related ActivitiesAlyssa J. Guadagni, Emily N. Werner, Ashley N. Triplett, Sue A. Petrisin, James M. Pivarnik, FACSM. *Michigan State University, East Lansing, MI.* (Sponsor: James M. Pivarnik, FACSM)

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PURPOSE: Our purpose was to collect collegiate mascot pilot data to determine physiological HR responses during two football games and pregame-related activities.

METHODS: A physiological tracking system was used to evaluate HR and movement from individuals (N=7 [1 female]; avg ht=1.82m, wt=75.6kg) who performed mascot activities "in suit" (weighing ~14kg) before and during two NCAA Division I University football games. Both games were played at night under moderate ambient conditions (temp=22-14 °C, rh=64%, wind speed=4 mph). Prior to the study, individuals' HRmax values were determined during graded treadmill tests performed to volitional exhaustion. Variables analyzed during the games were time in suit, time in pre-established HR zones [including HRzone1 (50-59%HRmax), HRzone2 (60-69%HRmax), HRzone3 (70-79%HRmax), HRzone4 (80-90%HRmax), and HRzone5 (>90%HRmax)], and distance covered per minute. Differences in time per HRzone were evaluated using 95% confidence intervals. Differences in average HR between pre-game and game conditions were evaluated via a t-test.

RESULTS: Sessions in suit lasted 43.5 ± 10.5 min, and distance traveled was 47 ± 22 m/min. HR averaged $82 \pm 8\%$ of HRmax, with over half the time spent in HRzone4 ($34 \pm 20\%$; $p < 0.05$) and HRzone5 ($23 \pm 27\%$), with only $2 \pm 2\%$ spent in HRzone1. HR values were significantly lower during pregame ($74 \pm 4\%$ HRmax) compared to game ($85 \pm 6\%$ HRmax) activities ($p < 0.001$).

CONCLUSIONS: The mascot suit environment posed significant physiological strain on the wearer, despite relatively little activity or movement performed per session.

3810 Board #127 May 30 8:00 AM - 9:30 AM

Profiling Of High-intensity Events In Elite Chinese Female Field Hockey Matches

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Physical performance in field hockey (here on in referred to as hockey) is determined by many different factors. Recently, the development of small wearable inertial measurement units (IMUs) has provided new possibilities to profile the physical demands in different team sports, especially in the high intensity events (HIEs) aspect of competition and training.

PURPOSE: The aim of this study was to profile the position-specific HIEs in elite female hockey matches with the use of IMUs.

METHODS: Sixteen matches analyzing 22 elite Chinese female hockey players (height: 168.5±4.6 cm, body mass: 62.4±5.3 kg) were record by using IMUs (OptimEye S5, Catapult Sports, Australia) during the 2016-2017 Chinese national competition season. Players were categorized in three different playing positions: strikers, midfielders and defenders. Mean speed (MS), PlayerLoad™ (PL), accelerations (Acc), decelerations (Dec), changes of direction (CoD) and the sum of later three, HIEs, were extracted from raw-data files using the manufacturer's software (OpenField, version 1.14.0). All Acc, Dec, CoD and HIEs >2.5 m/s² were analyzed. Data were reported as mean±SD. Multiple paired t-test was used to compare data between different positions. Significance was set at P≤0.05.

RESULTS: The mean on-field time for individual players was 48.8±15.8 min and the mean PL and MS when combining all playing positions were 9.4±1.3 PL/min and 108.6±12.3 m/min respectively. The mean HIEs, Acc, Dec and CoD combined for all players were 1.1±0.3 HIEs/min, 0.2±0.1 Acc/min, 0.2±0.1 Dec/min and 0.7±0.2 CoD/min respectively. Defenders showed significantly lower PL and MS (8.7±1.2 PL/min, 100.7±11.9 m/min) than strikers (9.7±1.4 PL/min, 114.2±10.6 m/min) and midfielders (9.8±1.0 PL/min, 111.9±9.2 m/min) (P<0.01).

CONCLUSIONS: The mean playing time reported in the present study was similar to data from international hockey matches (48.8 ± 15.8 vs. 44.7±11.0 min), yet PL and MS from the present study was lower than that of elite international players (9.4±1.3 vs. 11.2±2.1 PL/min; 108.6±12.3 vs. 113.3±13.5 m/min). Competition level (national vs. international) is the most likely reason for these differences. Further research should focus on the HIEs' performance of elite international level hockey players. Supported by CSC (No. 2018083110192).

3811 Board #128 May 30 8:00 AM - 9:30 AM

Relationship Between The Attractiveness And Athletic Achievement In Track And Field Athletes

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previous studies have reported that males with superior attractiveness tended to have superior athletic achievement. **PURPOSE:** To examine the relationship between attractiveness and athletic achievement in male and female track and field athletes.

METHODS: Ninety-three athletes (42 males and 51 females, aged 19.8 ± 1.2 years) participated in the present study. Using a questionnaire, subjects answered questions about specialized events, athletic achievements, and personal bests, among others. Male subjects included 13 national tournament prize winners, 14 national tournament participants, and 15 others. Female subjects included 21 international tournament prize winners, one national tournament prize winner, 15 national tournament participants, and 15 others. Attractiveness was evaluated using the Visual Analogue Scale (VAS) by evaluators who were of the opposite sex and did not know the subjects. Two-hundred and forty-one evaluators (124 males and 117 females, aged 20.81 ± 1.5 years) evaluated the attractiveness of the subjects. Each subject was evaluated by 32-37 evaluators. **RESULTS:** Average attractiveness was 3.78 ± 0.6 (range, 2.7-5.2) and 3.68 ± 0.8 (range, 1.5-5.9) in males and females, respectively. In female subjects, athletes with superior attractiveness tended to have superior athletic achievements. There was a negative correlation between attractiveness and personal best times in the 100-meter (n=13, r=-0.52, p=0.069) and the 100-meter hurdle events (n=9, r=-0.72, p=0.028) in female athletes. However, there was no relationship between attractiveness and personal best time of the 100-meter and the 110-meter hurdle events in male athletes.

CONCLUSIONS: Female athletes with superior attractiveness tended to have superior athletic achievement. In addition, there is a negative correlation between attractiveness and personal best performance in female sprinter events. However, there was no relationship between attractiveness and personal best performance in male sprinter events.

3812 Board #129 May 30 8:00 AM - 9:30 AM

Effects Of Different Warm-up Protocols On Throwing Performance

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Power is essential in throwing performance. Past research indicated that high-intensity dynamic warm-up enhance the subsequent explosive performance, which is referred as post-activation potentiation (PAP). At present, there is no research explored the effect of maximal isometric contraction as warm-up on throwing performance.

PURPOSE: This study aimed to investigate the impact of maximum isometric squat (MIS) and counter movement jump (CMJ) as warm-up exercises on subsequent throwing performance. **METHODS:** 16 healthy experienced baseball or softball players (30.5±5.98 years old) performed two warm-up protocols (MIS and CMJ) in counter-balanced order. Throwing performance was examined at 15 minutes before and 4 minutes after warm-up. Distance of underhand medicine ball throw (MBT) and baseball throwing velocity (BTV) were used to evaluate throwing performance.

RESULTS: The results revealed that after performing two types of warm-up exercises, the average and best distance of MBT improved significantly (P<0.05). The average and best speed of BTV increased significantly (P<0.05) after warm-ups. Performance of MBT after MIS (average: +5.35%; best: +6.05%) showed greater improvement compare to warm-up with CMJ (+4.82%; +4.47%) (P<0.05). **CONCLUSION:** Both MIS and CMJ as warm-up exercise are beneficial in subsequent throwing performance. MIS showed better effect than CMJ for underhand medicine ball throwing distance.

3813 Board #130 May 30 8:00 AM - 9:30 AM

Competing In A Big City: Effects Of Air Pollution On Performance And Physiological Parameters During A 50-km Cycling Time-trial

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PURPOSE: Air pollution is one of the main health risks caused by the environment. Exposure to particulate matter smaller than 2.5 microns in diameter (PM_{2.5}) leads to an increase in risk for cardiovascular and respiratory disease. Although many major sporting events are held in large, polluted cities (e.g. the Beijing 2008 and Rio 2016 Olympic Games), the effects of air pollution on performance and physiological parameters during endurance exercise remain unclear. Most laboratory research uses simulated air pollution which is not representative of actual "real-world" pollution exposure. Therefore, the aim of the current study was to investigate the effect of atmospheric air pollution on performance and physiological parameters during endurance exercise using "real-world" air pollution.

METHODS: Ten trained cyclists completed, in a counterbalanced order, two simulated 50-km cycling time-trials (50km-TT). These sessions were carried out in a modified shipping container capable of providing either a clean (filtered air) or polluted (ambient São Paulo air) environment. This design ensured that the participants were blinded to the polluted [POL] and filtered air [FA] conditions. Venous blood gas analysis was performed on 1mL samples taken from the forearm.

RESULTS: There were no differences in the performance in 50km-TT (FA= 90.4 ±5.8 vs. POL= 90.3±4.3 minutes, p=0.93). The power output was not different (FA= 200.2±30.4 vs. POL= 199.3±24 Watts, p=0.90). However, the inhaled PM_{2.5} was increased in polluted ambient (FA= 66.5±29 vs. POL= 222±62, p= <0.0001). In addition, the venous blood pO₂ and pCO₂ were not different between the two conditions.

CONCLUSIONS: Our findings showed that "real-world" air pollution exposure during a 50-km simulated TT exposure did not affect performance and physiological parameters.

- 3814** Board #131 May 30 8:00 AM - 9:30 AM
Practice Within 24 Hours Of Competitive Play Compromises Performance In Collegiate Basketball
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The NCAA regulates collegiate basketball practice schedules, imposing limitations on daily and weekly practice duration. Coaches seldom schedule fewer hours than permitted and commonly maximize participation within those limitations. There is reason to wonder: does maximum engagement correspond to optimal preparation? **PURPOSE:** To test the effect of pre-game practice on in-game performance in women's collegiate basketball. **METHODS:** We analyzed 15 female basketball players on an NCAA D1 team throughout the 2018-2019 season. Heart rate monitors and GPS trackers were worn during all games (n=33) and practices. Data collected were maximum heart rate (HR_{max}) and total distance moved in games and practices, whether the team won, win-loss margin, and individual athlete rebounds and points scored per game. Paired-samples t-tests, linear regressions, and logistic regressions tested the effect of pre-game practice on in-game performance. **RESULTS:** The analyzed team won 60.6% of games. When practice was performed within 24hr of a game, winning percentage was 33.3% compared to 70.8% in games without prior practice ($p<0.001$). Holding constant the opponent's rank ($p<0.001$) and whether it was a home game ($p<0.001$), practicing within 24hr of competition reduced the odds of winning by 98.2% ($p<0.001$; 95% CI of OR: 0.007 to 0.049) and reduced the win-loss margin by 4.7 points ($p=0.001$; 95% CI: -7.398 to -1.962). During games, players ran $6,735.1 \pm 2,268.4$ meters and had a HR_{max} of 98.6 ± 9.3 . There was no difference in HR_{max} during practices that did and did not occur within 24hr of a game ($p=0.598$). During games, HR_{max} was elevated 2.4 bpm if practice occurred in the previous 24hr ($p=0.045$; 95% CI: -4.6 to -0.1) despite no difference in on-court movement ($p=0.243$). Holding confounding variables constant, practicing within 24hr prior predicted trends for each player to score 1.8 fewer points ($p=0.067$; 95% CI: -3.7 to 0.1) and accomplish 0.9 fewer rebounds ($p=0.079$; 95% CI: -1.8 to 0.1). **CONCLUSION:** These data do not support a "more is better" approach to collegiate basketball practice schedules. When practice occurs within 24hr of a game, despite elevated in-game cardiovascular effort of the athletes, individual and team performances are compromised.

- 3815** Board #132 May 30 8:00 AM - 9:30 AM
The Effects Of Kinesio Tape On Throwing Velocity And Accuracy In Collegiate Softball Players
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 (No relevant relationships reported)

The act of overhead throwing is a series of complex tasks that require synergy between multiple joints and muscle groups, lack of this synergy may lead to a decrease in performance and injury over time. In recent years, Kinesio tape has gained popularity as modality for the treatment and prevention of some of these injuries. To date, there is little research that looks at the use of Kinesio Tape in female athletes during the dynamic movement of overhead throwing. **PURPOSE:** The purpose of this study was to investigate the effects of Kinesio Tape on throwing velocity, accuracy and range of motion, and angle of ball release after the application of Kinesio Tape. **METHODS:** NCAA Division II softball players (n=9) participated in this study. The study was a randomized crossover design, subjects were either allocated to the control group (no Kinesio Tape) or the experimental group (Kinesio Tape) at their first testing session and then switched for the second testing session. Each subject performed 15 overhead throws approximately 20 feet from the target. Velocity, range of motion and angle of ball release were measured using Dartfish software, and accuracy was calculated based on points earned for hitting different levels of concentric rings. **RESULTS:** Statistical analysis revealed no significant differences between all variables between the experimental and control conditions. However, when looking at the means there was an interesting trend in the data. Kinesio Taping showed an increase in throwing velocity of .69 m/s (21.3 m/s to 21.99m/s, $p=0.480$). There was a 92.78-point increase in throwing accuracy from the control, 81.11 points to 173.83 in the experimental group ($p=0.092$). The Kinesio Taping condition also demonstrated an increase in maximal external rotation from 79.74° to 86.11° ($p=0.621$). Finally, there was a 1.17° increase in the angle of ball release with Kinesio Taping (148.68° to 149.85° , $p=0.732$). **CONCLUSION:** In conclusion, there was an increase in throwing velocity, accuracy and range of motion with the addition of Kinesio Tape during overhand throwing in collegiate softball players. Although the data did not present as statistically significant, it does demonstrate that Kinesio Tape may be a practical way to improve performance.

- 3816** Board #133 May 30 8:00 AM - 9:30 AM
Mouthguard Efficacy In Baseball Pitching Velocity
 Nathan O. Iskowitz, Jo Morrison, Laura Jimenez, Robert Brian Blaisdell. *Longwood University, Farmville, VA.*
 (No relevant relationships reported)

Successful pitching in baseball may be due to a number of factors including the mechanics of the motion, the strength, power, flexibility of the athlete, as well as their intent and fatigue levels. The pitching motion is a very powerful, violent, complex and abnormal range of motion of the body. In recent studies, it has been widely evidenced that the ability to produce instantaneous high peak force outputs is related to success in sport. Therefore, the ability to produce higher peak force may be related to the ability to pitching in baseball. Mouthguards have been shown to significantly increase power production in a number of dynamic exercise movements. **Purpose:** The purpose of this study was to determine if maximal and average pitching velocity could be increased when wearing a mouthguard. **Methods:** Twenty-two male collegiate baseball pitchers participated in this study (age: 19.9 years old \pm 1.4 years, body mass: $87.1 \text{ Kg} \pm 11.6 \text{ Kg}$, body height: $182.5 \text{ cm} \pm 6.1 \text{ cm}$). All study participants were competitive athletes at the NCAA Division 1, Division 3, or University Varsity Club level. **Results:** Pitching velocity changes resulted in a mean increase of 0.732 km/h for all groups. Velocity change for each level tested resulted in mean increases of 1.652, 0.402, and 0.370 km/h for the university club, Division 3 and Division 1 levels, respectively. The results of a paired samples t-test analysis showed that there was a statistically significant improvement when using a mouthguard in pitching velocity across all groups combined; $t(109) = 2.958$, $p = 0.004$. Further, university club level pitchers experienced a statistically significant improvement; $t(29) = 5.972$, $p = 0.000$; while Division 3; $t(39) = 0.772$, $p = 0.445$; and Division 1; $t(39) = 1.014$, $p = 0.317$; players did not show a statistically significant improvement with the mouthguard. **Conclusion:** The authors found that a mouthguard may improve throwing velocity in male collegiate baseball athletes. These findings could be useful to both coaches and sport performance specialists that are working with pitchers to bring about increases in power output and subsequent increases in pitching velocity, simply by implementing the use of a mouthguard.

- 3817** Board #134 May 30 8:00 AM - 9:30 AM
Effect Of Self-controlled And Regulated Feedback On Motor Skill Performance And Learning: A Meta-analytic Study
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Previous research has reached conflicting conclusions regarding the effects of regulated (R) and self-controlled (SC) feedback during the practice of motor skill acquisition and retention. **PURPOSE:** Use the aggregate data meta-analytic approach to examine the effects of R and SC feedback on motor skill acquisition and retention in healthy participants of any age. **METHODS:** Randomized trials of SC and R feedback in motor learning published up to 2019 were included by searching eleven databases, cross-referencing and expert review. Studies were selected and extracted by two authors. Risk of bias was assessed using an adaptation of the TESTEX Scale (maximum points = 10). Random-effects models using the standardized mean difference effect size (ES) were used to pool results. Heterogeneity was examined using the Q statistic and inconsistency using I^2 . An alpha value <0.05 was considered statistically significant for changes in motor skill acquisition and retention. **RESULTS:** Of 238 studies screened, 17 were included, representing 42 ES for acquisition and 44 for retention. Risk of bias was $M \pm SD = 6.3 \pm 1.2$. The R group significantly improved performance during the acquisition phase ($ES = 0.85$; $CI_{95\%} = 0.61, 1.09$, $n = 31$, $I^2 = 69.6\%$, $Q = 98.7$, $p < 0.01$) but decreased performance during the retention phase ($ES = -0.82$; $CI_{95\%} = -1.21, -0.43$, $n = 33$, $I^2 = 86.6\%$, $Q = 238.7$, $p < 0.01$). The SC group significantly improved performance during the acquisition phase ($ES = 1.87$; $CI_{95\%} = 1.01, 2.73$, $n = 8$, $I^2 = 82.0\%$, $Q = 39.0$, $p < 0.01$) but there were no statistically significant changes during the retention phase ($ES = -0.05$; $CI_{95\%} = -0.76, 0.66$, $n = 8$, $I^2 = 80.7\%$, $Q = 36.3$, $p < 0.01$). A yoked group to SC feedback significantly improved performance during the acquisition phase ($ES = 1.50$; $CI_{95\%} = 0.27, 2.72$, $n = 3$, $I^2 = 80.9\%$, $Q = 10.5$, $p < 0.01$) with no change during the retention phase ($ES = -0.88$; $CI_{95\%} = -2.11, 0.35$, $n = 3$, $I^2 = 83.4\%$, $Q = 12.2$, $p < 0.01$). **CONCLUSIONS:** The overall results suggest that SC and R feedback improve performance during the acquisition phase, with greater improvements observed for SC feedback. SC feedback had no significant change during the retention phase, while R feedback decreased performance. These findings suggest that SC feedback may be the better choice for enhancing motor skills.

3818 Board #135 May 30 8:00 AM - 9:30 AM
The Effect Of Percussive Massage Versus Foam Rolling Aided Warmup On Vertical Jump Performance
 Peter Byrne, Michele Aquino, Casey Spor, Jacob Virginia, Jessica Diaz, Ryan Mullin, John Petrizzo, Robert Otto, FACSM, John Wygand, FACSM. *Adelphi University, Garden City, NY.*
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Reported Relationships: P. Byrne: Industry contracted research; Theragun®.

Vertical displacement is a vital component of success in many power sport activities including volleyball and basketball. The Vertical Jump test (VJ) is a common, easy to use measure of power production applicable to many athletic populations. Treatments or preparations, such as Percussive Massage (PM), and Foam Rolling (FR) have been introduced to warm up routines on the premise that they will enhance power output and performance. **Purpose:** The purpose of this study was to assess vertical jump performance following a warm up of one of three treatments, including no massage (N), (FR) and (PM). **Methods:** 11 male and 7 female recreationally active college-age students (age: 23.4 ± 3.7 yr., height: 171.6 ± 11.4 cm, body mass: 68.2 ± 15.8 kg.) volunteered to participate in a randomized single-blind crossover design study. Three trials of 3 VJ separated by 2 minutes between jumps were conducted. During the 2 minutes of rest, an intervention (N, FR, or PM) was administered. For both FR and PM, treatment was administered bilaterally for 30 seconds per muscle group (Gluteus Maximus, Hamstrings, Quadriceps, and Gastroc/Soleus) for a total of 2 minutes. Vertical jump height was recorded after each jump using a standard vertical jump tester. **Results:** Statistical analysis by ANOVA ($P < .05$) revealed no significant difference (NSD) between best jumps. The best jumps for N, FR, and PM were 54.11 ± 2.5 cm, 54.96 ± 2.3 cm, and 54.05 ± 2.7 cm, respectively. In addition, subjects were very consistent among the first, second, or third trials across all conditions (NSD). **Conclusion:** The results of this study suggest that neither percussive nor non-percussive massage improve or detract from vertical jump performance and the use of either as a pre vertical jump warm-up may be an individual choice. Supported, in part by a grant from Theragun®.

3819 Board #136 May 30 8:00 AM - 9:30 AM
The Effect Of Percussive Massage Or Foam Roller Aided Warmup On Wingate Power Test Performance
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Percussive massage tools (PMT) have recently become a topic of interest in the realms of fitness, wellness, pop culture, and athletics. PMT are designed to be implemented during warmups, pre-competition, and recovery processes. Little is known about the warm-up effects of these relatively new tools on muscular power. **Purpose:** The purpose was to determine the efficacy of a PMT aided warmup on Wingate Anaerobic Power Test (WAPT) performance. **Methods:** 20 college-aged subjects (16♂, age 22.6 ± 2.8 yr., height 176 ± 8.4 cm, body mass 78.6 ± 15.4 kg) volunteered to participate in the WAPT following familiarization and 3 randomly assigned warm-up protocols. All warm-up protocols began with 3 minutes of cycling at 50 watts. The cycling was followed by: 2 minutes of (PMT) on the lower extremity, 2 minutes of foam rolling on the lower extremity (FR), and no intervention (C). The Wingate Test was performed at 100g/kg body mass on a Lode cycle ergometer. ANOVA with repeated measures was used to analyze these data ($*p < 0.05$). **Results:** PP-Peak Power (watts) and MP-Mean Power(watts) were: PMT 1328 ± 368 & 640 ± 173 , FR: 1139 ± 284 & 623 ± 155 , and C 1183 ± 386 & 634 ± 160 , respectively. PP was significantly higher following PMT than both FR 189 (+16.6%) and C 145 (+12.2%). There were no significant differences in MP among trials. Fatigue index (FI) of (PMT): $80.8 \pm 9.6\%$ FR: $77.7 \pm 11.9\%$ C: $76.1 \pm 9.3\%$. PMT FI was 4.7%* higher than C trials. Blood lactate values obtained 3 minutes post WAPT were not significantly different among the trials and were as follows: PMT 10.9 mmol ± 2.3 mmol, FR 11.2 mmol ± 2.7 mmol, and C 11.0 mmol ± 2.1 mmol. **Conclusion:** A PMT aided warm-up may be an effective means of improving PP production and possibly performance in acute power-based events lasting 30 seconds or less. The greater FI of PMT may be partially attributed to the significantly greater PP. Supported, in part by a grant from Theragun®.

3820 Board #137 May 30 8:00 AM - 9:30 AM
The Acute Effect Of Percussive Massage Or Static Stretching On Hamstring Flexibility
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The effectiveness of techniques to enhance joint range of motion including static and dynamic stretching, have been studied for more than 50 years and is well documented. However, there is a paucity of research on the effect of a new percussive massage technique on flexibility. Percussive massage provides a machine generated series of rapid movements over specific areas of the body with a variation in both the depth and speed of percussion. **Purpose:** The purpose of this study was to assess the effect of percussive massage (PM), static stretching (ST) and no massage (NM) on low back and hamstring flexibility. **Methods:** 30 subjects (age 22.2 ± 2.2 yr., height 174.2 ± 8.6 cm., weight 75.6 ± 14.2 kg., BMI 24.6 ± 4.3 Kg/m²) volunteered to participate in this single blind, crossover study. Subjects reported to the lab on three separate days in a resting state. Pre sit and reach measurements were taken immediately upon arrival. Thereafter, they participated in randomly assigned interventions of PM, ST, and NM. PM performed on both hamstrings and gluteal muscles simultaneously, 30 seconds at each muscle origin, muscle belly and insertion; total time of 90 seconds on each muscle. Static stretching consisted of a seated unilateral hamstring stretch and a supine unilateral leg cross-over stretch both held for 30 seconds. Following each intervention, post sit and reach measurements were obtained. A maximum of two minutes separated all pre and post- test measurements. **Results:** Mean pre and post-test Sit and Reach measures (cm) were: 29.2 ± 8.1 and 31.6 ± 7.9 , 28.7 ± 8.1 and 31.5 ± 7.8 , and 28.6 ± 7.8 and 30 ± 8.1 for PM, ST, and NM, respectively. Statistical analysis by repeated measures ANOVA at $p < .05$, was applied to assess pre-post intervention differences. The changes (cm) between pre - and post-interventions were 2.4 ± 2 , 2.8 ± 2.9 , and 1.5 ± 1.5 for PM, ST, and NM, respectively. A significant difference was evident between ST and NM ($p = .004$), with NSD ($p > .05$) between PM and ST and PM and NM. **Conclusion:** PM and ST elicit similar, acute improvements in low back and hamstring flexibility. Supported, in part by a grant from Theragun®.

3821 Board #138 May 30 8:00 AM - 9:30 AM
Effects Of Self Natural Posture Exercise On Pain Perception, Functional Movement, And Physical Fitness In Women With Chronic Pain
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PURPOSE: While Self Natural Posture Exercise, SNPE, widely practiced in Korea is claimed to be effective, it has not been systematically demonstrated. This study examined whether SNPE is effective in pain, functional movement, and fitness improvement. **METHODS:** Twenty four women with chronic pain at least last 3 month prior to study participated (27.5 ± 5.8 yrs, 23.0 ± 3.8 kg/m²) and were divided into two groups; SNPE group (EG; n=12) and non-exercise group (NG; n=12). Subjects in EG participated in 12 weeks of exercise program consisted of 60 min per session, twice a week, while those in NG did not. Those in EG were tested before and after the program, and those in NG were tested twice in the same time interval. The pain perception was evaluated by Short-Form McGill Pain Questionnaire (MPQ). Movement tests were performed using Functional Movement Screen (FMS). Physical fitness was evaluated by grip and lower back strength, sit-and-reach, and back extension. **RESULTS:** Pain perception in EG was decreased (pre; 9.5 ± 7.2 vs. post; 3.5 ± 2.8), and group difference was noticed ($p < 0.01$). Deep squat in EG increased (1.3 ± 0.5 vs. 1.9 ± 0.5 , $p < 0.005$). Hurdle step in EG increased (1.0 ± 0.0 vs. 1.6 ± 0.4 , $p < 0.005$), and group difference was noticed ($p < 0.05$). Inline lunge both in EG (1.4 ± 0.6 vs. 2.6 ± 0.4 , $p < 0.001$) and in NG (1.5 ± 0.5 vs. 2.2 ± 0.7 , $p < 0.001$) increased. Shoulder mobility in EG increased (1.9 ± 0.7 vs. 2.9 ± 0.2 , $p < 0.001$), and group difference was found ($p < 0.05$). Active straight leg raise in NG decreased (2.7 ± 0.4 vs. 2.1 ± 0.7 , $p < 0.05$), but not in EG (2.7 ± 0.4 vs. 3.0 ± 0.0). Push up in EG increased (1.0 ± 0.2 vs. 1.6 ± 0.4 , $p < 0.005$). Rotary stability both in EG and NG did not show pre and post trial differences, but group differences were noticed ($p < 0.05$). FMS total score both in EG (11.4 ± 1.5 vs. 15.4 ± 1.7 , $p < 0.001$) and in NG (12.1 ± 1.7 vs. 13.2 ± 2.0 , $p < 0.05$) increased, and group differences were noticed ($p < 0.05$). Strength parameters were not changed. Sit-and-reach in EG (19.7 ± 6.4 vs. 22.7 ± 6.0 , $p < 0.01$) and back extension in EG (53.4 ± 8.4 vs. 58.5 ± 7.8 , $p < 0.05$) increased, and group differences in both were noticed ($p < 0.05$).

CONCLUSIONS: It is demonstrated that SNPE is valuable exercise modality to release pain perception, to improve functional movement, and to enhance flexibility in women experiencing chronic pain.

3822 Board #139 May 30 8:00 AM - 9:30 AM
Relationship Of Body Composition, Cutaneous Body Temperature & Muscle Power Of Lower Limbs In Folk Dancers

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PURPOSE: Scientific evidence establishes that the practice of physical exercise increases the cutaneous body temperature, but the relationship with muscle power and body composition in dancers has not been established. **METHODS:** Twenty healthy professional dancers (11 men) and (9 women) participated in this study. The 20 dancers participated in a normal dance session (1 hour duration). Body composition was measured with electric bioimpedance BC-601FS FitScan evaluating Weight; P Body fat%; P Body water%; P Muscle mass; P Daily Caloric Intake; P Metabolic age; P Bone mass P Visceral fat. Muscle power was evaluated with DMJump jumping platform. Evaluating the Bosco Ergo Jump Protocol including (Squat Jump (SJ); Squat Jump with extra weight (SJ +); CounterMovement Jump (CMJ); Abalakov Jump (ABK); Drop Jump (DJ) calculating the elasticity index: elastic energy and the upper limbs coordination index The cutaneous body temperature was measured by infrared thermography before the session and during a session of 15, 30, and 60 minutes and 5 minutes after the session. The temperature was evaluated in the anterior tibial muscle of the gastrosoleo muscle. Achilles and sole, denominating "region of interest" (ROI). **RESULTS:** The behavior of the cutaneous body temperature in the different indoor regions increased during exercise and then returned to its basal state. It is evidenced that there is a direct relationship between muscle mass and cutaneous body temperature R = 0.91 (p <0.01). There is an inverse relationship between% fat and body temperature R = -0.89 (p <0.01). The behavior of the cutaneous body temperature in the lower limbs is inversely related to the muscular power R = 0.76 (p <0.05). **CONCLUSIONS:** The findings found in the present study establish the importance of the management of body composition and muscle power in cutaneous body temperature. In the future, the impact of dance on ligament and muscle structures can be detected to prevent injuries.

Characteristics of the participants, by sex.			
Characteristics	Men (11)	Female (9)	P value
Age mean (SD)	20 (3.1)	21 (2.6)	0.299
Anthropometric and body composition			
Height mean (SD) (cm)	171.9 (7.0)	157.9 (4.1)	<0.001*
Weight (SD) (kg)	66.7 (6.6)	56.3 (5.1)	<0.001*
Mass body index (SD) (kg/m ²)	22.5 (1.2)	22.7 (1.7)	0.833
Fat % (SD)	12.9 (3.2)	25.6 (3.2)	<0.001*
Muscle mass % (SD)	55.0 (3.3)	36.4 (8.08)	<0.001*
Weight status %			

Table 2.

ROI	Pre-Ss	Post 15-SS	Post 60'-ss
	n 20 Mean, SD.	n 20 Mean, SD.	n 20 Mean, SD.
Anterior Knee Left	23.3±2.64	34.2±3.5	28.5±3.0
Anterior Knee Right	24.1±4.3	32±2.5	28.4±6.4
Posterior Knee Left	24.3±3.2	27.5±7.7	24.±4.3
Posterior Knee Right	25.5±3.3	28.1±2.5	25.3±4.1
AT Left	28.5±4.2	33.7±3.7	28.8±5.2
AT Right	29.4±2.2	32.5± 4.7	26.3±2.3

Table 3.

Correlations	Muscle power peak	Fat % (SD)	Muscle mass % (SD)
Cutaneous body temperature means	R = 0.76 (p <0.05)	R = -0.89 (p <0.01)	R = 0.91 (p <0.01)

3823 Board #140 May 30 8:00 AM - 9:30 AM
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PURPOSE: A pre-resistance training (RT) counter-movement jump (CMJ) has been proposed as a convenient neuromuscular readiness test to predict specific RT

performance and thus guide acute program modification. The present study assessed whether fatigue-related decrements in CMJ were associated with concomitant reductions in barbell squat performance.

METHODS: Adult males (n = 12, 25 ± 5 years; 178 ± 5 cm; 89 ± 12 kg) with >1 year RT experience performed 6 sets to failure with 90% of their 10 repetition maximum in the squat, bench press and latissimus dorsi pull-down. Relative changes (Δ) from pre- to 24 and 48 h post-RT were calculated for CMJ height (derived from force plate computed take-off velocity) and mean concentric barbell velocity (derived from a linear position transducer) in the barbell squat with loads corresponding to 1.0 (V1.0) and 0.8 m·s⁻¹ (V0.8). Differences in variables across time were assessed with repeated measures analysis of variance (for CMJ) or Friedman's test (for V1.0 and V0.8). Associations among Δ variables were quantified with Pearson's correlations. **RESULTS:** Squat V1.0 was significantly reduced at 24 (median ± interquartile range, 0.95 ± 0.07 m·s⁻¹, p = 0.04) and 48 h (0.93 ± 0.11 m·s⁻¹, p = 0.03) post-RT. Squat V0.8 was also significantly reduced at 24 (0.70 ± 0.09 m·s⁻¹, p <0.01) and 48 h (0.75 ± 0.04 m·s⁻¹, p = 0.03) post-RT. CMJ height was significantly reduced at 24 (mean ± standard deviation, 33.66 ± 5.20 cm, p = 0.02) but not 48 h (34.51 ± 5.12 cm) relative to pre-RT (36.00 ± 5.26 cm). No significant associations (all p <0.05) were observed between ΔCMJ and ΔV1.0 or ΔV0.8 at 24 (r = -0.06 - 0.29) or 48 h (r = 0.17 - 0.37) post-RT. **CONCLUSIONS:** Recovery of CMJ performance did not parallel recovery of barbell squat performance. CMJ height should not be used to predict daily barbell squat performance.

3824 Board #141 May 30 8:00 AM - 9:30 AM
Workload Demands Of Position Players In Major League Baseball

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PURPOSE: The injury burden within Major League Baseball (MLB) is significant in terms of events, days missed and financial cost. The types of injuries experienced by MLB players is diverse and differs by position; likely reflecting different running, throwing and batting-related workload demands. Understanding in-game demands is critical to athlete preparation, monitoring and management as well as return to play following injury however, little is known about the workload demands of position players in Major League Baseball across each of the key activity-domains. This study seeks to describe the physical demands of position players within Major League Baseball to inform physical preparation, monitoring and return to play. Given the uniquely demanding MLB playing schedule (6.3 games per week), demands across a single game, typical 5-day and worst 5-day periods are presented.

METHODS: Total and high-speed running distance (>75% Vmax), high-speed running count, hard accelerations (>3.0 m/s/s), defensive and baserunning minutes, total and hard throws (>80% Vmax), and bat swings were calculated from the Statcast Data provided by MLB to each club. Data were limited to players with 100 games or more in the 2018 championship season. 129 players met the inclusion criteria including: 18 1B, 17 2B, 20 3B, 21 SS, 12 C, 16 CF, 10 LF, 12 RF, and 3 DH. Levene's test was used to assess for Heteroscedasticity. Between group (position) differences were assessed using ANOVA (Bonferroni adjustment; criterion Alpha p=0.05).

RESULTS: Significant positional differences were evident across running and throwing but not bat swing metrics. Outfielders did more total (941.9 ± 135.5 yds per game), and high-speed running (87.3 ± 16.9 yds per game) than other positions. First-basemen did more hard accelerations (33.4 ± 8.7 per game). Middle infielders made more throws (3.5 ± 0.6 per game), and shortstops (0.9 ± 0.3 per game) made more hard throws. Bat swings were similar across positions (7.6 ± 1.0 per game).

CONCLUSIONS: This is the first description of workload demands for position players in Major League Baseball. This information can inform pre-season physical preparation, in-season monitoring and management and return to play progressions for injured professional baseball players.

3825 Board #142 May 30 8:00 AM - 9:30 AM
Analysis Of The Use Of Sodium Bicarbonate In Performance Of Surfing Athletes

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PURPOSE: Surf is a sport that presents variations of intensity and duration during its practice. Therefore, strategies that contribute to muscle buffering in periods of high intensity, may be efficient to improve the performance of practitioners of this modality. **Objective:** To evaluate the efficiency of sodium bicarbonate in the performance of surfing athletes.

METHODS: Twenty surfers with an average age of 18 years were submitted to a sodium bicarbonate solution (0.5mg / kg) 40 minutes prior to the practice tests performed in the pool, alternating the same method, but with a solution containing chloride sodium and water (placebo), the other day, at random, in a cross over style. Upon arrival at the test site, the volunteers had blood lactate collected by a Roche® lactimeter pre and post practice and underwent a progressive paddling test on the pool on their own surfboard. They were instructed to shoot at a maximum speed of 20 meters to determine the time to be adhered as a basis for further testing. Subsequently, the athlete rested for 2 minutes and was instructed to perform up to 20 shots from 20 meters at 80% of his maximum speed with an interval of 100% of the time taken in the shot. The test was interrupted when the subject increased by 2 seconds of the maximum time performed, two consecutive times, or when completed the 20 idealized shots of the test. At the end of each test, blood samples were collected for lactate concentration analysis.

RESULTS: See table 1.

Evaluation	Bicarbonate	Placebo	P value
Lactate	16,43±3,1	14,83±2,7	0,04
Maximum time	10,68±0,8	10,88±0,6	0,05
Shots	16,35±5,2	16,35±5,2	

Table 1: Description, by the Student's t-test, of mean and standard deviation of lactate values; maximum time; and number of shots in relation of the use of bicarbonate and sodium chloride (placebo). The accepted significance level was p≤0.05.

CONCLUSIONS: The administration of sodium bicarbonate positively impacted the performance of the surfer athletes, leading to a maximum paddle test time improvement and an increase of the blood lactate.

3826 Board #143 May 30 8:00 AM - 9:30 AM
Effect Of Pedaling Feedback On 20-km Time Trial Gross Efficiency And Power Output

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INTRODUCTION: Gross efficiency (GE) is a crucial factor in endurance cycling performance. Elite cyclists have superior pedaling technique, sustaining a greater average power output (PO) through the pedaling cycle than non-elite cyclists. Previous studies have demonstrated that pedaling technique can be improved with visual feedback (FB), however, the effect of pedaling feedback on GE and PO has not been investigated. **PURPOSE:** Determine the effect of FB on pedaling technique software on GE and PO during a 20-km time trial completed with feedback (WF) and without feedback (WO). **METHODS:** Eight recreationally-trained males (39 ± 6 y, VO2peak: 47.5 ± 6.1 mL·kg⁻¹·min⁻¹ at 282 ± 43 W) with at least six months of consistent cycling or triathlon training completed three 20-km TT. The first TT served to familiarize subjects with the FB software and cycle ergometer. During the other two sessions, subjects completed the time trial in the fastest time possible in both WF and WO conditions completed in randomized order. For WF, subjects received feedback regarding the smoothness of their pedal stroke cycle and attempted to optimize their pedaling technique real-time. Both GE and PO were calculated at 25, 50, 75, and 100% completion time. Statistical analyses of GE and PO for all stages of both WO and WF were completed using a 2x4 repeated measures ANOVA. **RESULTS:** GE and PO tended to be greater in all stages of WF when compared to WO (GE: 25%: 20.2 vs. 19.1%, 50%: 19.0 vs. 16.9%, 75%: 19.0 vs. 17.1%, 100%: 19.7 vs. 19.0%) (PO: 25%: 195 vs. 194 W, 50%: 203 vs. 171 W, 75%: 203 vs. 195 W, 100%: 221 vs. 213 W), but none were statistically significant (GE p = 0.084, PO p = 0.119). The biggest differences in GE and PO between the WF and WO conditions were at 50 and 75% completion. **CONCLUSIONS:** The monitoring of pedaling technique with FB of pedaling technique during a 20-km TT may lead to an improvement in GE without a reduction in PO during a single session using FB.

3827 Board #144 May 30 8:00 AM - 9:30 AM
Self-reported Training Variables Are Poor Predictors Of Laboratory Measures In A Heterogenous Group Of Cyclists

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PURPOSE: Cycling is a predominantly aerobic activity that depends on a range of physiological attributes, as well as genetic, dietary and lifestyle factors. It is unknown

to what extent laboratory-measured physiological and performance characteristics are predicted by individual training factors such as intensity, duration, distance, coach supervision, level of competition and training experience in cycling. **METHODS:** Fifty-two men and 18 women completed a training questionnaire and performance tests generating 14 outcomes (incremental cycling test [8 outcomes]; 30-s Wingate test [4 outcomes]; and 4-km cycling time-trial [2 outcomes]). LASSO (least absolute shrinkage and selection operator) regression was performed for each performance outcome including demographic and training factors as potential predictors. Continuous regression inputs were scaled by dividing values by two standard deviations to facilitate comparisons with binary predictors and assist with model interpretation. Models were generated using the glmnet package in R with associations described by regression coefficients and percentage inclusion in 10000 bootstrap samples. **RESULTS:** Laboratory measures indicated a heterogenous group of athletes, as demonstrated by the range of maximal oxygen uptake values (VO_{2max}, range: 26.3 - 69.8 mL·kg⁻¹·min⁻¹). LASSO models identified that demographic factors were the most influential predictors of laboratory variables, with sex (76±37% inclusion), age (55±27% inclusion) and height (55±40% inclusion) featuring consistently in bootstrap samples across outcomes. In contrast, no discernible patterns were identified for training factors. When training factors did appear consistently in a model, the regression coefficients were small and median estimates of the best training predictors were equal to 15.1±7.4% of sex or 30.6±14.5% of the next most influential demographic factor. **CONCLUSIONS:** Self-reported training variables were poor predictors of physiological and performance measures in a heterogenous group of cyclists, while demographics such as sex, age and height were greater predictors of these variables. A lack of a properly structured or implemented training program might explain the low predictive ability of training variables towards these laboratorial outcomes.

3828 Board #145 May 30 8:00 AM - 9:30 AM
Dynamic Vision Training Transfers Positively To Batting Performance Among Collegiate Baseball Batters

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PURPOSE: A growing body of evidence has demonstrated that visual, perceptual, and oculomotor abilities contribute to batting performance in baseball. As such, an important question is whether training such abilities can transfer positively to batting performance.

METHODS: The current study tested this question through a pre-registered, randomized, and placebo-controlled training intervention, conducted with 24 collegiate baseball players at two Division 1 universities. Athletes were randomized into two groups and received either active dynamic vision training consisting of stroboscopic, anticipatory timing, and eye quickness drills, or placebo drills stylized after control procedures in previous vision therapy studies. Visual-motor and batting performance data were collected and compared between the two cohorts to test the transfer of training effects, while controlling for covariates such as expectations and site. Generalized near-transfer of training was tested with a digital visual-motor task battery, while sports-specific intermediate and far transfer of training were evaluated through tracking metrics collected during structured batting practice and box score performance in NCAA-sanctioned games, respectively. Participants averaged 8.5 hours of training with no significant group differences in adherence, expectations, or baseline assessments.

RESULTS: Analysis of covariance revealed no group differences in measures of generalized visual-motor skills or NCAA game statistics. However, structured batting practice results revealed consistent gains in batting performance, with significant improvements in the Launch Angle (delta = 8°, p <0.001, Cohen's d = 0.66) and Hit Distance (delta = 41 ft, p <0.001, Cohen's d = 0.61) for the active cohort relative to the control group. This finding was present at each individual study site and in both the complete-case and intent-to-treat analyses.

CONCLUSIONS: These findings indicate that the use of sports vision training programs can result in improved performance beyond the direct skills trained, warranting further study and creating new opportunities for training baseball athletes.

3829 Board #146 May 30 8:00 AM - 9:30 AM
The Athlete Specific Chronotype Index (ACTi)

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The circadian variation of athletic performance has been observed to coincide with daily peaks in body temperature. Chronotypes (CT) take into account inter-individual variations in circadian rhythms, yet there is discord regarding the relationship between

CT and athletic performance. This may be due to the most common chronotyping method, the Morningness-Eveningness Questionnaire (MEQ), lacking validity for athletic populations. **PURPOSE:** The purpose of this study was to develop and validate an athlete specific CT index (ACTi). **METHODS:** 297 athletes completed a CT questionnaire in MEQ (19) and newly-developed questions (15). Principle component analysis (PCA) was used to identify common themes and reduce the final number of questions. 10 respondents from each CT category, as determined by the MEQ, then participated in a 24-hour laboratory study. Participants abided by their typical sleep/wake cycle, provided hourly saliva samples (for dim light melatonin onset (DLMO) analysis) whilst awake and hourly core body temperature (CBT) readings (ingestible thermistor) for the 24-hours. Stepwise multiple linear regression analysis to predict DLMO onset and CBT was used to further refine the ACTi.

RESULTS: PCA of the extended ACTi responses were performed, identifying 7 themes. Multiple regression identified 11 questions that explained DLMO ($r^2=0.81$), forming the final ACTi. DLMO CT differences were observed between MEQ morning-type (MT) and intermittent-type (IT) (64 ± 61.6 min, $p=0.02$); and MT and evening-type (ET) (114 ± 71.2 min, $p=0.002$). No CT differences were observed in CBT for MEQ or ACTi. Cohen's Kappa revealed moderate CT classification changes between MEQ and ACTi (0.62). **CONCLUSION:** The ACTi is an 11-point index that enhances CT determination of athletes versus MEQ, based on the criterion measure DLMO. The ACTi may be used in team-sports to examine the impact of CT upon performance, monitoring of training responsiveness and athlete wellbeing.

3830 Board #147 May 30 8:00 AM - 9:30 AM
Effects Of Yoga On A Vibration Platform With Or Without Blood Flow Restriction

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PURPOSE: To investigate acute effects of yoga performed on a vibration platform (VP) with and without blood flow restriction (BFR) on hemodynamics, flexibility, and lower extremity explosive power.

METHODS: Total 17 healthy subjects, 8 males (age= 22 ± 4.2 years) and 9 females (age= 24.2 ± 2.9 years), were screened by questionnaires, read and signed informed consent, and participated in the study. Subjects completed 4 separate randomized yoga sessions (on the floor, on the floor with BFR (FL+BFR), on the VP (VP), and on the VP with BFR (VP+BFR)) with at least 48-hr in between. The sessions involving BFR consisted of application of specialized cuffs on the uppermost portion of both thighs restricting blood flow. All sessions started with the measuring of resting heart rate (HR) and blood pressure (BP), followed by a 5-min treadmill warm-up session. Then vertical jump performance (VJ) and flexibility were assessed. The yoga sessions consisted of a series of 8 different yoga poses (Garland pose, Downward dog, Lunge, Chair pose, Twisted chair, Warrior, Squat and Lord of the dance), each lasting 30-sec with 1-min of rest in between poses. During each pose, breathing was monitored by using a metronome to prevent subjects from holding their breath during exercise. VJ and flexibility were again tested immediately post-exercise. HR and BP were also measured immediately after and every 5-min for 25-min following completion of the yoga session.

RESULTS: Two-way ANOVA showed significant condition main effect ($p<.05$) for flexibility, indicating enhanced flexibility following VP compared to floor ($p<.05$) and VP+BFR ($p<.05$). Significant time main effects were detected for flexibility ($p<.01$), HR ($p<.01$), SBP ($p<.01$) and DBP ($p<.01$) indicating higher post-exercise values.

CONCLUSIONS: Enhanced flexibility in response to yoga on VP can be attributed to a vibration-induced activation of Golgi tendon organ causing the related muscle to relax and desensitization of stretch reflex due to activation of muscle spindles by the rapid changes in muscle length. However, no significant improvements in flexibility following the VP+BFR session could be due the placement of BFR cuffs on the uppermost portion of thighs, interfering with vibration-induced muscle length alteration and excitation of Golgi tendon organs.

3831 Board #148 May 30 8:00 AM - 9:30 AM
GLOBAL PERFORMANCE INDEX IN TRIATHLON

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 (No relevant relationships reported)

PURPOSE: The aim of this study is to evaluate the relative importance of each modality in the result of the IRONMAN® World Championship race at Kona.

METHODS: All the analyses were made from 1981 until 2018, considering just the male professional triathletes that appeared, at least, 5 times between the TOP 10 finishers. 24 triathletes were selected. Their racing times were converted into seconds. The analysis was made in a global way and by modalities (swimming, cycling and

running). A global performance index (GPI) and a specific performance indexes were created for the triathletes for each modality: swimming performance index (SPI), cycling performance index (CPI) and running performance index (RPI). Afterwards, we calculated the correlation between the stages and made a regression with the overall performance as an independent variable and the relative performance in each stage (SPI, CPI and RPI) as dependent variable. In the regression analysis, we used the "Enter" method to force the entry of all the dependent variants.

RESULTS: The final equation to evaluate the Global Performance was: $GPI = (0,324 \times SPI) + (0,871 \times CPI) + (1,07 \times RPI)$. When the correlation between the stages was analyzed, we observed a negative correlation between SPI and RPI (0,403). This finding contradicts most of the studies that put cycling as the crucial stage in a long term triathlon race like IRONMAN®

CONCLUSIONS: This results can confirm that in triathlon races, being a good swimmer can be very important, despite the swimming stage be less representative. In general, the running stage is the most important of the race, based in the analysis of the correlation between the 3 modalities. Running is crucial, but this analysis is very complex, because the 3 stages are not independent as far as the effort made in one stage tends to impact the performance on the next one.

3832 Board #149 May 30 8:00 AM - 9:30 AM
Sex Differences In Fatigability During Metabolically-matched Locomotor Exercise: An Integrative Approach

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¹Northumbria University, Newcastle upon Tyne, United Kingdom. ²Marquette University, Milwaukee, WI. (Sponsor: Professor Glyn Howatson, FACSM)
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Purpose: To compare the cycling power-duration relationship between males and females and assess fatigability in the heavy and severe exercise intensity domains.

Methods: Eighteen cyclists (age: 25 ± 6 years, 10 males, 8 females) performed an incremental ramp test, then three constant-load cycling trials to task failure (110, 90, and 80% of maximum ramp test power (P_{max})). Critical power (CP) and the curvature constant (W') of the power-duration relationship were subsequently calculated and constant-load experimental trials were performed to task failure at 110% CP, and to task failure or for 60 mins at 90% CP, whichever occurred first. Near-infrared spectroscopy of the vastus lateralis (VL) and pulmonary gas exchange were monitored during exercise, and neuromuscular function assessed before and after experimental trials.

Results: Males had a greater P_{max} (362 ± 29 vs. 241 ± 42 W, $P<0.001$) and $\dot{V}O_{2max}$ (60.5 ± 8.2 vs. 44.2 ± 4.8 mL·kg⁻¹·min⁻¹, $P<0.001$) vs. females. In absolute units, CP (260 ± 28 vs. 179 ± 32 W, $P<0.001$) and W' (18.5 ± 4.8 vs. 12.7 ± 3.2 kJ, $P=0.009$) were greater in males, but when expressed relative to P_{max}, no differences existed ($P\geq 0.209$). There was no sex difference in time to task failure at 110% CP (752 ± 329 vs. 681 ± 277 s, $P=0.645$), but throughout the trial, females experienced a smaller decrease in VL oxygenation (-20 ± 8 vs. $-7 \pm 4\%$, $P<0.001$), and a smaller post-exercise reduction in twitch force (-35 ± 17 vs. $-15 \pm 10\%$, $P=0.010$) compared to males. During the 90% CP trial, three males and three females reached task failure prior to 60 mins (mean duration: 3073 ± 835 vs. 2937 ± 964 s, $P=0.758$). Females demonstrated a smaller decrease in VL oxygenation (-21 ± 9 vs. $-1 \pm 6\%$, $P<0.001$), as well as a lesser reduction in twitch force (-24 ± 11 vs. $-10 \pm 11\%$, $P=0.020$) and voluntary activation (-9 ± 6 vs. $-4 \pm 3\%$, $P=0.036$) post-exercise compared to males. Cortical ($-20 \pm 32\%$, $P=0.039$) and spinal ($-22 \pm 45\%$, $P=0.039$) excitability were reduced following the 90% CP trial, but no sex difference existed ($P\geq 0.132$).

Conclusions: No sex difference exists in the power-duration relationship when data are expressed relative to P_{max}. However, females demonstrate a greater fatigue resistance of the knee-extensors during both severe and heavy intensity cycling, likely due to lesser reductions in locomotor muscle oxygenation during exercise.

G-35 Free Communication/Poster - Physical Activity: Injury and Illness

Saturday, May 30, 2020, 8:00 AM - 10:30 AM
 Room: CC-Exhibit Hall

**3833 Board #150 May 30 8:00 AM - 9:30 AM
 Running Injury According To Training And Performance Related Data**

Cassie Oddy¹, Mark I. Johnson¹, Gareth Jones¹, Peter Francis².
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 (No relevant relationships reported)

PURPOSE: A runners training and performance history over the previous 12 months is rarely considered in data related to running injury and participation level. The purpose of this on-line questionnaire was to gather self-reported history of exposure, performance and injury over the preceding 12 months in runners of different abilities. Self-reported history of barefoot running and injuries was also collected.
METHODS: An on-line questionnaire (QualtricsSM software) was developed by the investigators and then distributed to a sample of runners recruited via social media and running clubs. Runners declared their participation level as; Non-competitive/recreational (NCR), represent club (RC) and represent county (RCOUN).
RESULTS: There were 224 respondents (59% = NCR, 35% = RC and 6% = RCOUN). Respondents reported (mean ± SD): fastest 5km run time (minutes) = NCR 24.4 ± 6.6, RC 21.05 ± 4.06 RCOUN 16.53 ± 1.61; 'on average' kilometres ran per week = NCR 28.8 ± 18.50, RC 43.52 ± 20.44, RCOUN 82.35 ± 36.0; 'on average' minutes ran per week = NCR 190.36 ± 142.28, RC 268.10 ± 126.21, RCOUN 428.21 ± 157.92. There were 175 respondents (78%) reporting at least one injury over the previous 12 months (total injuries = 348). Injury rates were; 10.99 injuries/1000hrs for NCR, 4.52 injuries/1000hrs for RC and 2.48 injuries/1000hrs for RCOUN. The most common injury sites were; knee for NCR (17%, 30/176), Achilles (19%, 21/109) for RC and calf (21%, 5/24) and/or shin (21%, 5/24) for RCOUN. There were 31 respondents (14%) that reported participating in barefoot running at least once per week, of which 20 (65%) reported having at least one injury with a relative risk of 0.803 (95% CI, 0.613-1.053), and an odds ratio of 0.613 (95% CI, 0.197-1.009). The Achilles was the most common site of injury (30%, 9/30).
CONCLUSIONS: These findings offer insights to the injury characteristics of runners from different participation levels. The findings should serve to catalyse prospective studies, including exploration of the risk of barefoot running on injury.

**3834 Board #151 May 30 8:00 AM - 9:30 AM
 Characterizing OA Phenotype Response To Emerging Science In Sports (COMPRESS) Trial**

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 (No relevant relationships reported)

Osteoarthritis (OA) is among the most prevalent and debilitating chronic diseases worldwide affecting the general population as well as athletes. Despite that, no therapies have been proven to modify disease progression or to be highly effective for symptomatic relief, other than joint replacement surgery. Accordingly, recent effort has been aimed to define a classification of OA phenotypes for the purpose of better identifying individuals at higher risk of progression and to better delineate subpopulations attributable to distinct risk factors and disease mechanisms that may be suitable for targeted treatment and prevention strategies. Purpose: To characterize using the Dell'Isola criteria, the frequency of knee OK (KOA) phenotypes (6 in total) in new patients presenting to a single tertiary care institution. Methods: Following IRB approval, patients were phenotyped by the senior author (TMB) at their initial clinic visit. Kellgren-Lawrence (KL) readings were evaluated by the senior author and verified by a board certified MSK radiologist. Results: We successfully characterized 242 patients (30 - 70 years of age) with the Dell'Isola system. Due to requirements for specific biomarkers for the classification of the bone and cartilage metabolism phenotype, we were only able to classify five phenotypes (chronic pain, inflammatory, metabolic syndrome, mechanical overload, minimal joint disease). The most common phenotype was minimal joint disease (30% or 73 patients) followed by metabolic syndrome (19% or 45), mechanical overload (15% or 36), chronic pain (15% or 36), and inflammatory (6.3% or 15). For both the minimal joint disease and chronic pain phenotypes, there was unequal distribution of Latino to non-Latino subjects (70% vs. 30%). Discussion: OA is a complex disease increasingly recognized to be a disorder of multiple phenotypes. This study begins to phenotype a culturally and ethnically diverse population of patients with KOA in an academic Sports Medicine clinic. Ongoing investigations include validated functional evaluation (KOOS, WOMAC) of

our subjects to determine if certain phenotypes are associated with poorer functional outcomes. Reference: Dell'Isola A et al. *MJBmd. Identification of clinical phenotypes in knee osteoarthritis: a systematic review of the literature.* 2016; 17(1): 425.

**3835 Board #152 May 30 8:00 AM - 9:30 AM
 Abstract Withdrawn**

**3836 Board #153 May 30 8:00 AM - 9:30 AM
 Abstract Withdrawn**

**3837 Board #154 May 30 9:00 AM - 10:30 AM
 Head Impacts In Women's Collegiate Club Lacrosse**
 Nicholas J. Cecchi, Derek C. Monroe, Gianna M. Fote, Steven L. Small, James W. Hicks. *University of California, Irvine, Irvine, CA.*
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 (No relevant relationships reported)

Women's lacrosse is an 'incidental contact' sport meaning that intentional contact with an opponent is not permitted by the game's rules. Despite this, women's lacrosse played at the high school and collegiate varsity levels of competition carry a risk of repetitive head impact exposure and sport-related concussion. Head impact exposure at the collegiate club level of women's lacrosse has not yet been described.
PURPOSE: To characterize the anticipated and observed incidence of head impacts in women's collegiate club lacrosse.
METHODS: Experienced women's collegiate club lacrosse players (n=10) filled out questionnaires reporting how often they sustained head impacts (per game exposure) during the past year. Headband-mounted head impact sensors were worn by athletes (n=11) during eight collegiate club lacrosse games sanctioned by the Western Women's Lacrosse League. The sensors reported the peak linear acceleration (PLA) and peak rotational acceleration (PRA) associated with each recorded accelerative event. Head impacts were confirmed by two researchers independently reviewing competition video time-synced with sensors. Video review was also used to determine the mechanisms of confirmed impacts.
RESULTS: Athletes had a median 4 (range: 0.25 - 8) years of lacrosse experience and expected to sustain a median 0 (range: 0 - 3) head impacts per game. 75 accelerative events were recorded by the head impact sensors across 81 total game exposures. Six head impacts were confirmed using video and 69 accelerative events were rejected as false positives. Confirmed impacts had a median PLA of 21.0 g (range: 18.3 g - 48.3 g) and PRA of 1.1 krad/s² (range: 0.7 krad/s² - 5.7 krad/s²). Four impacts resulted from contact with an opponent's body and two impacts resulted from contact with an opponent's stick. Only one head impact incurred a penalty against the opposing player.
CONCLUSIONS: Athletes anticipate and sustain infrequent head impacts in women's collegiate club lacrosse relative to lacrosse and contact sports played at the high school and collegiate varsity levels of competition. Those impacts that are sustained are of relatively low magnitude. Head impact sensors are prone to high false positive rates and the use of video recordings to filter sensor data is necessary.

**3838 Board #155 May 30 8:00 AM - 9:30 AM
 Effects Of Adolescent Sports Specialization On NFL And MLS Players' Injury Propensity**

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Adolescent single sport specialization has been linked to a higher rate of overuse injuries and has even been shown to be detrimental to the health and career longevity of NBA players (Rugg et al).
Purpose:
 To evaluate a potential relationship between adolescent sports specialization and injury propensity in elite NFL and MLS players.
Methods:
 570 first and second round NFL draft selections from 2010-2018 and 202 first round MLS draft selections from 2005-2018 with reliable sport specialization, injury history, and playing career data were identified. Publicly verified internet sources were used to classify adolescent sport participation, number and type of severe injuries sustained during pro football or soccer games, and number of total possible games played and missed due to injury. Subjects for each league were divided into 2 cohorts: multisport (MS) and single sport (SS). Sports specialization comparisons were made as follows:

(1) Average % of games missed due to injury (APGM) using 2 sample T test and (2) % of players who sustained at least 1 major injury (%MI) using one-tailed Fisher's exact test.

Results:

APGM was lower in the NFL MS group (11.4±0.7% vs 18.7±2.3%; $p<.01$) but not in the MLS MS group (6.51±1.9% vs 5.8±1.0%; $p=0.377$) [Figure 1]. %MI was also lower in the NFL MS group (54.2 vs 68.8%; $p<.01$) but not in the MLS MS group (41.7 vs. 35.1%, $p=0.4528$) [Figure 2].

Figure 1. APMG Sports Specialization Comparison in NFL and MLS

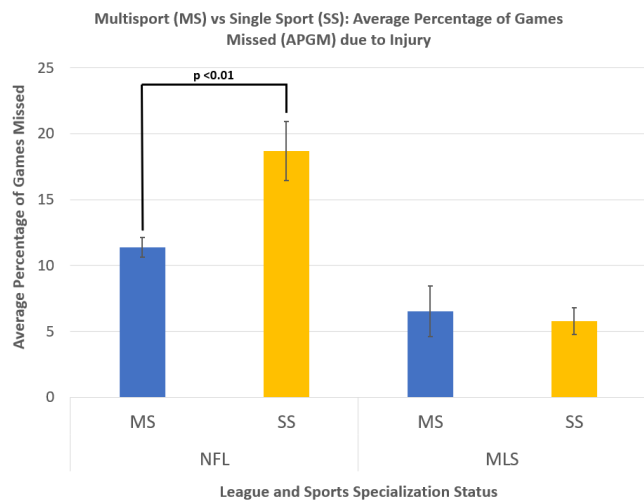
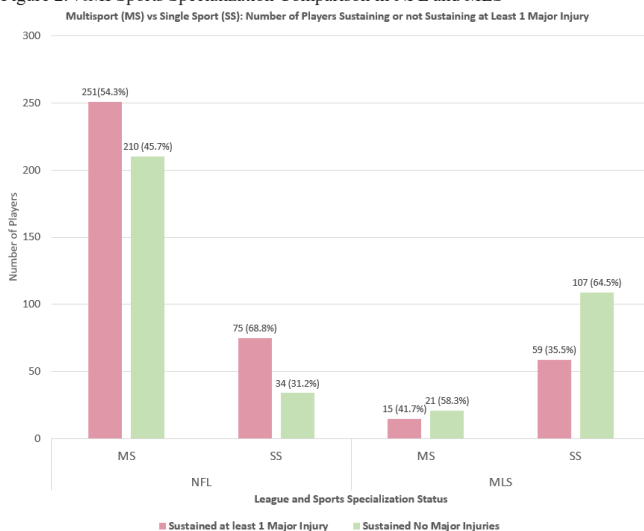


Figure 2. %MI Sports Specialization Comparison in NFL and MLS



Conclusion:

Adolescent MS specialization contributes to a reduction in injury predisposition in NFL athletes but not in MLS athletes.

3839 Board #156 May 30 8:00 AM - 9:30 AM Epidemiology Of Sudden Death In Organized School Sports In Japan

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There are approximately three-million four-hundred thousand registered student athletes in middle and high school in Japan. Despite a large number of participants, health and safety policies for student athletes in Japan are at its infancy and there is paucity of data-driven policies to reduce catastrophic and fatal injuries from sports. **PURPOSE:** Describe the epidemiology of sudden death in organized school sports in Japan. **METHODS:** Data submitted to Japan Sport Council (JSC) Injury and Accident Mutual Aid Benefit System between 2005-2016 were retrieved from JSC website for

analysis (n=1,137). Case information on fatal incidents occurred during organized school sports in middle and high school students were extracted for further analysis (n=198). Descriptive statistics related to information about activity type, sex, sport, diagnosis, and presence of on-site trained medical personnel were calculated using frequency and proportion. Sudden death incidence rates were expressed per 100,000 athlete-years and 95% confidence intervals (CI). **RESULTS:** Fatalities were reported in practice (n=120/198, 60.6%), scrimmage (n=16/198, 8.1%), game (n=10/198, 5.1%), training camp (n=16/198, 8.1%), and other (n=36/198, 18.2%). The average incidence rate of sport related fatality was 0.39 death per 100,000 athlete-years (95% CI= 0.31-0.47). Most fatalities were in male student athletes (n=149/162, 92%), which yielded to 7.5 times greater fatality rate in male than female student athletes (male, 0.60 death per 100,000 athlete-years, 95% CI= 0.46-0.73; female, 0.08 death per 100,000 athlete-years, 95% CI= 0.03-0.13). Baseball (n=25/162, 15.4%), judo (n=24/162, 14.8%), soccer/futsal (n=20/162, 12.3%), and basketball (n=18/162, 11.1%) accounted for 53.7% of fatalities. Sudden cardiac death (n=68/162, 42.0%), head trauma (n=32/162, 19.8%), and heat related injury (n=25/162, 15.4%) were the top three diagnosis of fatality. Only three cases (2%) reported of having trained medical personnel on-site at the time of incident. **CONCLUSIONS:** Sports-related fatality among Japanese student athletes was highest in male baseball players during practice due to sudden cardiac death. Almost no incidents had trained medical personnel on-site at the time of catastrophic injuries during school organized athletics in Japan.

3840 Board #157 May 30 8:00 AM - 9:30 AM Removal From Activity Following Sport-related Concussion In Sex-comparable Sports

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As sport-related concussion (SRC) awareness has increased, timely reporting and immediate removal from play have become a focal point of proper management. Delayed removal may result in additional injury and protracted recovery. Research has demonstrated that girls are more honest and likely to report their concussion symptoms compared to boys. However, it is unknown if these reporting behaviors correspond with immediate removal from play in girls compared to boys in sex-comparable sports. **PURPOSE:** To compare the incidence of high school athletes not removed from activity following SRC in sex-comparable sports in Michigan. **METHODS:** An epidemiological study of athletes diagnosed with SRC participating in Michigan High School Athletic Association-sponsored basketball, baseball/softball, and soccer from 2016-2019 was performed. All SRCs were recorded in a Head Injury Reporting System by certified athletic trainers, administrators, or coaches. Removal from activity indicated the athlete was removed from play at the time of an injury event. Lack of removal does not indicate mismanagement at the time of the event, but that the injury was not reported. Incidence was calculated by dividing SRCs not removed by total SRCs in each sport. Risk ratios were calculated by dividing the incidence of girls not removed by boys not removed in each sport. **RESULTS:** A total of 3696 (2425 female, 1271 male) SRCs were reported, with the most occurring in girls' soccer (n = 1024). Overall, 442 girls and 182 boys were not removed from activity, resulting in incidences of 0.18 (95% CI, 0.17-0.20) and 0.14 (95% CI, 0.12-0.16), respectively. Across all sports, girls were 1.27 (95% CI, 1.09-1.49) times as likely to not be removed from activity compared to boys. Girls had 1.16 (95% CI, 0.91-1.50), 1.19 (95% CI, 0.77-1.84), and 1.41 (95% CI, 1.12-1.78) times the risk of not being removed from basketball, softball, and soccer, respectively, when compared to the equivalent boy sports. **CONCLUSIONS:** Girls were at greater risk of not being removed from activity compared to boys in sex-comparable sports. Although girls are more likely to report symptoms of SRC, there is still a gap in their removal from play, potentially due to a delayed onset or recognition of symptoms. Future research and initiatives should target reporting and removal in female sports.

3841 Board #158 May 30 8:00 AM - 9:30 AM Domain-specific Physical Activity, Pain Interference, And Muscle Pain After Activity

Christopher TV Swain¹, Julie K. Bassett¹, Allison M. Hodge¹, Shahid Mahmood², Harindra Jayasekara¹, Robert J. MacInnis¹, Graham G. Giles¹, Roger L. Milne¹, Dallas R. English¹, Brigid M. Lynch¹. ¹Cancer Council Victoria, Melbourne, Australia. ²The University of Melbourne, Melbourne, Australia.
(No relevant relationships reported)

PURPOSE: The context in which physical activity is performed may affect self-reported indicators of pain. Using the Melbourne Collaborative Cohort Study, we examined associations between occupation, household, transport, and leisure physical activity with pain interference and muscle pain after activity. **METHODS:** The analysis included 9,577 working and 12,281 non-working participants. Physical activity was assessed using the International Physical Activity Questionnaire-Long

Form. Pain interference was assessed using SF-12, and muscle pain after activity was assessed using Sphere-12. Ordered logistic regression was used to estimate odds ratios (OR) and 95% confidence intervals (CI), and restricted cubic splines were used to graphically represent the dose-response association between each physical activity domain and pain outcome. **RESULTS:** Compared to those in the lowest quartile, participants in the highest quartile for transport activity had less pain interference (workers OR: 0.84, 95% CI: 0.74, 0.95; non-workers OR: 0.80, 95% CI: 0.71, 0.89) and muscle pain after activity (workers OR: 0.82; 95% CI: 0.69, 0.98; non-workers OR: 0.81, 95% CI: 0.71, 0.93). Similarly, participants in the highest quartile of leisure activity had less pain interference (workers: OR: 0.82; 95% CI: 0.69, 0.98; non-workers OR: 0.81, 95% CI: 0.71, 0.93) and muscle pain after activity (workers OR: 0.79; 95% CI: 0.64, 0.96; non-workers: OR: 0.89, 95% CI: 0.76, 1.03). In workers only, participants in the highest quartile of household activity reported more pain interference (OR: 1.37; 95% CI: 1.20, 1.57) and muscle pain after activity (OR: 1.34; 95% CI: 1.12, 1.61) than those in the lowest quartile. Occupational activity was not associated with either pain outcome. **CONCLUSIONS:** Within the transport and leisure domains, physical activity was inversely associated with pain-related outcomes, whereas more household physical activity was positively associated with pain scores within the working sample.

3842 Board #159 May 30 8:00 AM - 9:30 AM
Characterizing Impacts In Girls' High School Lacrosse Using Video Analysis

Samantha L. Hacherl¹, Patricia M. Kelshaw¹, Andrew E. Lincoln², Heather K. Vincent, FACSM³, Daniel C. Herman, FACSM³, Shane V. Caswell¹. ¹George Mason University, Fairfax, VA. ²MedStar Sports Medicine, Baltimore, MD. ³University of Florida, Gainesville, FL. (Sponsor: Heather K. Vincent, FACSM)
 (No relevant relationships reported)

Participation in high school girls' lacrosse is increasing, commensurate with concerns of risks for head impacts. Wearable sensors coupled with video analysis have characterized the incidence of head impacts in girls' lacrosse. However, due to high sensor measurement error, the true incidence of game-related impacts remains unclear. **Purpose:** Characterize the incidence of impacts in girls' high school lacrosse using video analysis.

Methods: Forty participants volunteered in 16 games during the 2019 lacrosse season. All games were filmed using a digital camera affixed to a tripod to capture impacts. Descriptive statistics were reported for all video-identified game-related impacts (VIGI), including impact rates (IR) and 95% confidence intervals (CI).

Results: There were 208 VIGI, for 297 player-games (IR=.70 impacts/player-game, CI: 0.61, 0.80). Overall, midfielders had the most impacts (n=88, 42.3%) followed by attackers (n=79, 38%) and defenders (n=41, 19.7%). The most common impact mechanisms were player (n=105, 50.5%), stick (n=88, 42.3%), and ground (n=13, 6.3%) contact. Most impacts occurred during offense-defense transitions (n=44, 21.2%) and settled game play (n=39, 18.8%), defending (n=33, 15.9%) and shooting (n= 34, 16.3%). Of all impacts, 29 (13.9%) were direct head impacts (IR=.10, CI: 0.06, 0.13). The most common head impact mechanisms were contact with stick (n=24, 82.8%), ground (n=4, 13.8%), and ball (n=1, 3.4%). The most common game play impact characteristics were shooting (n=7, 24.1%), settled game play (n=7, 24.1%), offense-defense transitions (n=4, 13.8%) and defending (n=4, 13.8%). A penalty was called by the referee for 17 (58.6%) head impacts.

Conclusion: The incidence of overall VIGI was considerably greater than previously reported studies using a sensor driven approach to identify and subsequently verify impacts using video. However, the rate of head impacts was lower, but similarly stick and ground contact remained the most common mechanisms despite their prohibition in the sport. Our findings reinforce the need for rule enforcement of prohibited game play behaviors. Prospective video analysis of head impacts in girls' lacrosse may assist with characterizing impacts and their incidence, especially as the sport shifts toward the intervention of headgear.

3843 Board #160 May 30 8:00 AM - 9:30 AM
How Many Snaps Are Too Many? Survival Analysis Of Concussions In The National Football League.

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 (No relevant relationships reported)

Current methods used to estimate concussion risk in American football generally do not account for within-season variation in exposure between individual players. Thus, utilizing individual snap count data to quantify exposure may be beneficial for epidemiologic studies evaluating concussion risk in football.

PURPOSE: To determine the association between football exposure, quantified using snap count data, and concussion within the regular season in the National Football League (NFL), and how this varies by playing position.

METHODS: Weekly snap count and injury report data were obtained for every player who participated in the 2012 through 2017 NFL regular seasons, using the Football Outsiders database. Exposure was quantified as the cumulative total number of snaps that a player participated in for a given season, and used as the time-dependent variable in a Cox proportional hazard model. Concussion status (concussed vs. not-concussed) served as the event variable. If an individual received multiple concussions within a season, only the first within a season was included in the model. The effect of playing position on time to concussion were independently assessed as a categorical covariate. Hazard ratios (HR) were computed, with special teams positions (kicker, punter, and long snapper) as the reference category. **RESULTS:** A total 5,289,149 player-snaps were analyzed from 4231 distinct players, representing 12,004 player-seasons. Position was significantly associated with concussion hazard (p<0.001), with defensive backs [HR (95% confidence interval); median (interquartile range) number of snaps to first concussion = 2.8 (1.2, 6.3); 324 (377)], running backs [3.0 (1.3, 6.9); 200 (225)], tight ends [3.5 (1.5, 8.2); 290 (334)], and wide receivers [2.7 (1.2, 6.1); 227 (251)] having significantly greater hazard than special teams players. Across positions, the median number snaps before first concussion was 295 (355).

CONCLUSIONS: Survival analysis using snap count to quantify football exposure provides similar results to other epidemiological studies regarding which positions are at greatest risk of concussion. Future research should examine whether using this metric of exposure provides any additional insight into other potential risk factors for concussion or concussion-related outcomes.

3844 Board #161 May 30 8:00 AM - 9:30 AM
Assesment Of Physical Activity Levels And Quality Of Life In Different Clinical Populations

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 (No relevant relationships reported)

Impaired quality of life (QoL) has been reported in different clinical populations such as patients suffering from cancer (CA), multiple sclerosis (MS) or cardiovascular diseases. A growing body of evidence indicates that physical activity (PA) affects subjective QoL while there is a dose-response relationship between the volume of exercise and its health benefits. **PURPOSE:** The present study assessed and compared PA levels and QoL of different clinical populations and age-matched healthy adults. **METHODS:** One hundred and thirteen volunteers, i.e., 29 with CA under chemotherapy (age: 56.0 ± 10.4 yrs, BMI: 27.2 ± 5.4 kg/m²), 20 with MS (age: 53.3 ± 14.4 yrs, BMI: 25.9 ± 3.5 kg/m²), 14 with hypertension (HYP) (age: 55.0 ± 11.0 yrs, BMI: 31.0 ± 6.0 kg/m²) and 50 healthy controls (CON) (age: 51.3 ± 6.5 yrs, BMI: 25.3 ± 3.1 kg/m²), participated in the study. Levels of PA and QoL were self-estimated with the International Physical Activity Questionnaire and the SF-36 Health Survey questionnaire or the EORTC-QLQ30, respectively. **RESULTS:** The weekly energy expenditure was higher (p<0.01) in the CON group (2658.4 ± 2763.6 METs) compared with all clinical populations examined (CA: 2176.5 ± 2033.6 METs; HYP: 1560.9 ± 760.2 METs; MS: 64.2 ± 67.6 METs). Moreover, the metabolic cost of vigorous intensity PA was low in CA (30.6 ± 114.9 METs), HYP (36.9 ± 92.1 METs) and MS (0 METs), in contrast with the controls (1020.0 ± 1472.5 METs) (p<0.001). Differences were also revealed in walking energy expenditure between CON and MS group (1653.4 ± 1726.4 vs 114.0 ± 163.1 METs; p<0.05). Physical functioning (PF) score was higher in CON (85.5 ± 15.1) compared with MS (31.3 ± 31.2; p<0.001) and CA (69.4 ± 22.0; p<0.05). Furthermore, QoL was assessed as poor in MS (29.5 ± 20.4) and moderate to high in CA, (59.8 ± 17.5) CON (71.10 ± 18.7), HYP (71.4 ± 14.3) (p<0.001).

CONCLUSIONS: Our findings revealed that clinical populations included in this study had a lower total weekly energy expenditure compared to healthy individuals, without engaging in high-intensity PA. In particular, MS patients exhibited the lowest rates of PA, PF and QoL, while CA and HYP group showed higher scores in of PA, PF and QoL, implying a potential relationship between PA and QoL. The specific nature of each disease may explain the differences observed among the clinical populations examined.

3845 Board #162 May 30 8:00 AM - 9:30 AM

Migraine In College Students: Relationships Of Exercise, Sleep And Stress

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(No relevant relationships reported)

Migraine headaches is a common disabling disorder which affect daily activities and academic performance in college students. There is disagreement in published research whether exercise triggers or prevents migraine. **PURPOSE:** The purpose of this study was to identify the relationships of migraine, regular exercise, sleep and stress in college students. **METHODS:** An online survey was sent to 9,675 students at a mid-sized university. A total of 675 students responded to the survey, with 557 respondents (5.7%) completing the entire survey [age: 21.01±4.86 y.o., females: 80.9% (n=451); males: 18.1% (n=101); other: 0.9% (n=5)]. Prevalence of migraine headache, self-reported triggers, exercise habits and perception of exercise in relation to migraine, and relationship between sleep (PSQI), stress (PSS) and migraine impact (HIT-6) were examined via SAS and MS Excel. **RESULTS:** Prevalence of self-reported migraine headache in the past six months was 63.5% (n=354) while prevalence of migraine headache confirmed by a physician was 26.7% (n=149). The top three identified trigger factors were life stress (96.6%), academic stress (96.0%) and lack of sleep (94.6%). About 40% of migraineurs reported that they did not have migraine 24 hrs after exercise. Participants who exercised regularly were less likely to get migraines (~21% less likely). Interestingly, those with migraines exercised more than those who did not have migraines (38.4% versus 23.7%). A higher sleep quality was inversely correlated to prevalence of migraine ($r=-0.335$). Impact of the headache on daily life was also correlated with perceived stress ($r=0.239$), and inversely correlated with sleep score ($r=-0.208$). **CONCLUSION:** Stress and lack of sleep are the most common self-reported migraine triggers in college students. Our study found that currently migraineurs do more regular exercise than those who did not report migraines. Quality of sleep is an important factor in migraine prevention. Regular exercise has the potential to prevent migraines but further studies need to be done to examine the exercise frequency, duration, intensity to determine long term outcomes.

3846 Board #163 May 30 8:00 AM - 9:30 AM

Sports Injury Model For Effective Prevention, Diagnostic And Rehabilitation

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(No relevant relationships reported)

In order to develop a model for a safe and effective return to sport after injuries, it is important to identify the risk factors associated with the occurrence of an injury. For the first time, we introduce the Tensiomyography (TMG) in the field of sport injuries (SI), a non-invasive and selective tool for the assessment of skeletal muscle contractile properties. As a recommendation from former experiences, a FC Barcelona documented a Muscle Injuries Clinical Guide 3.0 that explicitly emphasizes the use of TMG for the follow-up of muscle functional recovery and to help decide when the athlete can return to play. **PURPOSE:** To develop a thigh SI prediction model and explore factors of safe return to play. **METHODS:** The ongoing research project aims to monitor SI epidemiology in Slovenian premium soccer clubs. We monitored TMG of vastus lateralis and medialis, rectus femoris, biceps femoris and semitendinosus of both legs; body characteristics (body height, mass and fat), motor tasks (strength endurance in hamstrings; explosive lower-body strength, flexibility of lower body). **RESULTS:** Based on 11 thigh SI we were able to predict four (sensitivity 27%, specificity 99%). When predicting only 6 biceps femoris hamstring SI we could predict 4 (sensitivity 80%, specificity 100%). The predictive factors were derived only from TMG parameters. It appears that the worst-case scenario for the SI occurrence of biceps femoris is it short TMG-derived contraction time, high biceps femoris tone and low lateral symmetry. Interestingly, there were no significant predictors from body characteristics and motor tasks. **CONCLUSION:** Twenty-seven percent of all thigh SI and 80% of hamstring SI could be predicted solely from simple-to-use and non-invasive TMG screening. It seems that short contraction time (previously linked to high proportion of type II muscle fibers) and high muscle tone are risk factor for hamstring injuries, especially where imbalances between both lateral sides were present. Supported by Slovenian Research Agency (research core funding no. L5-8245).

3847 Board #164 May 30 8:00 AM - 9:30 AM

Injury Rates Among Elite Wushu Kung-fu Martial Artists And Access To Health Care

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(No relevant relationships reported)

Wushu Kung-Fu is a worldwide practiced martial art commonly known as “Kung-Fu”. The International Wushu Federation (IWUF) host a world competition every 2 years with more of 1,500 participants from countries all over the worlds. Musculoskeletal injuries are common among elite and amateur athletes of any sport. Access to health care can and might determine their proper treatment and return to sport. **PURPOSE:** To assess the injuries rate among Elite Wushu Kung-Fu Martial Artists and observe the relationship between access to health care and proper injury treatment. **METHODS:** One hundred and three athletes (n = 103; Males = 69, Females = 34) completed a survey prior before the 10th World Wushu Championships in China. Out of this sample, 94 were performance athlete (Taolu) and nine were professional fighters (Sanda). **RESULTS:** Out of the 103 responders, 49.5% reported Ankle injuries, 29.1% Lower Back, 18% reported an Anterior Cruciate Ligament (ACL) injury, 18.4% meniscus, 5.8% of combined ACL and meniscus, 16.5% Patella Tendinopathy, 14.6% leg adductors injuries, 7.8% Medial Collateral Ligament, and 6.8% Lateral Collateral Ligament injuries; from these injuries, only 48.5% reported a serious injury (time to heal > 8 weeks). About 50.5% of these injuries were reported to happened during technical training, 47.6% during jumping maneuvers, 17.5% during the warm-up and strength training, and 11.7% during competition. In terms of medical insurance, 46% reported to have private medical insurance, 29% government insurance, and 25% no insurance at all. In addition, 46.4% reported to have access to a Physical Therapist, and only 53.6% reported no access to Physical Therapist. A chi-squared showed no association between those who have medical insurance (governmental or private), or no medical insurance, and those who have access to proper physical therapy ($p > 0.05$). **CONCLUSIONS:** The great majority of injuries were reported to happen during technical training sessions and jumping maneuvers. The most common injuries sites were the Ankles, Lower back muscles, ACL, and Meniscus. Coaches and athletes might want to look into strategies on how to lower the risk of injuries at these specific sites for Martial Artists.

3848 Board #165 May 30 8:00 AM - 9:30 AM

Determinants Of Lower-extremity Injury Severity And Recovery Among High School Soccer Players In The U.S.

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Reported Relationships: A. Chandran: Other (please describe); This study would not be possible without the assistance of the many high school athletic trainers who participated in the NATION-SP. This project was funded by the National Athletic Trainers' Association Research and Education Foundation, and the Central Indiana Corporate Partnership Foundation in cooperation with BioCrossroads. The content of this report is solely the responsibility of the authors and does not reflect the views of the sponsors. All actions pertaining to the study analysis were performed at The George Washington University. The authors declare that they have no competing interests.

PURPOSE: Lower-extremity injuries are common among soccer players, yet few studies have attempted to identify determinants of lower-extremity injury severity in this group. We examined the impact of injury site, injury mechanism, sex, injury history, setting and playing surface on lower-extremity injury severity. **METHODS:** The NATION-SP captured soccer-related injury data collected by athletic trainers (ATs) during the 2011/12-2013/14 academic years. Lower-extremity injury sites of interest were hip/groin, thigh, knee, lower-leg/Achilles, and the ankle/foot. The nature/type of injuries, surgery for treatment (yes/no), season-ending outcomes (yes/no), and the recovery process (using observed time loss) were the outcomes of interest. Exposures of interest were injury site, injury mechanism (contact vs. non-contact), sex, injury history (new vs. recurrent), event-type (game vs. practice), and playing surface (natural vs. turf). Summary statistics (frequencies, %) were used to examine the nature/type of injuries. Multivariable logistic regressions were used to examine odds of season-ending outcomes, and surgery, as a function of the exposures; random effects Poisson regressions were used to examine exposure effects on the recovery process. Odds Ratios (ORs) and Time Loss Ratios (TLRs) with 95% confidence intervals (CI) excluding 1.00 were deemed significant. **RESULTS:** The majority of all lower-extremity injuries (n=2871) in this sample were sprains, strains/tears, or contusions (72%). Odds of a season-ending injury were higher in games than practices (OR_{adj}=2.64, 95%CI=1.39,5.01). Also, odds

of a lower-extremity injury resulting in time loss were significantly higher in female players compared to male players (OR_{adj}=1.34, 95%CI=1.05,1.71), and in games compared to practices (OR_{adj}=2.19, 95%CI=1.72,2.80). Sex, event-type, and playing surface emerged as significant determinants of any time loss following lower-extremity injuries, as well as predictors of recovery duration.

CONCLUSIONS: Sex, injury setting, playing surface differentially determine injury severity and recovery. Future studies using multi-method, multivariable approaches may be used to identify determinants of lower-extremity injury severity in this context.

3849 Board #166 May 30 8:00 AM - 9:30 AM
Incidence, Mechanism, And Severity Of Game-related High School And College Football Hand Injuries
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 (Sponsor: Michael C. Meyers, PhD, FACSM)
 (No relevant relationships reported)

Injuries among high school and college football players are recorded on a game-by-game basis; however, the prevalence of hand injuries is often overlooked in lieu of more prominent football trauma. Presently, few football studies have been published comparing specific high school and college hand injuries. **PURPOSE:** To quantify the incidence, mechanism, and severity of specific game-related high school and college football hand injuries. **METHODS:** Hand injury cases were divided into two groups by level of play (high school, college), involving 783 FBS university and 1,921 high school games over 9 competitive seasons. Outcomes of interest included total and specific hand extremity, injury mechanism, and injury severity. Data were subject to multivariate analyses of variance (MANOVA) and Wilks' λ criteria using general linear model procedures. Injury incidence rate (IIR) was determined by the (number of injuries/number of team games) x 10. **RESULTS:** Of the 2,704 total games documented, a total of 270 hand injuries were reported with 167 (62.0%) occurring in college competition, and 103 (38.1%) in high school games. MANOVAs (Wilks' λ) indicated no significant main effect by total hand extremity ($F_{2,267} = 0.230$; $P = 0.876$), injury mechanism ($F_{2,263} = 1.203$; $P = 0.298$), and severity ($F_{2,267} = 1.572$; $P = 0.210$). Tests of between-subjects effects indicated no significant differences in IIRs of Boutonniere deformity ($F_{2,267} = 0.123$; $P = 0.726$), gamekeeper's thumb ($F_{2,267} = 0.124$; $P = 0.725$), or mallet finger ($F_{2,267} = 0.121$; $P = 0.505$). There was a trend, however, for greater IIRs of Boutonniere deformity [0.1 (95% CI, 0.0-0.2) vs 0.5 (95% CI, 0.4-0.7)], gamekeeper's thumb [0.3 (95% CI, 0.2-0.4) vs 1.1 (95% CI, 0.9-1.4)], and mallet finger [0.0 (95% CI, 0.0-0.1) vs 0.4 (95% CI, 0.3-0.6)] during high school play when compared to collegiate competition, respectively. Blocking (10.3 vs 14.8%) and tackling (8.8 vs 18.9%) were the primary mechanisms of injury in both high school and college, respectively. **CONCLUSION:** A substantial number of hand injuries were documented between high school and college games, which may ultimately lead to long-term articular compromise. Therefore, further studies are warranted to reduce predisposition of hand trauma at all levels of football competition.

3850 Board #167 May 30 8:00 AM - 9:30 AM
Use Of Two Screening Tools To Determine Injury Risk In Collegiate Acrobatics And Tumbling Athletes
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Participation in athletic teams, especially those that involve difficult stunts and acrobatic maneuvers increase the risk for injury. With this emerging sport and the skills needed to participate, it is important to identify those athletes at risk. Yet, it is unknown whether a functional screening or proprioceptive tool can be used to predict injury in this population. **PURPOSE:** To determine if compensatory movement patterns predispose acrobatics and tumbling athletes to injury, and to determine if a functional movement screening (FMS) and Lower Quarter Y Balance Test (LQ-YBT) could predict potential injury risk in the sport population. **METHODS:** 22 participants (age 19.25yrs \pm 0.91, height 161.97 \pm 7.03cm, weight 62.53 \pm 8.71kg) from one acrobatics and tumbling team were used in the study. All participants that volunteered for the study were current student-athletes at a NCAA DII institution on a NCATA recognized Acrobatics and Tumbling team. The participants were asked to complete the seven movement patterns and three clearing tests of the FMS along with the LQ-YBT test in three directions (anterior, posterolateral and posteromedial) for both limbs. A total of three practice trials were used. Screening data was gathered over a two-week period at the beginning of the season. A self-report demographic and injury questionnaire was also used. **RESULTS:** FMS score was 15.9 \pm 1.87, while the LQ-YBT was 98.36 \pm 11.63 for the right and 99.24 \pm 12.01 for the left. Cox Snell R^2 was used to determine the percentage of the variables used to fit the model. The best fit was for FMS Cut (≤ 14 , ≥ 15) and total accounted injury that produced a Cox Snell R^2 (0.342) with a significant OR=28.335 (95% CI, 4.29 to 561.997, $p=0.028$) for FMS Cut (≤ 14 , ≥ 15). Years of competition and total accounted injury with a Cox Snell R^2 (0.276) and a significant OR= 1.451 (95% CI, .980 to 2.149, $p=0.05$) for years of competition was a moderate fit. FMS Final, LQ-YBT (R) and (L) produced a Cox Snell R^2 (0.259) with

a non-significant FMS Final OR= 1.983 (95% CI 1.045 to 3.763, $p=.36$). All other results were not significant. **CONCLUSIONS:** Compensatory fundamental movement patterns, increased skill and years of competition can increase the risk of injury. A score of 14 or less on the FMS paired with a higher number of previous injuries resulted in a 28-fold increase in risk of injury

3851 Board #168 May 30 8:00 AM - 9:30 AM
Lower Suicide Risk In Former US Olympians
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 (No relevant relationships reported)

PURPOSE: To determine the suicide risk among Former US Olympians, according to their medal status and their sport, compared to the general population. **METHODS:** All female (n = 2,301) and male (n = 5,823) US athletes who participated in at least one summer or winter Olympic Games between 1912 and 2012 were followed until 2016 (the latest rates for specific mortality). Olympians' life statuses and causes of deaths were certified by the National Death Index and coded to the version of the International Classification of Diseases that was in effect at the time of their death. Intentional, self-inflicted deaths among Olympians were analyzed through the years lost/saved method accounting for their medal status and their sport. The model was adjusted by sex, age, and period, in relation to the general population. **RESULTS:** Overall 2,309 deaths occurred; the cause underlying 29 deaths was suicide (1 woman, 28 men). The cumulative probability of deaths for this cause was significantly lower among former US Olympians compared to the general population ($p = 2.6e-08$) for all ages between 20 and 90 years. The risk of death by suicide among former Olympians did not differ based on their medal status at the Olympics. Athletics, rowing, fencing, shooting, and swimming could be individually analyzed as each of these sports had more than 100 overall deaths. Olympians engaged in athletics, rowing, and swimming presented diminished suicide risk. Fencing displayed equivalent rates to the general population, and shooting had higher trends. However, limited power existed for significant statistical testing. **CONCLUSION:** Former US Olympians presented lower suicide risk compared to the general population, whether they were an Olympic medalist or not. The only sport presenting higher trends is shooting.

3852 Board #169 May 30 8:00 AM - 9:30 AM
Describing Red-s Outcomes And Potential Risk Factors In A National Cohort Of Ncaa Di Female Cross Country Runners
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PURPOSE: The purpose of this study was to assess the prevalence of self-reported Relative Energy Deficiency in Sport (RED-S) outcomes in National Collegiate Athletic Association (NCAA) Division One (DI) female cross country runners, and to describe environmental risk factors for RED-S. **METHODS:** This sample is composed of a nationally representative random sample of NCAA Division One (DI) collegiate female cross-country runners from the ongoing Female Athlete Study of Health Trajectories (FASHT) cohort (N=152), with 133 complete respondents and 29 partial respondents. Randomly selected athletes were emailed a web-based survey, including demographic information, individual and environmental risk factors, and the 10 physical health outcomes of the RED-S model. **RESULTS:** Preliminary results show that this sample is overwhelmingly White (91%, n=139), non-Hispanic (91%, n=138), with a "comfortable" financial background (61%, n=90), and a mean age of 20.6 (SD= 2.6) years. Of note, 62% (n=82) of athletes reported having at least one sport-related bone injury over their athletic career, 49% (n=65) reported any history of irregular menses and 15% (n=20) reported currently experiencing irregular menses. The burden of clinical mental health diagnosis in the population included Anxiety (25%, n=33), Depression (15%, n=20), and any Eating Disorder (14%, n=18). **CONCLUSIONS:** These results suggest that this population of collegiate female cross-country runners experience a high burden of physical and psychological health morbidities and have a significant need for focused prevention and intervention for RED-S. Importantly, forthcoming research will focus on associations between risk and outcomes to inform public health programming.

3853 Board #170 May 30 8:00 AM - 9:30 AM

Sport Participation And Sport-related Concussion Trends In High School Athletes

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(No relevant relationships reported)

Sport-related concussions (SRC) represent approximately 9% of high school athletic injuries. This high incidence has contributed to participation reduction, concussion legislation, and rule modifications. With these changes becoming more frequent, it is unknown if SRC trends are decreasing.

PURPOSE: To examine trends in contact sport participation and SRC clinical incidence in high school athletes during the 2015-16 to 2018-19 athletic seasons.

METHODS: A total of 724,784 athletes (male = 436,509; female = 288,275) participated on 15 sponsored teams in the state of Michigan during the 2015-16 to 2018-19 athletic seasons. Sport participation and diagnosed SRCs were reported by athletic trainers, coaches, or administrative officials using the Michigan High School Athletic Association Head Injury Reporting System. Clinical incidence was calculated for each sport by dividing the number of SRCs by the number of participants and is expressed per 100 athletes (95% CI). Linear regression was used to examine annual trends in participation and SRC clinical incidence for each sport. *aprior* < .05.

RESULTS: Football (144,708), boys' basketball (85,288), and girls' volleyball (76,950) had the highest sport participation. A total of 15,300 SRCs were reported yielding an overall clinical incidence of 2.11 (95% CI, 2.08-2.14) SRCs. Football (4.52 [95% CI, 4.41-4.62]), boys' ice hockey (3.51 [95% CI, 3.20-3.82]), and 8-person football (3.35 [95% CI, 2.85-3.85]) had the highest SRC clinical incidence. Trends in overall sport participation significantly decreased over time (-1983.0 athletes; *p*=.02). Only football yielded significant participation reduction (-1487.8 athletes; *p*=.01), while trends in 8-person football (182.8 athletes; *p*=.03) and boys' lacrosse (151.2 athletes; *p*=.03) increased. No significant trends were identified for overall SRC incidence (*p*=.14). Only girls' basketball had a significant reduction in SRC incidence (*p*=.04).

CONCLUSIONS: Contact sport participation, especially in football, may be decreasing due to concerns over athlete safety. With SRC incidence not declining, stakeholders should re-evaluate current initiatives to identify a more successful approach at reducing these injuries. Improving contact sport safety may then assist in increasing high school sport participation.

3854 Board #171 May 30 8:00 AM - 9:30 AM

Examining Acute Effects Of Concussion On The Child Scat5

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The Child Sport Concussion Assessment Tool 5th Edition (Child SCAT5) is recommended for the clinical assessment of concussion in children. To date, no studies have investigated how children perform on the Child SCAT5 acutely following concussion.

Purpose: We examined Child SCAT5 performance and symptom reporting among concussed middle school children assessed on the day of injury.

Methods: Certified Athletic Trainers diagnosed middle school student athletes (ages 11-13) with a sports-related concussion using the Child SCAT5 between 2017-2019. All assessments were administered on the day of injury ("day-of-concussion"). Day-of-concussion performance was compared to normative reference values derived from over 1,300 uninjured middle school athletes who underwent baseline, preseason Child SCAT5 assessments.

Results: There were 46 middle school student-athletes diagnosed with concussions [girls=17, boys=29, mean age=12.4±0.7]. The most commonly endorsed acute symptoms were: "I have a headache" (95.6%), followed by "I feel dizzy" (73.9%), and "I have problems remembering what people tell me" (63.0%). Middle school student-athletes day-of-concussion scores on the Child SCAT5 were: Total Symptoms (n=44, 10.4±5.9), Symptom Severity (n=44, 18.0±13.3), Immediate Memory (n=45, 13.0±2.6), Digits Backwards (n=45, 2.8±1.0), Concentration (n=45, 3.7±1.0), Total Balance (n=39, 8.5±5.9), Delayed Recall (n=44, 3.1±1.6), and Standardized Assessment of Concussion-Child Version (SAC-C n=44, 19.9±4.3). The mean number of total balance errors and the mean symptom severity scores were elevated relative to normative reference values.

Conclusion: Our results describe day-of-concussion Child SCAT5 scores in middle school children. The total symptom severity scores and total errors on the balance appeared to be most reflective of the acute effects of concussion. Further research is needed to establish the sensitivity and specificity of the Child SCAT5 to the acute effects of concussion in children.

3855 Board #172 May 30 8:00 AM - 9:30 AM

Physical Activity And Body Composition Of Women With Anterior Cruciate Ligament Reconstruction

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(No relevant relationships reported)

Women are 4 to 6 times more likely to sustain an anterior cruciate ligament (ACL) injury than men. Women with ACL reconstruction (ACLR) are also 2.36 times less likely to be active than healthy individuals. In addition to reductions in physical activity (PA), it has been reported that BMI remains elevated up to 2 years post-ACLR, but the effects of ACLR on body composition profiles following surgery is unclear.

PURPOSE: To compare PA engagement and body composition between women with ACLR and healthy controls. **METHODS:** Ten women with ACLR (less than 5yrs post-ACLR, age=21.4±3.8yrs, BMI=26.1±3.8kg/m²) and 10 healthy women (age=21.9±3.1yrs, BMI=21.8±2.5kg/m²) completed the Tegner Activity Scale to assess current PA level. Body fat percentage (%BF) was estimated using air displacement plethysmography. Objective PA was assessed using hip-worn accelerometers for 10 hours/day for 7 days and Freedson Adult VM3 cut points were used for PA data processing. Groups were compared using Mann-Whitney U tests due to limited sample size. Time (minutes/week) spent in moderate-to-vigorous PA (MVPA) and step count (steps/day) were compared between groups using a one-way ANCOVA with total wear time as a covariate. **RESULTS:** Women with ACLR had significantly higher %BF than controls (ACLR=32.7±6.7%, healthy=22.6±4.9%; *p*<0.01) and higher fat mass (ACLR=25.4±9.0kg, healthy=13.7±4.1kg; *p*<0.01). Healthy women participated in significantly more steps per day (ACLR=6650±3227 steps/day, healthy=9361±2626 steps/day; *p*=0.02) than women with ACLR, but no differences in MVPA time (ACLR=367.2±226.2 mins/week, healthy=448.9±164.0 mins/week; *p*=0.34) were observed. **CONCLUSIONS:** Women with ACLR engage in similar levels of MVPA compared to controls, but they may exhibit greater %BF and fat mass than women who have not experienced ACLR. Compared to controls, women with ACLR also have lower step counts, which is consistent with previous studies. Lack of PA, high %BF, and overweight status increase the risk of premature mortality and morbidity. Therefore, it is crucial to further assess these characteristics and determine potential interventions that would promote PA and maintenance of healthy body composition in the months following ACLR.

G-36 Free Communication/Poster - Diet and Obesity: Animal/Cell Models

Saturday, May 30, 2020, 8:00 AM - 10:30 AM
Room: CC-Exhibit Hall

3856 Board #173 May 30 9:00 AM - 10:30 AM

HIIT Improves Insulin Resistance In T2DM Mice By Regulating Lipid Metabolism In Skeletal Muscle

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(No relevant relationships reported)

Abnormal skeletal muscle lipid metabolism is associated with insulin resistance in people with type 2 diabetes. Recent studies have indicated that high-intensity interval training (HIIT) lowers blood glucose and improves insulin resistance in individuals with type 2 diabetes. However, the physical mechanism is largely unknown.

PURPOSE: This study aimed to investigate whether HIIT improves insulin resistance in T2DM mice by regulating lipid metabolism in skeletal muscle.

METHODS: Diabetic mice were randomly assigned to the diabetes group (T2DM, n=11) and the HIIT group (n=11), and age-matched wild type mice were assigned as the control group (CON, n=11). HIIT was performed on a motored mice treadmill at 15° inclination 5 days/week for 8 weeks. The mice were trained with a starting speed of 10m/min, where after HIIT consisted of 10 bouts of 4 min high-intensity treadmill running, interspersed by 2 min complete rest. The pace during HIIT was increased gradually from 16 to 26 m/min over eight weeks. The fasting blood glucose, glucose tolerance was measured one week before the end of the experiment, and the gastrocnemius muscles of mice were collected 36h after the last exercise. The fat content of skeletal muscle was detected by Oil Red O staining. Protein expression of ACC, HMGCR, Cpt-1α, and CD36 was measured with Western blot.

RESULTS: The fasting blood glucose was decreased in the HIIT mice when compared to that in the T2DM mice (17.6±0.72 vs. 19.8±0.74 mmol/L, *p*<0.01). Glucose tolerance and the area under the curve (3325±126.4 vs. 3737±38. mmol/L·min, *p*<0.01) were improved after HIIT treatment when compared to that in the T2DM mice. Skeletal muscle exhibited a substantial amount of lipid deposition in the T2DM

group, which was markedly alleviated in the HIIT group ($p < 0.05$). In the skeletal muscle, HIIT treated mice showed significantly decreased protein expression related to lipogenesis, including reductions in ACC (0.39-fold, $p < 0.01$) and HMGCR (0.52-fold, $p < 0.01$). Expectedly, the protein expression level of Cpt-1 α (1.6-fold, $p < 0.01$) and CD36 (1.78-fold, $p < 0.01$) was significantly enhanced by HIIT.

CONCLUSION: HIIT improves insulin resistance was, at least partly, through deduces lipogenesis and increases lipolysis in skeletal muscle in the T2DM mice.

3857 Board #174 May 30 9:00 AM - 10:30 AM
High-fat Diet Induces Nr4a3-dependent Decrease In Respiratory Capacity Of Mouse Soleus Muscle

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(No relevant relationships reported)

The Nuclear Hormone Receptor 4A family of genes have been observed to play a role in proper metabolic function in various tissues, including skeletal muscle.

PURPOSE: To analyze the effect of the Nr4a3 gene on respiratory capacity of mitochondria in skeletal muscle of mice on a normal or high fat diet.
METHODS: Nr4a3^{-/-} and WT mice were fed a normal chow (NC) or high fat diet (HF) for at least 20 weeks. After euthanasia, soleus muscle was harvested and wet weight was measured. Muscle fibers were teased apart and permeabilized with saponin in preparation for respirometry. Mitochondrial respiration was evaluated using an Oroboros Oxygraph Respirometer. Respiratory capacity comparisons were made with a two-way ANOVA and Tukey multiple comparison test.

RESULTS: Oxygen consumption is reported as pmol/(s*mg wet tissue) and statistics are represented as mean \pm SEM. In the WT male mice there was a decrease in coupled complex I supported respiration in HF vs. NC diet (25.9 \pm 7.3 vs. 64.5 \pm 5.0, $p = 0.004$). In the HF WT group there was also a decrease in coupled complex I and II supported respiration (57.2 \pm 13.4 vs. 102.5 \pm 7.0, $p = 0.0005$) and uncoupled respiration (61.4 \pm 15.0 vs. 107.8 \pm 7.1, $p = 0.0004$) compared to NC WT. In female mice there was also a decrease between HF WT and NC WT in complex I (28.2 \pm 3.7 vs. 57.4 \pm 5.7, $p = 0.0005$) and complex I and II (78.2 \pm 6.1 vs. 108.8 \pm 6.7, $p = 0.0003$) supported respiration as well as in uncoupled respiration (87.1 \pm 7.1 vs. 119.4 \pm 8.9, $p = 0.0001$). However, there was no significant difference between the WT NC mice and either of the Nr4a3^{-/-} groups. Coupled complex I, complex I and II and uncoupled respiration states in both Nr4a3^{-/-} groups were not significantly different from WT.

CONCLUSIONS: The Nr4a3 gene plays a role in mitochondrial function in mouse skeletal muscle. Feeding mice a high fat diet impairs proper mitochondrial function in muscle when compared to a normal chow diet. The decrease in respiration from the HF diet is dependent upon the function of the Nr4a3 gene, as no decrease was observed in Nr4a3^{-/-} mice. A limitation of this study is that this effect could be due to the lack of Nr4a3 in the skeletal muscle, or a secondary effect of lacking the gene in other parts of the body.

3858 Board #175 May 30 9:00 AM - 10:30 AM
Transcutaneous Carbon Dioxide Attenuates Impaired Muscle Atrophy And Glucose Metabolism In The Spontaneously Diabetic Rat

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(No relevant relationships reported)

PURPOSE: Diabetes has been known to result in attenuated growth and atrophy in skeletal muscle. Recently, it has been reported the Carbon dioxide (CO₂) exposure leads to an increase of muscle mass in normal rats. Therefore, the aim of the present study was to investigate the effects of transcutaneous CO₂ exposure with the hydrogel (eCO₂GEL) on diabetic-associated muscle atrophy.

METHODS: Male Goto-Kakizaki (GK) rats were divided into control (GK) and CO₂ exposure (CO₂) groups and male Wistar rats used as a non-diabetic control. The hair on the lower limbs was shaved and the hydrogel (eCO₂GEL), which can increase the absorption of CO₂ from skin, was applied. The CO₂ adaptor was attached to the limbs and sealed, and CO₂ gas was administered into the adaptor for 30 min. The CO₂ exposure was performed everyday for 8 weeks.

RESULTS: The muscle weights of soleus and tibialis anterior in the GK group decreased compared with those of the control group. CO₂ exposure attenuated decreased muscle weights in diabetes-associated muscles ($P < 0.05$). In addition, the level of HbA_{1c} and fasting blood glucose were decreased by CO₂ exposure compared with non-CO₂ exposure condition ($P < 0.05$). Furthermore, the level of LDL cholesterol in the CO₂ exposure group was significantly decreased compared with the GK group ($P < 0.05$).

CONCLUSIONS: These results indicate that the transcutaneous CO₂ exposure may have a therapeutic potential for diabetic-associated muscle atrophy. This amelioration may associate with improved glucose metabolism in skeletal muscle.

3859 Board #176 May 30 9:00 AM - 10:30 AM
Enterococcus Faecium Strain R30 Attenuates Capillary Regression In Type 2 Diabetic Muscle

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It is widely accepted that diabetes affects the peripheral vascular bed. We found that *Enterococcus faecium* strain R30 (R30) supplementation caused increased velocity of red blood cells in capillaries of skeletal muscle. **PURPOSE:** We determined the effects of R30 supplementation on the three-dimensional capillary structure in the soleus muscle of Goto-Kakizaki (GK) diabetic rats. R30 supplementation was chosen, because it may be beneficial in management of skeletal muscle and to be safe for individuals with cardiovascular complications such as those associated with diabetes. **METHODS:** Thirty-six male (Wistar or GK) rats were assigned randomly either to a control (Con), control with R30 supplementation (Con+R30), diabetes (GK) or diabetes with R30 supplementation (GK+R30) group for 8 weeks. The capillaries of soleus muscle were stained with alkaline phosphatase. In addition, the three-dimensional capillary network of soleus muscle was visualized using a confocal laser scanning technique, and the capillary volume and diameter were measured. **RESULTS:** The blood glucose levels were higher in the GK and GK+R30 groups than in the Con and Con+R30 groups. There were no significant differences in the capillary-to-fiber ratio between the Con and GK+R30 although the ratio was lower in the GK group than in the Con group. The capillary volume and diameter in the muscle of GK group were lower than those in Con group. Meanwhile, R30 supplementation attenuated the decrease of capillary volume and diameter in diabetic muscle. **CONCLUSION:** These data suggest that R30 supplementation may be an effective treatment to counter the detrimental effects of type 2 diabetic complications in skeletal muscle.

3860 Board #177 May 30 9:00 AM - 10:30 AM
Aerobic Exercise Counteracts Mitochondrial Dysfunction In The Insulin Resistant Brain

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Insulin resistance (IR) increases the risk for Alzheimer's disease and other dementias; however, the underpinning mechanisms for this increased risk remain to be fully defined. Impaired mitochondrial function is one component contributing to cognitive impairment. **PURPOSE:** As insulin resistance impairs mitochondrial oxidative metabolism and increases reactive oxygen species (ROS) in skeletal muscle, we considered whether similar events occur in the brain, which like muscle is rich in insulin receptors and mitochondria. Further, we sought to determine whether aerobic exercise (AE) could prevent the hypothesized deficits in mitochondrial function accompanying diet-induced IR. **METHODS:** 12-week-old, male, C57BL6 mice were fed a standard (Chow) or high fat diet (HFD) (60% kcal from fat) for four-weeks and provided access to running wheels (EX) or sedentary (SED) conditions (n = 9-10 per group). Following treatment, mitochondria were freshly isolated from the cerebrum to assess mitochondrial respiration, ROS production, and ATP production. Insulin resistance was determined *ex-vivo* in the hippocampus by the ability of insulin to stimulate AKT-phosphorylation, mtDNA copy number, mRNA expression, and proteomic measurements were performed on isolated hippocampal tissue. **RESULTS:** HFD induced hippocampal insulin resistance ($p < 0.001$), which was corrected by AE. HFD decreased ATP production 12% ($p = 0.01$) and increased ROS emission 79% ($p < 0.01$) in isolated cerebral mitochondria, which were rescued with AE. Impairments in mitochondrial function with HFD were paralleled by reductions in mtDNA copy number (1.00 \pm 0.06 vs 0.85 \pm 0.06; $p = 0.02$) and mRNA expression of mitochondrial genes, such as PGC1 α 1 (1.00 \pm 0.05 vs 0.78 \pm 0.07; $p = 0.03$) and TFAM (1.00 \pm 0.08 vs 0.62 \pm 0.11; $p = 0.03$), which were corrected by AE. Proteomic analysis of the hippocampus showed that HFD led to oxidative post-translational modifications (PTMs) to 17 mitochondrial proteins (corrected p -value ≤ 0.05 and absolute log₂ fold change ≥ 0.5); however, this increase in oxidative PTMs to mitochondrial proteins with HFD was almost completely reversed by AE. **CONCLUSIONS:** HFD induces IR in the cerebrum and hippocampus, which associates with mitochondrial dysfunction. Brain IR and mitochondrial dysfunction accompanying HFD are prevented with AE.

3861 Board #178 May 30 9:00 AM - 10:30 AM
A High-fat Diet Causes Nr4a3-dependent Changes In Mitochondrial Respiration In Mouse Liver
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 (No relevant relationships reported)

PURPOSE: To determine the role of the Nr4a3 gene in mitochondrial respiration in mouse liver, as well as how its role changes in obesity-induced diabetes (OID).
METHODS: This study was designed using Nr4a3^{+/+} (WT) and Nr4a3^{-/-} (KO) mice that were fed a normal chow (NC) or a high-fat (HF) diet from the age of 4 weeks to ~24 weeks. Mitochondrial respiration was measured in liver tissue using high-resolution respirometry. Mitochondrial health was assessed by stimulating the different complexes of the electron-transport chain: glutamate, malate and ADP (complex I), cytochrome c (membrane integrity), succinate (complex II), FCCP (uncoupled respiration), and antimycin A (background respiration). Data were analyzed using a two-way ANOVA followed by a Tukey Multiple Comparisons Test.
RESULTS: Oxygen consumption is reported as pmol/(s*mg wet tissue) and statistics are represented as mean ± SEM. In female WT mice, uncoupled maximal respiration was increased by a HF diet compared to NC (141.0 ± 9.8 vs. 95.3 ± 12.3, p<0.001). This increase was absent in KO mice, which indicates that Nr4a3 may be partially responsible for the increase in respiration in HF WT female mice. In males this trend was reversed, with a decrease in coupled complex I and II respiration in HF WT vs. NC WT (69.6 ± 5.1 vs. 98.7 ± 6.3, p<0.05), but an increase in HF KO vs. NC WT (control) (122.3 ± 8.3 vs. 98.7 ± 6.3, p<0.01). In an uncoupled state, HF KO was greater than NC WT (control) (129.2 ± 8.4 vs. 103.7 ± 7.8, p<0.001). No difference was observed between NC WT and HF WT. This indicates that the Nr4a3 gene plays a role in suppressing respiration when male mice are fed a HF diet.
CONCLUSIONS: This study shows that OID caused an Nr4a3-dependent increase in respiration in females, and an Nr4a3-dependent reduction in respiration in males. As part of this study, muscle, kidney and adipose respiration are also being investigated, as well as glucose-stimulated insulin secretion of the pancreatic beta-cells. It is unclear if the observed changes here are due to a direct effect of knocking out Nr4a3 in the liver, or to a secondary effect because of the full-body KO. Therefore, further investigation is warranted.

3862 Board #179 May 30 9:00 AM - 10:30 AM
Effects Of Hypoxic Training On Gdnf In The Cortex Of Obese Rats
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Glial cell-derived neurotrophic factor (GDNF) is an important indicator that represent the function of nervous system. Exercise and hypoxic environment both can reduce weight and improve nervous system function in obese rats. But the mechanism by which hypoxic training affects the nervous system is unclear.
PURPOSE: To determine the potential mechanisms of hypoxic training on GDNF in the cortex of obese rats. **METHODS:** Forty SD obese rats were assigned into one of the following groups (n=10 each): normal oxygen control group (NC), normal oxygen training group (NT), hypoxic control group (HC) and hypoxic training group (HT). Rats were kept continuous exercise 1 hour per day, 6 days per week for 4 weeks on a rat treadmill at a speed of 25 m/min in normoxic conditions or 20 m/min in hypoxic conditions (13.6% O₂). After 4 weeks, the expressions of GDNF in the cortex were detected by quantitative fluorescent PCR and Western blotting. The level of inflammatory cytokine interleukin 1β (IL-1β) and interleukin 6 (IL-6) in the cortex were measured by ELISA. The phosphorylation of ERK1/2 and JNK of cortex were detected by Western blotting. **RESULTS:** 1) The results of qPCR showed that the expression of GDNF in the cortex of HT were higher than NT and HC (2.75±0.69 vs. 1.66±0.88 and 1.06±0.45, p<0.05). 2) The results of Western blotting showed that the expression of GDNF in the cortex of HT were higher than NT and HC (489±23.58 vs. 337±46.22 and 387±36.98, p<0.05). 3) The results of phosphorylation of ERK1/2 and JNK showed that the ratio of ERK1/2 and JNK to β-actin integral optical density in the cortex showed no significant difference in all groups (p>0.05), while compared with NC, the ratio of p-ERK1/2 to ERK1/2 and p-JNK to JNK integral optical density in HC, NT and HT were significantly increased (P < 0.05, P < 0.05, P < 0.01). 4) The results of ELISA showed that IL-1β and IL-6 serum levels in HC, NT and HT were decreased compared with NC (19.28±1.41, 19.99±1.26 and 17.8±1.5 vs. 27.15±2.27, p<0.01; 53.82±2.54, 57.53±1.96 and 52.22±1.4 vs. 66.87±2.73, p<0.01). **CONCLUSION:** Hypoxic training can increase the expression of GDNF in the cortex of obese rats and improve the function of the central nervous system. Its mechanisms may relate to the activation of ERK1/2 and JNK signaling pathways and inhibit inflammatory cytokine IL-1β and IL-6 level in the cortex.

3863 Board #180 May 30 9:00 AM - 10:30 AM
The Role Of Cd36 In Relieving Lipotoxicity Of Skeletal Muscle Cells In High Free Fatty Acid Environment.
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PURPOSE: Lipotoxicity is closely related to the etiology and complications of type 2 diabetes mellitus (T2DM). Lipotoxicity in muscle cells induces insulin resistance, which is a key factor in the pathogenesis of T2DM. This study investigated the protective effect of Fatty Acid Translocase (FAT/CD36) against palmitic acid (PA)-induced lipoapoptosis.
METHODS: Cells at ~40-60% confluence were transfected with siCtrl or siCD36 for overnight using Lipofectamine RNAiMAX. Cells were treated with PA at 200μM for 16 h. The PA-induced viability in C2C12 cells was measured by MTT assay; the PA-induced apoptosis in C2C12 cells was monitored by flow cytometry. The differences in means were analyzed by t test.
RESULTS: PA treatment increased apoptosis (7.50% ± 0.21% vs. 10.40% ± 1.25%, p < 0.05) and decreased viability (100% ± 2.40% vs. 97.32% ± 3.60%, p < 0.05) in C2C12 cells in contrast to cells that were treated with PA-free media. After 16 h of PA treatment without CD36 protection, C2C12 cells had a significant increase in apoptosis when treated with siCD36 transfection, in contrast to cells that were negative control siRNA transfected (10.40% ± 1.25% vs. 16.04% ± 1.58%, p < 0.05), indicating that the existence of CD36 may protect high PA-induced lipoapoptosis by increasing cell uptake of FFA. Further statistical analysis confirmed a significant increase in the percentage of apoptotic cells both in early stage and late stage when subjected to CD36 deficiency (7.93% ± 0.57% vs. 10.70% ± 1.55%, p < 0.05; 2.47% ± 0.68% vs. 5.34% ± 0.06%, p < 0.05, respectively).
CONCLUSIONS: This study demonstrated a novel function of CD36 in preventing lipotoxicity in skeletal muscle cells when subject to high FFA environment, implicating a promising target for obesity and diabetic therapy.

3864 Board #181 May 30 9:00 AM - 10:30 AM
Beta-blocker Effects On The Adipose Tissue Of Trained Rats
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Hypertension afflicts about 40% of the world population. Among the most important causes for high blood pressure are obesity and lack of physical activity. Evidences show that weight control and physical activity are effective in reducing blood pressure, associated or not to pharmacological strategies. One of the most common class of drugs used is the β-blockers that may act exclusively on adrenergic receptors β1 (heart) or on all β adrenergic receptors. The same receptors are present on the adipose tissue making lipolysis possible, and thus, weight loss.
PURPOSE to evaluate if cardio selective and non-selective β blockers may interfere with the body composition (fat) of trained rats. **METHODS** Adults Wistar rats, initial weight between 200-400g, were randomly distributed in three groups: non-treated (control), atenolol and propranolol treated groups. The drugs or water were given via oral gavage in the morning, before the training session. After six-weeks of training in a swimming pool system, the animals were euthanized and blood, liver, gastrocnemius muscle, and epididymal, mesenteric and retroperitoneal adipose tissues were removed for biochemical and fat content analysis. **RESULTS** Although randomly assigned, animals in the propranolol group had an initial weight significantly smaller than the control group (296.4g ± 15.25 x 250.5g ± 7.8, p<0.05), however from 4th week and on, animals treated with the non-selective β-blocker significantly gained weight when compared to their initial weight (250.5g ± 7.82 x 285.6g ± 7.8, week 1 x week 6, p<0.05). The animals treated with propranolol had a significant reduction in the amount of 14C-oleate incorporated in their carcass and adipose tissues when compared to the other two groups (p<0.05), as well as higher insulin (p<0.05). Propranolol-treated animals also tended to have higher levels of glucose and free fatty acids in their blood, and less glycogen in their muscle. **CONCLUSION** A non-selective β-blocker such as propranolol may not be the best course of action to treat people with high blood pressure who most of the time need to lose weight. These drugs seem to cause insulin resistance leading to high glucose levels in the blood, as well as lower activity of lipolytic enzymes. Cardio selective drugs, such as atenolol, may seem better for not causing similar side effects.

3865 Board #182 May 30 9:00 AM - 10:30 AM

Exercise Attenuates Weight Gain And Modulates Satiety Hormones In Female MiceCandace Rae Longoria, Paul J. Wisniewski, Robert A. Dowden, Natasha Malonza, Sara C. Campbell, FACSM. *Rutgers University, New Brunswick, NJ.* (Sponsor: Sara Campbell, FACSM)*(No relevant relationships reported)*

Exercise contributes to both caloric expenditure and nutrient partitioning. We have shown that lean sedentary (LS) male mice had lower levels of insulin and Interleukin-6 (IL-6) when compared to their high-fat fed sedentary (HFS) counterparts. Further, both exercise groups, lean (LX) and high-fat fed (HFX) demonstrated lower ghrelin, a hormone that regulates appetite and energy homeostasis levels compared to their sedentary counterparts. However, there is little work done in understanding the female response to blood biomarkers and exercise. **PURPOSE:** Therefore, the purpose of this study was to replicate our previous study in female mice to ascertain which biomarkers are similar across gender, and further evaluate any potential differences. We hypothesized that female mice would have a similar inflammatory biomarkers response as males, but a different hormonal profile. **METHODS:** Thirty-six, 6-week old C57BL/6NTac female mice were fed a normal or high-fat diet for 12-weeks and randomly assigned to exercise or sedentary groups. After 12 weeks animals were sacrificed, and blood was collected for metabolic hormone analysis using a magnetic bead-based multi-analyte panel. A total of seven biomarkers were analyzed including: insulin, peptide-YY (PYY), ghrelin, amylin, IL-6, tumor necrosis factor alpha (TNF- α), and pancreatic polypeptide (PP). **RESULTS:** HFS female mice had the highest body weight, kcal intake per day and percent weight increase compared to all other groups ($p < 0.05$). Exercise attenuated the body weight gain in HF-fed mice (24.7g vs. 30.3g). Exercised groups had significant decreases in levels of insulin (1286.925 pg/ml, 2819.299 pg/ml; $p = 0.021$) and amylin (67.233 pg/ml, 95.048 pg/ml; $p = 0.009$), and increased levels of PYY (18.840 pg/ml, 61.688 pg/ml; $p = 0.031$) compared to sedentary groups. Groups fed HF diets also had increased levels of PYY (64.673 pg/ml, 15.978 pg/ml; $p = 0.018$) compared to normal diet groups. **CONCLUSION:** Exercise attenuates body weight gain and the rise in insulin in mice fed high fat diet and this is consistent between genders. Further, appetite/glucose regulating hormones like amylin and PYY are significantly altered in females but display different responses in males. This continues to add to the exciting story of metabolic differences between males and females.

3866 Board #183 May 30 9:00 AM - 10:30 AM

Effects Of Exercise On The Expression Of Kiss-1/GPR54 In Testis Of High-fat Diet Rats In Growth PhaseJUNPENG FENG, YI YAN. *BEIJING SPORT UNIVERSITY, BEIJING, China.*

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(No relevant relationships reported)

PURPOSE: To explore the effect of exercise on localization and expression of KISS-1 and GPR54 in the growth period (PND 21st to 56th day) of high-fat diet rat testes. **METHODS:** 21D old weanling rats were randomly divided into group HC ($n = 32$) and group HE ($n = 32$). HE group took 5-weeks trained (60-70% vVO_{2max} , 1h/day, 5days/week). Groups HC and HE were fed with high-fat feed, which was purchased from Beijing Huafukang Biotechnology Co. Ltd. (LOT No: D12451). The rats of two groups were killed on the 21st D, 35th D, 43rd D, and 56th D old. The localization, mRNA expression and protein expression of KISS-1/GPR54 in the testis of each group were tested. **RESULTS:** The high-fat diet intervention resulted in a decrease in testicular index from pre-puberty ($p < 0.05$); testicular tissue testosterone decreased significantly from prepuberty ($p < 0.01$), and endocrine function was impaired; rat testicular tissue structure was loose, and the number of mature sperm decreased. The high-fat diet intervention had no significant effect on the localization of KISS-1/GPR54 system in rat testis, but affected the expression of KISS-1/GPR54 in rat testis and down-regulated the expression of KISS-1 protein ($p < 0.01$). Exercise intervention can improve testicular development in rats with high-fat diet, especially to improve sex hormone disorders caused by high-fat diet. Under exercise intervention, the testicular tissue testosterone decline caused by high-fat diet was improved ($p < 0.05$). Comparing with HC group, the expression of GPR54 protein increased significantly ($p < 0.01$), but the KISS-1 protein expression had no obvious change ($p > 0.05$). **CONCLUSION:** High-fat diet can inhibit the testicular development of male rats in the growth phase, and can also down-regulate the protein and gene expression levels of KISS-1/GPR54 system in testis tissue, and change the expression of KISS-1/GPR54 system, and its role needs further study. 60-70% VO_{2max} moderate-intensity aerobic exercise change the inhibitory effect of high-fat diet on testicular development in male rats, and up-regulate KISS-1/GPR54 in prepubertal stage and whether KISS-1/GPR54 in testicular tissue participates in its regulation remains to be further study.

3867 Board #184 May 30 9:00 AM - 10:30 AM

Western Diet And Exercise Training Increase Mitochondrial Lipid Respiration In Male But Not Female MiceErin M. McGowan, Sarah E. Ehrlicher, Harrison D. Stierwalt, Sean A. Newsom, Matthew M. Robinson. *Oregon State University, Corvallis, OR.*

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(No relevant relationships reported)

High-fat feeding in mice is a common model to investigate mitochondrial lipid metabolism during diet-induced obesity. Our previous work demonstrates 60% high-fat diet stimulates mitochondrial lipid respiration yet such fat content is higher than a typical western diet (~35% fat with higher sugar). Aerobic exercise training also stimulates mitochondrial lipid respiration, but the interaction with western diet is not clear. **PURPOSE:** We determined mitochondrial oxidative function in response to western diet in the absence and presence of concurrent exercise training. We hypothesized western diet would induce greater mitochondrial lipid respiration that would be further enhanced with exercise training. **METHODS:** Male and female C57BL/6J mice ($n = 5-7$ per group for each sex) ate either western diet (WD) or low-fat diet (LFD) for 4 weeks, with a group of WD mice randomized to perform concurrent treadmill training (WD+Ex). At week 4, dual-energy x-ray absorptiometry was used to measure body composition and in-vivo substrate oxidation was assessed using metabolic cage indirect calorimetry. Ex-vivo mitochondrial oxidation was measured via high-resolution respirometry using isolated mitochondria from quadriceps muscles collected 36-hours after final exercise session (or rest). Respiration protocols included lipid (octanoyl-carnitine+malate) and non-lipid (glutamate+succinate) substrates. **RESULTS:** Among sedentary mice, WD had higher body weight and fat mass than LFD ($P < 0.0001$), but only in males. WD had lower in-cage respiratory exchange ratio than LFD ($P < 0.05$) regardless of sex, indicating greater whole-body reliance on lipids. In males, WD+Ex stimulated mitochondrial lipid respiration more so than WD alone ($P < 0.05$). Females had no significant changes in mitochondrial lipid respiration. Non-lipid supported mitochondrial respiration was not significantly altered by WD or WD+Ex regardless of sex. **CONCLUSION:** In agreement with our hypothesis, WD stimulated lipid-specific mitochondrial respiration that further increased with Ex, but only in male mice. There were apparent sex differences such that females were protected against WD-induced weight gain alongside limited changes in mitochondrial lipid respiration.

3868 Board #185 May 30 9:00 AM - 10:30 AM

Genetic Deletion Of MicroRNA-16 In Muscle Results In Impaired Insulin Sensitivity & Exercise CapacitySeongkyun Lim, Megan Rosa-Caldwell, Wesely Haynie, David Lee, Tyrone Washington, Nicholas Greene, FACSM. *University of Arkansas, Fayetteville, AR.* (Sponsor: Nicholas P. Greene, FACSM)*(No relevant relationships reported)*

Type 2 diabetes mellitus (T2DM) has become the most common metabolic disease in Western society, leading to significant health problems and financial burdens. Numerous researchers have investigated different therapeutics to target T2DM, but the underlying molecular mechanisms are still not completely understood. Our laboratory and others have demonstrated consistent downregulation of the microRNA-16 (miR-16) in skeletal muscle across human, rodent, and tissue culture models of T2DM. **PURPOSE:** To investigate how deletion of miR-16 gene affects insulin sensitivity and exercise capacity during insulin resistance. **METHODS:** 10 wildtype (WT) and 12 muscle miR-16 knockout (KO) male mice were used for this study. At 9 wks of age, bodyweight, graded exercise test (GXT), glucose tolerance test (GTT; at 0, 30, 60, and 120 min) and insulin tolerance test (ITT; at 0, 15, 30, and 60 min) were measured. At 10 wks of age, half of the mice were given high-fat diet (HFD; 45% calories from fat) to induce insulin resistance, while the remainder were fed normal chow (NC; 17% calories from fat). At 13 wks, bodyweight, GXT, GTT, and ITT were repeated to examine the effect of HFD on miR-16 KO condition. Data were analyzed by two-way ANOVA and significance was denoted at $p < 0.05$. **RESULTS:** Bodyweight was increased by ~27% in WT HFD ($p < 0.05$) and ~21% in KO HFD group ($p < 0.05$) compared to WT NC group. Exercise capacity was decreased by ~46% in WT HFD, ~34% in KO NC, and ~153% in KO HFD group ($p < 0.001$) compared to WT NC group. GTT area under the curve (AUC) value was ~15% greater in WT HFD ($p < 0.05$) and ~20% greater in KO HFD group ($p < 0.05$) compared to WT NC group. ITT curve data indicated that glucose level was ~41% greater at 15 min in KO HFD ($p < 0.05$) compared to WT NC group. **CONCLUSION:** These data suggest prior observations of downregulated muscle miR-16 in human and animal models of T2DM may in part mediate impaired insulin sensitivity and exercise tolerance. Further research is warranted to elucidate molecular mechanisms of miR-16 and its potential role in insulin resistance. **ACKNOWLEDGEMENTS:** This study was funded by the Arkansas Bioscience Institute and American College of Sports Medicine Research Endowment Grant.

3869 Board #186 May 30 9:00 AM - 10:30 AM
The Role Of COX2 In The Regulation Of Brown Adipose Tissue In Obesity By Aerobic Exercise

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(No relevant relationships reported)

PURPOSE: The aim was to explore the regulation mechanism of aerobic exercise on brown adipose tissue (BAT) in obese mice and the role of COX2.

METHODS: The mice were randomly divided into the control group (C, normal diet), obesity group (H, high-fat diet to establish obesity model) and the obesity exercise group (HE, high-fat diet and medium intensity treadmill training). Blood lipid and glucose were detected after 4 weeks. Differentially expression genes in scapula BAT were determined by mRNA expression profiles, and functional annotation and signal pathway enrichment were carried out. COX2 (VEGF signaling pathway) involved in key biological processes (BP) and pathway. ADR β 3 agonist Isoprenaline (activating VEGF pathway) and NS-398 (COX2 inhibitor) were used, and the distribution of lipid droplets, the glycerol level, and the expression of mRNA and protein in VEGF pathway in brown adipocytes were detected.

RESULTS: High-fat diet could induce obesity, accompanied by increased blood glucose and lipid levels (2.03 \pm 0.09 vs. 4.54 \pm 0.3), reducing UCPI levels (1 vs. 0.71 \pm 0.1) in BAT. Aerobic exercise could significantly reduce the obese mice weight (C: 26.21 \pm 0.57; H: 27.53 \pm 0.61; HE: 26.32 \pm 0.52) and blood glucose levels (C: 8.5 \pm 0.78; H: 10.22 \pm 1.77; HE: 8.25 \pm 1.33). The BP of up-regulated genes in group H/C were mainly enriched in immune system progression, inflammatory and immune response, down-regulated genes were lipid metabolism and oxidation reduction. The up-regulated genes in group HE/H were enriched in glycolipid metabolism, while the down-regulated genes were cell death and apoptosis. VEGF signaling pathway plays an important role in this process, and COX2 in the VEGF pathway played a central role by interaction analysis. Application of Isoprenaline could increase the glycerol level (12.8 \pm 1.38 vs. 31.27 \pm 3.49) and the protein expression of VEGFa (1 vs. 1.34 \pm 0.12), COX2 (1 vs. 1.49 \pm 0.22) and UCPI (1 vs. 1.27 \pm 0.18); Simultaneous application of NS-398 could inhibit the protein expression of COX2 and UCPI in brown adipocytes.

CONCLUSIONS: Obesity could lead to disorder of glycolipid metabolism and inflammation of BAT. Aerobic exercise could activate BAT activity through VEGF-COX2 pathway to reduce adverse effects of obesity. Funded by FRF for the Central Universities of China (2018GJ017)

3870 Board #187 May 30 9:00 AM - 10:30 AM
Mict Improves Fgf21 And Klb Expression Better Than Hiit In Obese Mice

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(No relevant relationships reported)

(No relevant relationships reported) **Background:** Fibroblast growth factor 21 (FGF21), a key factor to prevent and treat overweight and obesity, regulates glucose, lipid, and energy metabolism. Besides, FGF21 needs β -Klotho (KLB) as a co-receptor to combine with the FGF receptor (FGFR) effectively and inter the target cell. However, it is unclear what condition promotes FGF21 and KLB expression in different tissue. **Purpose:** The goal of this preliminary study is to explore FGF21 and KLB expression related to two forms of exercise: moderate-intensity continuous training (MICT) and high-intensity interval training (HIIT) **Methods:** Mice were randomly divided into four groups (n=8 per group): MICT, HIIT, sedentary lifestyle (SED), and control (CON). Three groups, MICT, HIIT, and SED were fed on the high-fat diet (HFD) to induce obesity and CON was fed on the standard chow (Con) for 12 weeks. Exercise was performed on a motorized treadmill for further eight weeks and the diet continued in each group. **Results and Discussions:** (1) In mRNA level, MICT was more effective than HIIT in promoting FGF21 and KLB expression in liver (fgf21: 12.44 \pm 3.95 vs. 0.91 \pm 1.09, p <0.01; klb: 5.17 \pm 3.54 vs. 0.225 \pm 0.10, p <0.01), brown adipose tissue (BAT) (fgf21: 96.37 \pm 29.72 vs. 58.30 \pm 21.73, p <0.05; klb: 12.33 \pm 5.20 vs. 0.32 \pm 0.20, p <0.01), and muscle (fgf21: 10.17 \pm 5.81 vs. 5.49 \pm 9.09, p >0.05; klb: 42.83 \pm 19.07 vs. 10.33 \pm 14.50, p <0.01); (2) In protein level, MICT was more effective than HIIT in promoting FGF21 and KLB expression in liver (fgf21: 1.63 \pm 0.31 vs. 1.31 \pm 0.27, p >0.05; klb: 3.51 \pm 0.58 vs. 1.63 \pm 0.32, p <0.01), BAT (fgf21: 3.35 \pm 0.32 vs. 1.42 \pm 0.27, p <0.05; klb: 2.34 \pm 0.50 vs. 0.74 \pm 0.25, p <0.01), and muscle (fgf21: 1.32 \pm 0.12 vs. 0.72 \pm 0.12, p <0.05; klb: 2.17 \pm 0.12 vs. 1.46 \pm 0.06, p <0.01). **Conclusion:** MICT improves FGF21 and KLB expression in the liver, BAT, and muscle better than HIIT in obese mice.

3871 Board #188 May 30 9:00 AM - 10:30 AM
LIRAGLUTIDE AND PHYSICAL ACTIVITY EFFECTS IN ADIPOCITE TISSUE OF MICE OBESE

Aline de Freitas Brito¹, CYBELLE DE ARRUDA NAVARRO SILVA², Hellen Christina De Belmont Sabino³, Fabiano Ferreira de Lima¹, Igor Henriques Fortunato¹, Rinaldo Silvino dos Santos¹, Telma Maria Araújo Moura Lemos⁴. ¹University of Pernambuco, Recife, Brazil. ²UNIFACISA - Centro Universitário, Campina Grande, Brazil. ³UNIPÊ - Centro Universitário de João Pessoa, João Pessoa, Brazil. ⁴Federal University of Rio Grande do Norte, Natal, Brazil.
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(No relevant relationships reported)

PURPOSE: evaluating the effects of Liraglutide over the adipose tissue of Swiss mice subjugated to a cafeteria diet and physical activity, through swimming. **METHODS:** approved by the Ethics in Animal Use of UFRN (n. 003/2014). We have divided 74 animals (Swiss mice) into two phases: the initial phase had a pilot study (n=10) subdivided into the control group (PCON) (n=5) and the cafeteria group (PCAF) (n=5), to evaluate an attractive cafeteria diet to the animals taste, that would result in an increase of body weight. After the diet's introduction, the animals were weighed, euthanized, and had their intra-abdominal adiposity measured. The menu offered to the group PCAF was deemed attractive to taste and chosen for the development of the research. After, 64 animals were subdivided into two groups: the Cafeteria Base Study Group (EBCAF), further subdivided: cafeteria+exercise+liraglutide (CEL) (n=8), cafeteria+exercise+saline (CES) (N=8), cafeteria+liraglutide (CL) (n=8), and cafeteria+saline (CS) (n=8). And the Chow Base Study Group (EBR), that was further subdivided: exercise+liraglutide (EL) (n=8), exercise+saline (ES) (n=8), liraglutide (L) (n=8), and saline solution (SS) (n=8). All the animals were put through a cafeteria diet, following the physical activity with swimming and treating them with testing substances intraperitoneally (200 μ g/mL/kg). **RESULTS:** In the pilot study, the type of food did not significantly affect the increase in weight gain (PCAF = 47.38 \pm 0.70 vs. PCON = 46.48 \pm 1.08). However, it changed considerably the increase of intraabdominal adipose tissue: CAF = 0.74 \pm 0.05 vs. CON = 0.44 \pm 0.08 g (p < 0.05). The base study of the research showed that the treatment with liraglutide associated with physical activity when compared to saline had a significant reduction in the mass of adipose tissue: CEL-0.32 \pm 0.03 vs. CES-0.48 \pm 0.05 g; CL-0.41 \pm 0.09 vs. CS-0.76 \pm 0.09 g; L-0.24 \pm 0.04 vs. SS-0.52 \pm 0.08 g e CEL-0.32 \pm 0.03 vs. CS-0.76 \pm 0.09 g (p < 0.05 CEL vs. CES; p < 0.05 CL vs. CS; p < 0.01 L vs. SS; p < 0.001 CEL vs. CS.) (0.32 \pm 0.05 g), compared to the saline group (0.53 \pm 0.07 g).

CONCLUSIONS: the liraglutide supplied a weight loss in animals, especially in the intraabdominal adipose tissue and when associated with Physical activity has allowed greater efficiency in terms of adipose tissue decrease.

3872 Board #189 May 30 9:00 AM - 10:30 AM
Caloric Restriction Alters Bone Marrow Adiposity And Energy Metabolism

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(No relevant relationships reported)

BACKGROUND: Bone marrow adipose tissue (bMAT) refers to mesenchymal stem cell-derived adipocytes located within the bone marrow cavity. In adult humans, bMAT comprises ~15% of total body adiposity and is primarily located throughout the appendicular skeleton. bMAT is an extremely 'plastic' depot that rapidly responds to fluctuations in nutrient sensing and energetic homeostasis. Paradoxically, bMAT levels increase during both obesity and caloric restriction (CR); however, it is unclear whether the qualitative phenotype of bMAT differs under these conditions. **PURPOSE:** To identify obesity- and CR-induced alterations in bMAT lipid composition, transcriptional profile, and metabolic signature. **METHODS:** Male 6-week-old genetically obese ob/ob mice (leptin deficient) were housed at 32°C (thermoneutral) for 10 weeks. One group of mice was fed ad libitum (AL; N=9) for the study duration, while a second group was calorically restricted (CR; N=9) to ~50% of the AL group to prevent excess weight gain. Femora and tibiae were collected for lipid composition (gas chromatography), gene expression analysis (qRT-PCR), and *in situ* metabolic phenotyping (MPLSM-FLIM). Blood was collected for assessment of circulating analytes. **RESULTS:** CR mice had lower body mass and blood glucose, and higher blood corticosterone compared to AL mice. CR increased femur adipocyte density and adipocyte size compared to AL. Tibia lipid composition differed between AL and CR mice (AL>CR C16:0, C:18:1n-9, C:18:1n-7, C20:4n-6; CR >AL C14:0, C16:1n-7, and C18:2n-6). CR upregulated the expression of adipokines (e.g., *Adipoq*, *CFD*), which occurred co-incidentally with elevated levels of serum adiponectin and adipsin. Transcriptional profiling revealed differential expression of genes involved in adipogenesis, lipid metabolism, mitochondrial activity, and antioxidant response

(e.g., CR>AL *SCD1*, *FASN*, *LIPE*, *LPL*, *KLF15*, *PPARGC1a*, *PPARa*, and *SOD1*). MPLSM-FLIM revealed highly heterogenic metabolic phenotypes among cells within the bone marrow cavity. **CONCLUSION:** CR induces functional changes in bMAT that occur independent of leptin. bMAT lies at the interface of metabolic and inflammatory signaling mechanisms, and is a potential mediator of systemic metabolic and inflammatory homeostasis during health and disease.

3873 Board #190 May 30 9:00 AM - 10:30 AM
Regulation Of CD36/LKB1/AMPK On Fatty Acid Oxidative Metabolism Under High-fat Diet Conditions

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Activation of AMP-activated kinase (AMPK) in skeletal muscle increases FA oxidation by inducing Acetyl-CoA Carboxylase (ACC) deactivation. However, the upstream signal molecules that activate AMPK/ACC signaling remains unclear. It is expected that Fatty Acid Translocase (FAT/CD36) will become another potential target for diabetic therapy after AMPK.

PURPOSE: To explore the role of CD36, as a signal molecule, in regulating the upstream signaling pathway of AMPK/ACC in skeletal muscle under HFD conditions. **METHODS:** First, siRNA interference was used to knock down CD36 gene in C2C12 cells to investigate the effect of CD36 deficiency on the phosphorylation of AMPK/ACC signaling in skeletal muscle cells. Then, twelve 8-week-old C57BL/6 male mice were randomly divided into two groups: control group (CON; $n = 6$), and high-fat diet group (HFD; $n = 6$). The expression levels of CD36 protein and phosphorylation of AMPK/ACC signaling under HFD conditions were detected by Western blotting method; the translocation of Liver kinase B1 (LKB1) in nucleus was detected by immunofluorescence method; the ultrastructural changes of skeletal muscle were detected by transmission electron microscopy; and the activity of mitochondrial respiratory chain enzyme was detected by colorimetry. **RESULTS:** CD36 deficiency activated AMPK (0.129 ± 0.009 vs. 0.417 ± 0.055 , $p < 0.05$), ACC (0.044 ± 0.008 vs. 0.081 ± 0.010 , $p < 0.05$) signaling in skeletal muscle cells. Compared with the CON group, the expression levels of CD36 protein in HFD group were significantly increased (0.225 ± 0.041 vs. 0.506 ± 0.022 , $p < 0.01$), the phosphorylation levels of AMPK (0.142 ± 0.020 vs. 0.079 ± 0.010 , $p < 0.05$) and ACC (0.229 ± 0.023 vs. 0.119 ± 0.028 , $p < 0.05$) were significantly decreased, and induced LKB1 translocation from cytoplasm to nucleus. In addition, electron microscopic results showed that HFD intervention damaged the mitochondrial structure of skeletal muscle to a certain extent, and significantly decreased CS activity (411.32 ± 22.15 vs. 310.20 ± 44.09 , $p < 0.01$). **CONCLUSION:** CD36, as a signaling molecule, promotes LKB1 to translocate from cytoplasm to nucleus, which inhibits AMPK/ACC signaling activation, thereby regulating FA oxidation under HFD condition.

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3874 Board #191 May 30 9:00 AM - 10:30 AM
Insulin Action And Body Composition In Aged C57bl/6 Mice: A New Model For Obesity

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(No relevant relationships reported)

The prevalence of obesity in the United States has increased dramatically over the last three decades resulting in a major public health crisis. Feeding mice a high fat diet is a pervasively used model to study mechanisms of human obesity. However, the rapid weight gain that occurs in high fat fed mice and the extremely high fat content of commercially available experimental rodent diets pose serious limitations of this approach. A more appropriate model to study human obesity might be the aged male C57BL/6 mice. **PURPOSE:** To determine body composition and insulin action in young (YG, 6 months), aged (AG, 18 months), and very old (VO, 28 months) male C57BL/6 mice. **METHODS:** Body composition was assessed by an LF50 Body Composition Analyzer (Bruker, Inc). Insulin action was determined by conducting insulin tolerance (IT), glucose tolerance (GT), and 5-aminoimidazole-4-carboxamide ribonucleoside (AICAR) tolerance (AT) tests. Data was analyzed by using a 1 x 3 analysis of variance and least significant difference post-hoc test. Statistical significance was set at $P \leq 0.05$. **RESULTS:** Body mass (YG: 30.7 ± 1.1 vs AG: 46.3 ± 1.7 vs VO: 39.1 ± 1.6 g) and fat mass (YG: 5.8 ± 1.0 vs AG: 21.6 ± 1.6 vs VO: 10.2 ± 1.8 g) were significantly higher in AG mice compared to VO and YG mice. Lean mass was significantly higher in VO mice compared to AG and YG mice (YG: 20.4 ± 0.4 vs AG: 19.6 ± 0.6 vs VO: 23.4 ± 0.5 g). The area under the curve (AUC) for the GT test was significantly lower in VO mice compared to YG and AG mice (YG: 59030 ± 2817 vs AG: 54835 ± 3423 vs VO: 33378 ± 2286). The AUC for the IT test curve was similar in YG, AG and VO mice (YG: 11320 ± 214 vs AG: 11804 ± 343 vs VO: 11138 ± 968). Although the AUC for the AT test was similar, the decline in glucose following AICAR injections was significantly less in VO mice compared to

AG and YG mice, indicating an impairment in AMPK activity. These data suggest that adiposity increases substantially in 18 month old male C57BL/6 mice, a process that appears to be reversed by 28 months. Further, aging does not appear to cause a deterioration in insulin sensitivity when assessed by an IT test. The lower glucose values observed during the GT test in VO mice is likely due to enhanced insulin secretion. Overall our findings indicate that male C57BL/6 mice may be a valuable model to examine mechanisms of obesity when studied at approximately 18 months of age.

3875 Board #192 May 30 9:00 AM - 10:30 AM
Effects Of Different Exercise On Liver Lipid Metabolism In Lean And Obese Rats And Its Relationship With FGF21

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PURPOSE: This study aimed to investigate the effects of different exercise training: High Intensity Interval Training (HIIT) and Continuous Training (CT) on body mass gain, hepatic lipid accumulation and the correlation of the level of FGF21 in serum and liver tissues in lean and obese rats.

METHOD: Male Sprague-Dawley rats at 4 weeks of age were randomly divided into normal diet group (N) and obesity model group (H) after 1 week of adaptive feeding. Rats in the obesity model group were fed with 45% high-fat Diet for about 8 weeks, and 20% weight increase compared with normal rats was considered as obesity. Then, rats were given weight-bearing swimming training intervention for 8 weeks. The rats were divided into normal control group (NC), normal HIIT group (NHI), normal CT group (NCT), High fat diet-induced obesity control group (HC), obese HIIT group (HHI), and obese CT group (HCT).

RESULTS: (1) 8 weeks of HIIT (716.00 ± 15.98 vs 596.21 ± 14.27 g, $p < 0.05$) and CT exercise (716.00 ± 15.98 vs 629.62 ± 12.31 g, $p < 0.05$) result in the body weight of obesity animals significantly reduced. (2) Liver triglyceride content of obese rats were decreased by 21.8% and 7.7% respectively with 8-week HIIT and CT intervention. (3) The activity of LPL enzyme was only increased with CT in normal animals and FAT/CD36 activity was upregulated by CT both in normal and obese groups. HIIT significantly increased the mitochondrial CPT1- α and β -HAD enzyme activities in obese rats. (4) The serum FGF21 level in obese rats was significantly higher than that in normal rats (8.40 ± 1.14 vs 22.20 ± 3.59 pg/ml, $p < 0.05$), and further improved by CT. HIIT and CT increased the FGF21 expression in normal rats, but reduced its expression in obese rats.

CONCLUSION: Both types of exercise can affect the level of fat metabolism in the liver, but showed different mechanisms. HIIT significantly increased the activity of mitochondrial fat oxidase and had a significant effect on the alleviation of lipid deposition in the liver of obese rats, although this process was less correlated with changes in FGF21 levels. However, CT improve the activity of enzymes involved in fatty acid uptake, accelerate the utilization of fatty acids in the liver by regulating FGF21 levels in serum and liver tissues.

3876 Board #193 May 30 9:00 AM - 10:30 AM
FOUR WEEK DETRAINING PROMOTES FAT GAIN BUT NOT INFLAMMATION ON ADIPOSE TISSUE OF OBESE RATS

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Obesity caused by high-fat diet can lead to metabolic impairment in adipocytes as well as in other tissues. Resistance training can promote alterations to improve metabolic damages, which is likely reversed by detraining.

PURPOSE: To determine the effects of resistance training (RT) and detraining on the expression of TNF α , PPAR γ and HIF-1 α proteins of the adipose tissue of obese rats. **METHODS:** Wistar rats were divided into groups: Control (C), Trained (RT), High-fat diet (HFD), Trained/High-fat diet (HFD-T) and Detrained/High-fat diet (HFD-D). Control received standard chow; HFD received high-fat diet during 12 weeks. Trained performed RT (jump squat) for 12 weeks, 3x/week, 3 sets of 12 repetitions per session. The HFD-D interrupted the training at 8th week, characterizing detraining during 4 weeks. Adipose tissue was removed under anesthesia, weighed, and used in protein and genes expression analysis. **RESULTS:** HFD presented higher body weight gain and fat mass compared to the C and T groups ($P < 0.05$), which was reduced with RT (HFD-T vs HFD, $P < 0.001$). Among the HFD groups, HFD-T rats presented the lowest body weight ($P < 0.0002$), weight gain ($P < 0.0006$), and fat mass ($P < 0.0001$). HFD presented elevated TNF α protein and gene expression in adipose tissue compared

to C and T (50% higher), and HFD-T (40% higher) groups ($P<0.05$). HFD-T group presented higher levels of PPAR γ protein and gene compared to C (60%-higher), T (50%-higher) and HFD (50%-higher) groups ($P<0.05$). HIF-1 α mRNA expression was reduced in HFD-T rats compared with HFD ($P<0.05$). Detraining caused increase on the weight gain (50% higher) and fat mass (44% higher) compared to HFD-T ($P<0.05$). HFD-D maintained protein expression of TNF α and PPAR γ elevated compared to HFD and reduced HIF-1 α mRNA expression compared to HFD ($P<0.05$). **CONCLUSION:** Therefore, RT α can attenuate HIF-1 α and TNF α gene expression, and prevent reduction of PPAR γ independent on the ingestion of a high-fat diet. Additionally, TNF α expression remained lower, and PPAR γ expression remained increased in detrained rats, even with increased fat mass. These results suggest that four-week detraining can accelerate the gain of fat mass, without eliciting an inflammatory response in the adipose tissue. Supported by CAPES – Finance code 001.

3877 Board #194 May 30 9:00 AM - 10:30 AM
An Enzymatically Driven Hydrogen Peroxide Exposure To Human Hepatocytes And Its Effects On Iron Homeostatic Proteins

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(No relevant relationships reported)

Previous data in our lab has shown that high concentration (200 μ M) H₂O₂ exposure induces iron dysregulation in muscle cells. It is known that following strenuous exercise, oxidative stress is induced in tissues, leading to iron dysregulation, and generation of reactive oxygen species. Due to the unstable nature of H₂O₂ in solution and the critical role of the liver in iron homeostasis, we sought to see how human hepatocytes would respond to a 12-hour low-dose H₂O₂ exposure that mimics the concentration of neutrophils during the inflammatory response using glucose oxidase (GOX) and Catalase (CAT)

PURPOSE

To determine the effects of a low-concentration, H₂O₂ exposure on the iron regulatory proteins such as TfR, and Ferritin Light-Chain (FLC) in HepG2 cells.

METHODS

When HepG2 cells reached 80% confluency, iron treatments of 10, 50, and 100 μ M were imposed for 24 hours using an FeCl₃ solution diluted in media. Groups that received both iron and H₂O₂ treatments were exposed to 12 hours of iron, followed by 12-hour incubation with media that included both iron and a GOX-CAT cocktail. Western blots were carried out to measure protein content relative to controls. Cell viability was assessed using an MTT assay.

RESULTS

MTT assays for both FeCl₃ and FeCl₃ + H₂O₂ groups did not show any significant cell death. Treatment with FeCl₃ alone resulted in a significant decrease in TfR for all three groups when compared against controls ($C=1\pm 0.1$ SEM vs. 0.71 ± 1 ; $p<0.01$; $n=12$). We observed a significant increase in FTL, but only in the 10 μ M group ($C=1\pm 0.1$ vs. 1.6 ± 0.2 ; $p<0.01$; $n=11$). We saw no significant change in FTL at 50 and 100 μ M. H₂O₂ treatments driven by GOX and CAT produced concentrations of 5-10 μ M, mimicking neutrophils during inflammatory response. The addition of a low concentration H₂O₂ stress resulted in a 9-fold increase of FTL content at all iron exposure concentrations ($C=1\pm 0.3$ vs 9.3 ± 0.9 10 μ M; $p<0.01$; $n=4$). Groups of 50 and 100 μ M also showed similar results, with an increasing trend.

CONCLUSION

A low concentration exposure of H₂O₂ and iron to human hepatocytes results in a significant increase in FTL when compared to iron exposure alone. This suggests that liver cells have a robust defense against iron-dysregulation induced by oxidative stress. We are still evaluating changes that occur in other iron regulatory proteins.

G-37 Free Communication/Poster - Energy Metabolism, Obesity, and Weight Control

Saturday, May 30, 2020, 8:00 AM - 10:30 AM

Room: CC-Exhibit Hall

3878 Board #195 May 30 9:00 AM - 10:30 AM
Circulating Klotho Response To A Behavioral Weight Loss Intervention In Adults With Overweight Or Obesity

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Klotho, a biomarker of aging, is associated with a slower aging process. Klotho concentration is lower among adults with obesity compared to normal-weight adults, and exercise may independently increase levels of Klotho. Whether Klotho is altered by weight loss and whether there is an added effect of exercise are not understood.

Purpose: This study examined changes in Klotho concentration in response to a behavioral weight loss intervention among adults with overweight or obesity.

Methods: A subset of 152 adults (age: 45.4 ± 8.0 years; BMI: 32.1 ± 3.7 kg/m²) who participated in a 12-month weight loss intervention were classified as an intervention "responder" (achieved $\geq 10\%$ weight loss at both 6- and 12 months) or "non-responder" (achieved $<5\%$ weight loss at both 6- and 12 months). Intervention conditions included: 1) diet only (1200-1800 kcal/day), 2) diet plus 150 min/wk of moderate-to-vigorous intensity physical activity (MVPA) per week, 3) or diet plus 250 min/wk of unsupervised MVPA per week. Measures of height, weight, body composition, cardiorespiratory fitness, and Klotho were completed at baseline, 6-, and 12 months. Klotho was analyzed using solid-phase sandwich ELISA kits.

Results: There were significant ($p<0.0001$) changes in weight (-12.5 ± 9.1 kg), percent body fat ($-7.1\pm 5.5\%$), lean body mass (-1.7 ± 2.0 kg), and cardiorespiratory fitness ($+3.3\pm 4.1$ ml/kg/min) from baseline to 12-months. Klotho significantly ($p=0.009$) changed across the 12 months (baseline: 933 ± 381 pg/mL; 6 months: 985 ± 450 pg/mL; 12 months: 940 ± 423 pg/mL), with no difference by intervention group or weight loss response. Participants who performed physical activity had non-significantly greater changes in Klotho. Klotho was consistently associated with lean body mass at baseline ($r=-0.19$), 6 ($r=-0.23$), and 12 months ($r=-0.19$) ($p<0.05$). Klotho was not predictive of change in weight, body composition, or fitness.

Conclusion: Klotho significantly, but modestly, increases with weight loss; however, the increase in Klotho was not sustained throughout the intervention. There may be an influence of physical activity on change in Klotho with weight loss, but this warrants further investigation. Further investigation to examine how weight loss and physical activity may alter biomarkers of aging in adults with obesity may be warranted.

3879 Board #196 May 30 9:00 AM - 10:30 AM
Effects Of Beetroot Juice Components On Exercise Tolerance And Cardiometabolic Health In Individuals With Obesity

Christian E. Behrens, Rakesh Patel, Ahmed Khandaker, Braxton Linder, Jose Fernandez, Brenda Bertrand, Gordon Fisher, FACSM. *University of Alabama at Birmingham, Birmingham, AL.* (Sponsor: Gordon Fisher, FACSM) (No relevant relationships reported)

Routine exercise training is known to improve health outcomes in individuals with obesity (IO); however it remains challenging for IO to adhere to exercise programs. Thus, it is critical to identify novel strategies that can improve exercise capacity (EC) and lead to greater adherence in IO. Beetroot juice (BRJ), high in inorganic dietary nitrate, has been shown to consistently improve exercise performance in athletes, individuals with cardiopulmonary diseases, and non-obese lean individuals. These improvements may be explained by reduced oxygen uptake (VO₂) during exercise, enhanced blood flow, and greater mitochondrial efficiency. To date, we are aware of no studies that have compared the effects of BRJ, sodium nitrate (NaNO₃), denitrified BRJ (PLA), and control (CON) conditions for improving EC and cardiometabolic health in IO. **PURPOSE:** to determine if BRJ improves EC, exercise efficiency (EE) and cardiometabolic health in IO and identify possible mechanisms of action. **METHODS:** Vascular health (blood pressure and arterial elasticity), VO₂ on a cycle ergometer during submaximal- and maximal- exercise, and time to exhaustion (TTE) were assessed in 16 sedentary IO in a crossover design for the following 4 conditions: 1) consumption of BRJ, 2) NaNO₃, 3) PLA, or 4) CON. Study visits were at least 72 hours apart. **RESULTS:** A significant treatment effect was observed for submaximal exercise VO₂ ($p=0.003$), and TTE (seconds) ($p=0.035$). Post hoc analyses demonstrated a lower VO₂ during submaximal exercise in BRJ compared to PLA ($P=0.009$) NaNO₃

($P=0.042$) and CON (0.009). TTE was greater between BRJ and CON ($P=0.029$) with no other differences observed between conditions. No other significant changes were observed for other exercise or vascular health measures. In this analysis of 16 IO, consumption of BRJ improved EE during submaximal cycling exercise by 5.28% compared to PLA, 5.91% compared to the NaNO₂, and 4.22% compared to CON. Finally, BRJ resulted in a 19% improvement in TTE compared to CON condition. **CONCLUSION:** These results suggest that consumption of BRJ may improve cycling efficiency and exercise capacity in IO.

3880 Board #197 May 30 9:00 AM - 10:30 AM
Associations Among Measures Of Abdominal Fat And Metabolic Health In Normoglycemic Women

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Central adiposity, and particularly visceral fat, is tightly associated with metabolic health. Gold standard measures for visceral fat, MRI and CT, are impractical for widespread use. Ultrasound, DXA, and bioimpedance are useful alternatives, though their associations with metabolism are less understood.

OBJECTIVE: To test associations of abdominal adipose by ultrasound (US), DXA, and bioimpedance (BIA) with insulin sensitivity (IS), β -cell responsiveness, physical activity, and adiponectin (AdipN), an adipokine tightly associated with visceral fat.

METHODS: After overnight fast, 41 normoglycemic young women (Age 20.9 ± 2.7 ; BMI 27.8 ± 3.5) completed iDXA (GE Lunar) and BIA (InBody 770) for VAT and %BF; US for visceral (VAT-US) and subcutaneous adipose thicknesses (SAT-US) measured 1cm superior to umbilicus; circumferences; 2-hr OGTT (75g); and 5-day accelerometry (Steps; ActiGraph GT3x). Plasma insulin, c-peptide, and AdipN were determined by ELISA. IS was calculated using Matsuda Index from insulin and glucose at 0 and 120 min. First phase β -cell responsiveness (β Cell) was estimated as ΔC -peptide/ Δ glucose from 0 to 30 min.

RESULTS: VAT-DXA correlated strongly with VAT-BIA ($r=.80$), SAT-US ($r=.78$), Waist ($r=.81$; $p<.01$ for all), and weakly with VAT-US ($r=.35$) and Steps ($r=-.38$; $p<.05$ for all), but not AdipN ($r=-.31$, $p=ns$). VAT-US correlated with AdipN ($r=-.52$), VAT-DXA ($r=.35$), Waist ($r=.50$; $p<.05$ for all), but not SAT-US ($r=-.02$) or VAT-BIA ($r=.31$; $p=ns$ for both). IS was associated with VAT-US ($r=-.42$), VAT-DXA ($r=-.44$), and AdipN ($r=.46$; $p<.05$ for all), controlled for age and race, and these persisted when further controlling for BMI. Only SAT-US was associated with β -cell ($r=.38$, $p<.05$), controlled for age and race, but attenuated when controlling for BMI. Steps correlated with SAT ($r=-.36$), VAT-DX ($r=-.38$), and VAT-BIA ($r=-.39$; $p<.05$ for all), but not IS, β Cell, VAT-US, or AdipN ($p=ns$ for all). In multiple regression analysis with VAT-DX, and BMI included in the model, VAT-US was the only independent predictor of IS (Std. $\beta=-.36$, $p<.05$).

CONCLUSION: VAT by DXA and BIA are strongly related to SAT and overall adiposity, and less to VAT by US and AdipN. While VAT by DXA and ultrasound were both predictors of poor metabolic health in this population, VAT by ultrasound was the strongest independent predictor of IS.

3881 Board #198 May 30 9:00 AM - 10:30 AM
Longitudinal Characterization Of RMR Ratio In Ovulatory Exercising Women Across 12 Months

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Resting metabolic rate (RMR) ratio has been shown to be an indicator of energetic status as indicated by significant correlations with total triiodothyronine (TT₃) concentrations in exercising women. However, it is unknown whether the relationship between RMR ratio and TT₃ remains constant over time. **PURPOSE:** To examine the relationship between RMR ratio and TT₃ in exercising, ovulatory, weight-stable women for a 12-month observational period. **METHODS:** We performed a 12-month longitudinal analysis of data from exercising women ($n=14$). Dual-energy X-ray absorptiometry (DXA) and indirect calorimetry provided data on anthropometrics and energy expenditure. Harris-Benedict DXA, and Cunningham (1980 and 1991) equations estimated RMR and RMR ratio. Repeated-measures analysis assessed changes over time (ANOVA and Friedman). Intraclass correlation coefficient (ICC) and Cronbach's Alpha measure agreement over 12-months for RMR ratio and energy availability (EA). Generalized linear modeling tested whether RMR ratio predicted TT₃ to be above or below two thresholds (TT₃>73.2ng/mL and TT₃>80ng/mL) over 12-months. **RESULTS:** Women were 25.9 ± 5.4 yr, and at baseline, weighed 59.6 ± 5.2 kg with BMI 22.3 ± 1.4 kg/m², which remained unchanged during the study (weight: $p=0.52$; BMI: $p=0.51$). Over 12-months, RMR ($p=0.88$), TT₃ ($p=0.89$), EA

($p=0.21$), and RMR ratio (Harris-Benedict: $p=0.85$; DXA: $p=0.60$; Cunningham₁₉₈₀: $p=0.75$; Cunningham₁₉₉₁: $p=0.73$) remained consistent for 12-months. Each RMR ratio produced ICC and Cronbach's alpha greater than 0.90, indicating excellent reliability of repeated measures, while ICC of energy availability of 0.75 and Cronbach's alpha of 0.73, indicated moderate reliability. When TT₃>73.2ng/dL, each RMR ratio threshold (Harris-Benedict: $p=0.021$; DXA: $p=0.019$; Cunningham₁₉₈₀: $p=0.019$; Cunningham₁₉₉₁: $p=0.016$) significantly predicted participants as energy replete; however, when using a more lenient clinical TT₃ threshold of >80ng/dL, only the DXA ratio threshold yielded a significant model

(<0.001). **CONCLUSIONS:** The relationship between RMR ratio and TT₃ remains constant over time with excellent reliability helping to validate the use of RMR ratio for the longitudinal characterization of energetic status in exercising women (i.e. prospective serial monitoring).

3882 Board #199 May 30 9:00 AM - 10:30 AM
Sex Characteristics Of Fat Distribution In Chinese Adolescent: Based On Magnetic Resonance Imaging

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(No relevant relationships reported)

PURPOSE: To find out the characteristics of accurate fat distribution of healthy adolescent in China and compare the differences between different genders.

METHODS: We recruited 36 Chinese healthy adolescents without obesity or malnutrition. (12-17 years old, 3 men and 3 women of each age; height: 155.24 ± 15.66 cm; mass: 48.60 ± 14.41 kg). Scanning the whole body by MRI (1 cm apart). The visceral fat, subcutaneous fat and intramuscular fat of trunk, upper and lower limbs were calculated by gray area. The derivative index of the above indicators is obtained by dividing by the square of height. SPSS 22.0 was used to analyze the data by t-test.

RESULTS: 1) Fat mass. The visceral fat, the intramuscular fat of trunk and the subcutaneous fat of upper and lower limbs were higher in women than in men. But there was no significant difference in fat quality between men and women ($p>0.05$). 2) Fat mass index. There was a significant difference between the female and the male in the subcutaneous fat index of the upper extremity (m: 0.53 ± 0.14 ; f: 0.63 ± 0.16 ; $p=0.048$), and a significant difference between the female and the male in the subcutaneous fat index of the lower extremity (m: 1.94 ± 0.61 ; f: 2.55 ± 0.51 ; $p=0.002$). There was no gender difference in muscle fat between upper and lower limbs ($P>0.05$). The visceral fat index of female was higher than that of male (m: 0.43 ± 0.12 ; f: 0.53 ± 0.17 ; $p=0.042$). 3) The trunk fat mass of male accounted for 38.89% of the total fat mass, which was lower than that of female (41.77%), but there was no significant difference. ($p>0.05$). The visceral fat mass of male accounted for 10.10% of the total fat mass, which was higher than that of female (9.11%). The upper limb fat mass of male accounted for 12.17% of the total fat mass, which was significantly higher than that of female (10.72%) ($p=0.048$). There was no significant difference between male (47.93%) and female (47.50) in the proportion of lower limb fat mass. ($p>0.05$) **CONCLUSIONS:** There was no gender difference in fat mass of different parts of adolescent. The subcutaneous fat index and visceral fat index of women were higher than that of men, but there was no gender difference in muscle fat index. The centripetal accumulation of puberty male fat was not obvious, but the proportion of upper limb fat was relatively high.

3883 Board #200 May 30 9:00 AM - 10:30 AM
Habitual Physical Activity And Muscle Mass Changes With Weight Loss

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As with any weight loss program, losing fat while maintaining muscle is a desirable outcome. We sought to determine how different types of habitual activity influenced the retention of muscle mass with a decrease in body fat.

PURPOSE: As a preliminary analysis to guide future research, the purpose of this study was to determine whether self-reported frequency of aerobic, strength, and stretching exercise (days per week) associates with body composition changes in response to weight loss in overweight and obese adults. **METHODS:** Adults ($n=23$), 18-70 years old with a minimum waist circumference of 35 inches for women and 40 inches for men participated in an 8-week study diet intervention. Participants were asked to maintain habitual physical activity during the intervention. All participants reported their habitual exercise frequency for aerobic, strength, and stretching activities within a typical 7-day period. Body composition was assessed using bioelectrical impedance analysis (mBCA). After post testing, correlations (nonparametric, Spearman) between days reported for each activity and changes in body mass, percent body fat, visceral adipose tissue (VAT) and muscle mass were determined in participants who had a reduction in body mass during the intervention. **RESULTS:** The

average number of days per week reported for each activity was 4.3 for aerobic, 1.8 for strength, and 3.3 for stretching. Change in body mass pre to post intervention was from 94.6 + 22.3 kg to 92.9 + 21.4 kg. The range in change for muscle mass was from -2.31 kg to +1.1 kg. There was a correlation ($r = 0.603$, $p = 0.029$) between days per week of aerobic activity and change in muscle mass. **CONCLUSIONS:** While all individuals of the analysis lost some weight during the intervention, some of them lost and some of them gained muscle mass. Individuals who reported more days of aerobic activity per week as their habitual activity level were more likely to retain muscle mass. Supported by the USA Dry Pea & Lentil Council

3884 Board #201 May 30 9:00 AM - 10:30 AM
Body Shape And Basal Metabolism Characteristics Of Female College Students With Normal Weight Obesity
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PURPOSE: Female college students become a high-risk group of normal weight obesity (NWO) because of their lifestyle and psychological status. NWO can have an impact on the health of students. We analyze the characteristics of the body's physical form and basal metabolism to add a new basis for the evaluation of female college students' physical condition.

METHODS: A stratified cluster sampling method was used to extract 2000 samples from the two universities. Excluding those who did not meet the test conditions, eventually included 1,937 female college students. The subject's body mass index (BMI), body fat percentage (BF%), skeletal muscle percentage (SM%), waist-to-hip fat ratio, basal metabolic rate, waist circumference (WC), hip circumference (HC), and thigh circumference (TC) were measured. One-way ANOVA was used to compare the differences in body shape indicators between NWO and normal weight lean (NWL) female college students. Compare the incidence of central obesity among NWO and NWL female college students.

RESULTS: 1) Among female college students, the incidence of NWO was 33.3%, accounting for 66.02% of female college students with excessive body fat. Among NWO female college students, 4.19% belong to the group with BMI <18.5(kg/m²). 2) Compared with NWL, NWO had higher BF% and lower SM% (33.32±2.59 vs 26.49±2.70%; 35.79±1.53 vs 39.79±1.69%, $p < 0.01$); NWO had higher waist-to-hip fat ratio (0.83±0.02 vs 0.81±0.02, $p < 0.01$); NWO had lower basal metabolic rate (1192.09±75.99 vs 1240.71±77.93 kcal/d, $p < 0.01$). 3) In the circumference index, compared with NWL, WC, HC and TC of NWO were larger (69.38±4.62 vs 67.07±4.95cm, $p < 0.01$; 94.16±5.10 vs 92.09±4.48cm, $p < 0.01$; 55.97±3.14 vs 54.56±3.13cm, $p < 0.05$). 4) There are 19 central obese female college students, 68% of whom are from NWO population.

CONCLUSIONS: NWO female college students have a big difference in physical form compared with NWL. NWO has a larger circumference and its fat distribution is characterized by more fat accumulation in the waist and had lower basal metabolic rate. We need to pay attention to the status of female college students with NWO. Supported by Thirteenth Five-Year Plan for scientific research of Chinese society of Higher Education (17TZ006), Basic scientific research business fund project of Central University (2008XS030).

3885 Board #202 May 30 9:00 AM - 10:30 AM
High Versus Low Inflammation Phenotype And Fat Utilization During Exercise
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 (No relevant relationships reported)

Inflammatory markers are a well-known and reliable predictor of all-cause mortality in individuals as they are associated with disease-specific processes. It has also been established that individuals with higher adiposity tend to oxidize fat at a higher rate during exercise than lean individuals. It is currently not known whether there is any relationship between resting inflammatory markers and levels of fat oxidation during exercise.

PURPOSE: To examine the relationship between inflammatory phenotype and fat utilization in obese adults during a graded exercise test.

METHODS: Healthy overweight and obese (OW/OB) adults ($n=34$) were classified as either having or not having a low-grade inflammation phenotype according to at least four out of six elevated cytokines, obtained through a fasted blood draw. Selected inflammatory cytokines to be detected include IL-1 β , IL-6, TNF- α , granulocyte macrophage colony-stimulating factor (GM-CSF), IL-17A, and IL-23. Inclusion criteria also required that each participant achieve at least 80% VO_{2max} according to age-predicted heart rate max. Participants completed a modified Bruce protocol on a treadmill and carbohydrate and fat oxidation were compared at 35, 50, 65, and 80% of estimated VO_{2max} .

RESULTS: All participants had similar anthropometric measurements with a mean BMI of 30.6 kg/m². Male participants with low-grade inflammation phenotype oxidized a higher ($p < 0.05$) percentage (mean \pm SD, 10.2 \pm 10.2% vs 30.7 \pm 14.1%) of fat and greater Kcal of fat per kg body mass at 65% of VO_{2max} . However, exercise intensities at 35%, 50%, and 80% of VO_{2max} showed no difference between the two groups of males. Female participants showed no difference between inflammation phenotyping and utilization of fat during the graded exercise test.

CONCLUSIONS: It is understood that OW/OB individuals tend to oxidize a greater amount of fat than their lean counterparts, particularly during exercise. However, when observing OW/OB men who had been classified as having a low grade inflammation phenotype, were noted to utilize a greater amount of fat as exercise intensity increases. **FUNDING:** Montana State University Research Initiative 51040-MUSRI2015-03 and USDA-NIFA 2017-67018-26367.

3886 Board #203 May 30 9:00 AM - 10:30 AM
Weight Loss Strategies Used By Older Adults In A 6-month Weight Loss Intervention
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Obesity in older adults places them at risk for increased mortality and comorbid health conditions. Older adults are also at risk for loss of muscle mass and related decreased functioning with diet being an important factor. Gaining a better understanding of perceptions of weight loss in older adults and identifying successful weight loss strategies that can assist in reducing obesity while protecting muscle mass is important to improve health outcomes. **PURPOSE:** To identify and examine the perceptions of weight loss and weight loss strategies used by older adults in a 6-month weight loss intervention. **METHODS:** Twelve overweight (94.0 kg \pm 13.2), older adults (65.7 years \pm 4.0) were enrolled in a 6-month weight loss intervention. Participants received a calorically reduced meal plan (500kcal/d) with 1.2g/kg protein to protect against muscle loss. Fourteen follow-up sessions were conducted. Body weight (BW) and skeletal muscle mass (SMM) were monitored utilizing InBody770. Post program interviews were audio-recorded, transcribed and analyzed using constant-comparative analysis. A 35-item weight loss strategy inventory was completed and analyzed utilizing descriptive statistics. **RESULTS:** Ninety-two percent ($n=11$) of participants lost weight, with mean weight loss of 6.8% \pm 4.4 of BW. Seventy-five percent of participants had weight loss of >5% of BW. Mean SMM loss was 0.009% \pm 0.031 of BW with 33.3% ($n=4$) of participants increasing or maintaining SMM. Participants used a mean 15 \pm 6 weight loss strategies four or more times/week. Themes for successful weight loss included using personal behavioral strategies such as measuring portion sizes, biochemical and anthropometric motivators, personalized support, and accountability feedback and monitoring. Barriers included consuming the additional protein in the diet and care-taking of others. **CONCLUSION:** Results of this study provide considerations for the development of strategies to achieve clinically significant weight loss (>5%) while maintaining SMM in older adults. The higher intake of protein to protect against muscle loss was reported to be difficult for participants. Both personal strategies, as well as external strategies provided through the counseling relationship, contributed to success.

3887 Board #204 May 30 9:00 AM - 10:30 AM
No Changes In Appetite Stimulating Hormones Following Swimming And Cycling Exercise Interventions
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Swimming is a favorable and ideal modality of exercise for individuals with obesity and arthritis as it encompasses a minimal weight-bearing stress and a reduced heat load. However, the available evidence indicates that regular swimming may not be effective in reducing body weight and body fatness. A current hypothesis is that exercise in cold water somehow stimulates appetite. **PURPOSE:** We determined the effect of swimming exercise training on fasting concentrations of ghrelin, insulin, leptin, and peptide YY in obese individuals with osteoarthritis. Cycling training was included as a non-weight bearing land-based comparison group. **METHODS:** Thirty-nine obese participants with osteoarthritis (age=59 \pm 1 years, BMI=33 \pm 1 kg/m²) were randomly assigned to 12 weeks of supervised swimming training ($N=19$) or cycling training ($N=20$). In the initial few weeks, participants exercised for 20-30 minutes/day, 3 days/week, at an exercise intensity of 40-50% of heart rate reserve (HRR). Subsequently, the intensity and duration of exercise were progressively increased to 40-45 minutes/day, 3 days/week, at an intensity of 60-70% of HRR. Fasting blood samples were analyzed for ghrelin, insulin, leptin, and peptide YY concentrations

using ELISAs. **RESULTS:** There were no group differences in body weight, BMI, or appetite stimulating hormones prior to the exercise interventions. Fasting plasma concentrations of ghrelin (37±8 vs. 42±11 pg/ml), insulin (1,176±424 vs. 1,179±442 pg/ml), leptin (20,200±2,891 vs. 16,617±2,734 pg/ml), and peptide YY (51±6 vs. 54±7 pg/ml) did not change with the swimming exercise intervention (all p>0.05). Similarly, cycling exercise had no effect on ghrelin (36±10 vs. 44±8 pg/ml), insulin (978±321 vs. 964±311 pg/ml), leptin (29,261±5,438 vs. 26,308±4,771 pg/ml), or peptide YY (58±15 vs. 63±16 pg/ml) concentrations (all p>0.05). **CONCLUSIONS:** Our present results indicate that fasting levels of appetite stimulating hormones did not change with 12 weeks of swimming exercise intervention in obese participants with osteoarthritis and that there were no group differences in changes in these hormones between swimming and cycling exercise interventions.

3888 Board #205 May 30 9:00 AM - 10:30 AM
Rapid Weight Loss Adversely Affects Muscle Damage Markers In Elite Judo Athletes

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 (No relevant relationships reported)

Rapid weight loss (RWL) is a phenomenon that is commonly detected amongst elite judo athletes. It is used to gain the advantage over their lighter opponents. **PURPOSE:** To evaluate the effects of 7-day RWL intervention on muscle damage markers in seven elite judokas during a pre-competition period. **METHODS:** The participants voluntarily participated in this study. RWL was induced in accordance to personal preference previously practiced by judo athletes. Most frequently reported methods of RWL were increased exercise volume, fluid and caloric restriction and heated environment exposure. **RESULTS:** RWL induced a significant drop in weight within all seven participants (93.07 ± 10.69 kg at baseline vs. 88.12 ± 10.30 kg at follow-up; P < 0.001). Regarding biochemical changes, myoglobin levels significantly increased on the last day of intervention (P < 0.01) (day 7). In addition, creatine kinase levels were also elevated on the 6th day of the intervention. **CONCLUSIONS:** Based on the obtained results, RWL methods caused alterations in myoglobin and creatine kinase levels in elite judokas. This indicates that although RWL is perceived as helpful in achieving success in competition, it can produce muscle tissue damage that can further impact fitness profile of elite judokas. This project was partly supported by the Serbian Ministry of Education, Science and Technological Development (175037 and 179011), the Provincial Secretariat for Higher Education and Scientific Research (142-451-2473 and 114-451-710) and the Faculty of Sport and Physical Education, University of Novi Sad (2019 Annual Award).

3889 Board #206 May 30 9:00 AM - 10:30 AM
Baseline Characteristics Of Older Hispanics With Type 2 Diabetes Participating In An Intervention Study

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Type 2 Diabetes mellitus (DM2) affects 9.3% of the U.S. population. Health disparities are evident in DM2; twice as many Hispanics as non-Hispanic Whites have DM2. **PURPOSE:** The goal of this study was to describe the baseline characteristics of older Hispanics with DM2 participating in a diet and exercise study in 3 senior centers. **METHODS:** Data from 38 older Hispanics with DM2 was collected. The variables included age, body mass, height, waist circumference, Hemoglobin A1C, glucose, blood pressure, chair stands in 30s, grip strength, balance, and preferred gait characteristics. **RESULTS:** The characteristics of the 38 participants (29 women, 9 men) that completed the baseline assessments to date were: age = 79±7 yrs (♀78±7; ♂80±7), body mass = 75±16 kg (♀73±13; ♂85±23), height = 157±10 cm (♀154±8; ♂168±6), body mass index = 31±6 kg/m² (♀30±5, ♂30±7), waist circumference = 103±13 cm (♀101±11; ♂109±19); A1C = 7±1% (♀7±1; ♂6±1), non-fasting blood glucose = 140±47 g/dL (♀135±5; ♂157±30), systolic = 140±19 mmHg (♀139±18; ♂145±20) and diastolic blood pressure = 78±10 mmHg (♀78±10; ♂78±10). Their physical characteristics presented in Table 1 indicate frailty (e.g. chair stands ≤8, grip strength ≤ 21, ♂32 kg, and gait velocity ≤ 80cm/s). **CONCLUSION:** The results indicate that at baseline the participants had high prevalence of obesity (abdominal and total), low levels of glycemic control, borderline high blood pressure, and have low levels of physical function that are indicative of frailty.

Supported by Wertheim Innovation Faculty Grant from the FIU Nicole Wertheim College of Nursing and Health Sciences

Table 1. Characteristic of the physical function baseline characteristics of older Hispanics with DM2

	Variables	Total (n=38)	Women (n=29)	Men (n=9)
Muscle strength	Chair test (rep)	8±4	8±4	8±5
	Handgrip (kg)	21±6	19±5	29±5
Balance (Force plate)	A95 -EO (cm ²)	5.1±3.3	5.2±3.4	5.0±3.0
	A95 -EC (cm ²)	7.9±5.8	7.9±6.0	7.5±5.3
	VA-EO (cm/s)	3.9±0.8	3.8±0.7	4.0±1.1
	VA-EC (cm/s)	4.9±2.1	4.6±1.3	5.7±3.5
Gait (GaitRite®)	Velocity (cm/s)	81±22	78±24	89±15
	CP (steps/min)	99±12	99±13	100±10
	SL (cm)	48±9	47±10	53±5

Note: A95: Area 95 - Eyes Open and Closed; VA: Velocity Average - Eyes Open and Closed; CP: Cadence Preferred; SL: Step Length (mean right and left); Data are presented as mean±SD

3890 Board #207 May 30 9:00 AM - 10:30 AM
Substrate Utilization Differences Between Overweight And Obese Men And Women During Exercise

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 (No relevant relationships reported)

As exercise intensity and duration increase, substrate utilization typically shifts to carbohydrates over fats. However, individuals with higher levels of adiposity have been shown to rely more heavily on fat oxidation during higher intensity exercise than their lean counterparts. Currently, there is limited research on how carbohydrate and fat oxidation differ in men compared to women at different exercise intensities. **PURPOSE:** To examine the difference in substrate utilization of fat and carbohydrate between men and women at different exercise intensities. **METHODS:** Participants (n=34) between 18-55 years old (Women: 35.9 +/- 11.3 years; Men: 36.1 +/- 7.7 years) with a BMI between 27-35 kg/m² (Women: 30.5 +/- 1.7 kg/m²; Men: 30.6 +/- 2.2 kg/m²) completed a modified Bruce protocol on a treadmill for measurement of an estimated VO2Max at their age-predicted heart rate max. To be included in the analysis these participants were required to reach 85% age predicted heart rate max. **RESULTS:** Women utilized a higher (p≤0.05) percentage of fat at 65% (Women: 42.9 ± 16.9%; Men: 24.8 ± 17.7%), and 80% (Women: 14.7 ± 18.2%; Men: 2.7 ± 7.95%) of their VO2Max and greater (p≤0.05) usage of overall Kcal from fat per kg of body mass at 80% (Women: 0.02 ± 0.02kcalF/kg; Men: 0.01 ± 0.01 kcalF/kg) of VO2Max. Men relied more heavily (p≤0.05) than women on carbohydrates per kg of body mass at 50% (Women: 0.03 ± 0.02kcalC/kg; Men: 0.06 ± 0.03kcalC/kg), 65% (Women: 0.07 ± 0.03kcalC/kg; Men: 0.13 ± 0.06kcalC/kg) and 80% (Women: 0.16 ± 0.08kcalC/kg; Men: 0.26 ± 0.08kcalC/kg) of VO2max. **CONCLUSIONS:** Women oxidized more fat than men at 65% and 80% VO2Max, but not 35% and 50% VO2Max. As exercise intensity increased, the gap between women and men fat oxidation levels became larger. **Funding:** Montana State University Research Initiative 51040-MUSRI2015-03 and USDA-NIFA 2017-67018-26367.

3891 Board #208 May 30 9:00 AM - 10:30 AM
Whole-body Electromyostimulation Enhances Submaximal Performance And Leg Fatigue In Obese Women After Bariatric Surgery

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 (No relevant relationships reported)

Bariatric surgery (BS) is the most effective treatment for morbid obesity. Early rehabilitation strategies may be able to improve functional capacity (fc) and body composition that are impaired after the surgical procedure. In this sense, the whole-body electromyostimulation (WB-EMS) added to dynamic exercises may enhance the benefits for this population. **PURPOSE:** To evaluate if WB-EMS would enhance dynamic exercises on fc, dyspnea and leg fatigue, and body composition **METHODS:** Randomized double-blind controlled clinical trial. Twenty-six obese women (37±7years; BMI=37±4 kg/m²) were randomized after bariatric surgery into two groups (WB-EMSG, n=13; ShamG, n=13). Before and after training protocol, the patients performed body composition analysis (Inbody 720) and the two minutes step test (2MST) for functional capacity evaluation with portable ergospirometer (Oxycon Mobile®), with borg scale evaluation for effort perception. The WB-EMS (Miha

Bodytec) was applied at motor level (endurance training: 3x/week; frequency=85Hz, pulse duration=350 μ s, cycle on=6"; cycle off = 4"; strength training: 2x/week; frequency= 30Hz, pulse duration= 350 μ s, cycle on = 4"; cycle off = 10"), associated with dynamic exercises during 30 days, one week after BS. The ShamG performed the same exercises, but with the electric current turned off. After confirmation of normal data distribution (Shapiro-Wilk) a two-way ANOVA was performed ($p < 0.05$).

RESULTS: Weight loss was similar between groups after the intervention ($p < 0.002$), and higher values of up and down cycles were observed (WB-EMSG pre: 47, post: 57 vs ShamG pre: 44, post: 54; $p < 0.001$) and relative $\dot{V}O_2$ (WB-EMSG pre: 11.3, post: 14.1 vs ShamG pre: 10.3, post: 13.5; $p < 0.001$) (2MST) in both groups after the intervention. In addition, we observed lower values of ventilation per minute (pre: 37.1, post: 32.7, vs pre: 43.7, post: 45.4, $p = 0.002$) and leg fatigue (pre: 1.0, post: 0.79 vs pre: 1.9, post: 1.8, $p = 0.01$) at the 2MST peak in WB-EMSG compared to ShamG, respectively.

CONCLUSIONS: Early intervention composed of WB-EMS and dynamic exercises improved minute ventilation and leg fatigue in 2MST, which may reflect in a faster and quality recovery for these patients.

3892 Board #209 May 30 9:00 AM - 10:30 AM
PREDIABETES PHENOTYPE DOES NOT EXACERBATE MICROVASCULAR INSULIN SENSITIVITY IN METABOLIC SYNDROME

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Metabolic syndrome (MetS) and elevated glucose each promote microvascular dysfunction. Whether in combination these two conditions create increased dysfunction is not clear. Here, we tested whether glucose status worsens microvascular insulin sensitivity in MetS. Thirty-two sedentary, obese adults (54.2 \pm 1.2yrs; 35.9 \pm 1.3kg/m²; VO_{2max} : 19.9 \pm 1.3ml/kg/min) with MetS (≥ 3 ATP III criteria) were classified as normal glucose tolerant (NGT, n=8; 6F), impaired fasting glucose (IFG; n=10; 7F) or IFG+IGT (n=14; 11F) according to ADA criteria using a 75g OGTT. Capillary perfusion (microvascular blood volume, MBV), filling rate (microvascular flow velocity, MFV) and blood flow (MBF=MBV*MFV) were assessed as the change before and after a 2hr euglycemic-hyperinsulinemic clamp (90mg/dl, 40mU/m²/min) using contrast enhanced ultrasound. Glucose infusion rate (GIR) was used to determine metabolic insulin sensitivity while carbohydrate oxidation (CHO_{ox}) was measured before and after the clamp to understand nutrient utilization. T-tests, repeated measures ANOVAs and correlations were used when appropriate. Significance was accepted as $P \leq 0.05$. There were no differences in age, BMI, VO_{2max} or GIR (NGT: 2.26 \pm 0.48 vs. IFG: 2.66 \pm 0.46 vs. IFG+IGT: 1.91 \pm 0.37mg/kg/min, $P=0.44$) among groups. Insulin did not stimulate capillary perfusion (NGT: 0.16 \pm 0.19 vs. IFG: -0.02 \pm 0.14 vs. IFG+IGT: 0.08 \pm 0.12AI, $P=0.40$), filling rate (NGT: 0.006 \pm 0.005 vs. IFG: 0.003 \pm 0.004 vs. IFG+IGT: 0.004 \pm 0.004sec⁻¹, $P=0.11$) or blood flow (NGT: 0.02 \pm 0.02 vs. IFG: 0.01 \pm 0.01 vs. IFG+IGT: 0.01 \pm 0.01AI/sec, $P=0.21$). CHO_{ox} was likewise unresponsive to insulin ($P=0.34$). Although age, BMI, fasting and 2hr glucose concentrations did not relate to insulin effects on microvascular function, fasting triglycerides was related to insulin-stimulated MBF ($r=-0.39$, $P=0.03$). Prediabetes phenotype does not worsen microvascular insulin sensitivity in adults with MetS. Future work is warranted to examine the effects of different therapies (lifestyle, medication) on microvascular function.

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3893 Board #210 May 30 9:00 AM - 10:30 AM
Elevated Circulating Asprosin Impedes Low Intensity Exercise-induced Weight Loss In Obese Individuals

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(No relevant relationships reported)

PURPOSE: Circulating Asprosin is elevated in obese men and mice and mainly produced in white adipose tissue (WAT) to trigger hepatic glucose release into the bloodstream maintaining energy standards between meals, and hence has been suggested as pharmaceutical target to battle obesity and T2D. We hypothesized a mechanistic link to the empirical observation, why a predominant part of obese individuals mainly fail to lose depot-stored body fat despite their commitment to participate in aerobic exercise programs, and followed the research

question if stress induced secretion of Asprosin during aerobic exercise counteracts the metabolic consumption of body fat through stimulating insulin triggered refueling of WAT.

METHODS: After overnight fasting 7 obese men and women (age 59.7 \pm 5.6; BMI 40.2 \pm 8.4) and 7 age and sex matched lean counterparts (age 59.5 \pm 5.2; BMI 22.9 \pm 1.5) performed a treadmill protocol for 25 min at 90% of an individual's VT1 and RQ of ≤ 0.82 (controlled and adjusted if needed) to ensure that body fat as energy source was used. Venous blood samples (pre-, post-, +30 min post-, and +60 min post-exercise) were drawn to analyze Asprosin, Cortisol, Proinsulin, and acetylated Ghrelin using commercial ELISA kits.

RESULTS: Asprosin baseline data were significantly increased in obese compared to lean subjects ($p=0.013$) and further raised significantly during the course of the exercise trial only in obese. Stress marker Cortisol was comparable between groups at baseline ($p=0.38$) but significantly augmented in corpulent participants only, while it significantly decreased in lean subjects during the exercise test. Proinsulin increased significantly from baseline to +30 min post-exercise in obese ($p=0.013$) but remained unaffected in normal weight subjects ($p=0.99$) while their baseline data were comparable ($p=0.06$). Hunger hormone Ghrelin was already significantly increased at baseline in obese vs. lean subjects ($p=0.015$) but raised even significantly further in obese at +30 min post-exercise vs. baseline.

CONCLUSIONS: The stress induced aberrant hormone reaction of obese individuals counteracts the metabolic consumption of body fat through stimulating the refueling of WAT. This observation helps to explain the difficulty of obese persons to lose excess body fat when performing low intensity exercise.

3894 Board #211 May 30 9:00 AM - 10:30 AM
Associations Of Dietary Acid Load On Physical Function And Body Composition In Older Obese Adults

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Acid-base balance affects muscle quality in older adults leading to less muscle mass and strength. Individuals with knee osteoarthritis (OA) have less muscle mass and strength. It is unknown if OA's effect on function and strength is mediated by acid-base balance.

Purpose: This study examined associations between dietary acid production, physical function, muscle strength, and body composition in older obese adults with knee osteoarthritis. Higher acid load is hypothesized to be associated with lower physical function, strength and lean body mass (LBM).

Methods: Baseline data from the Intensive Diet and Exercise for Arthritis (IDEA) trial were used for this analysis. Measurements from IDEA included a 3-day food record to calculate daily potential renal acid load (PRAL) PRAL, 6-min walk distance, LBM via dual energy x-ray absorptiometry, and concentric knee extensor and flexor strength. Estimated potential renal acid load (PRAL in mEq H⁺ ions) = (0.49*mg protein) + (.037*mg phosphorus) - (.021*mg potassium) - (.026*mg magnesium) - (.013*mg calcium). Associations were determined by Pearson correlations.

Results: Data obtained from 388 participants (age=65.8 \pm 6.1 yrs; 70.4% female; body mass index=33.7 \pm 3.8 kg/m²) were used in the analysis. Mean values were: PRAL score (8.9 \pm 13.8 mEq/d); LBM (56.0 \pm 12.0 kg); 6-min walk distance (476.5 \pm 82.6 m); concentric knee extensor (60.2 \pm 26.0 Nm) and knee flexor (30.2 \pm 14.7 Nm) strength. PRAL showed significant positive associations with concentric knee extensor strength ($r=.19$; $p=.011$), knee flexor strength ($r=.19$; $p=.012$), and LBM ($r=.22$, $p<.001$).

Conclusion: The physiological importance of the statistical relationship observed for high PRAL (higher acid load) and high physical function and knee extensor and flexor strength, although minimal ($r \sim .2$), opposes our hypothesis. These discrepant findings may be from using an indirect measure acid production, presence of OA in this cohort, and the accuracy of self-reported dietary records.

3895 Board #212 May 30 9:00 AM - 10:30 AM
Obese Pediatric Youth Have A High Rate Of Adult Criminal Behavior And Low Rates Of Home Ownership That Is Not Linked To Pediatric Fitness
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 (No relevant relationships reported)

Purpose: Pediatric obesity has been linked to negative social outcomes in childhood. Minimal information is known about social outcomes in adulthood for obese pediatric patients and if they are linked with pediatric fitness. **Methods:** A retrospective chart review was performed evaluating all pediatric (<18 year old) youth with obesity who presented to the HealthWorks! pediatric weight management program from 1999-2009 and had a formal cardiopulmonary exercise testing (CPET), which was a requirement for clinic enrollment. Demographic and public record collection including body habitus, death records, real estate transactions and criminal conviction history was collected with baseline data compared to published lifetime criminal prevalence (Shannon SKS, et al, *Demography* 2017) and home ownership rates (US Census). Statistical analysis was performed using JMP®, Version 14 with differences between groups assessed using an unpaired t-test where a p-value <0.05 was considered significant. **Results:** A total of 719 pediatric youths with obesity (12.2±2.9 years) performed exercise testing with all patients now adults (28.5±3.7 years). There was a 1.5% mortality rate (11/719), and mortality was not associated with body habitus or any CPET parameter. Only 28.6% (206/719) of patients were able to complete a maximal effort CPET. On review of the criminal records, 9.7% (70/720) of these young adult patients were convicted of a felony compared to ~6% lifetime prevalence in Ohio during this period of time (p=0.004). There was no difference between incarceration rates of these now adult pediatric youths with obesity and the reported lifetime prevalence in Ohio (3.6% vs 3%, p=0.5). In addition, 14.7% (106/719) of study patients purchased a home in adulthood compared to 56.8% of Midwest adults <35 years of age (p<0.0001). Inability to complete a maximal effort CPET was associated with age, weight and future home ownership. History of criminal conviction was not associated to any study parameter. **Conclusions:** Children with obesity have higher social risk than their peers in adulthood as evidenced by higher rates of criminal behavior and lower rates of home ownership. Pediatric patients with obesity have low rates of exercise test completion and pediatric exercise capacity is not associated with mortality or social outcomes.

3896 Board #213 May 30 9:00 AM - 10:30 AM
No Association Of Weight Gain Since Age 20 With Cardiorespiratory And Muscular Fitness
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Substantial exercise-induced weight loss is unachievable by many people. With no dietary modifications, a person of average size and fitness requires 60+ hours of moderate intensity exercise to lose 5 kg of fat. Individuals who are overweight or obese might not have the cardiorespiratory and muscle health necessary for successful exercise-induced weight loss, but it has yet to be determined if individuals with different patterns of weight gain (gradual vs fluctuation vs rapid) have different cardiorespiratory and muscle health levels.

PURPOSE: This pilot study's aim was to determine if weight gain since the age of 20 and recent weight history is related to current cardiorespiratory and muscular fitness. **METHODS:** A retrospective health and weight history questionnaire was completed by 23 overweight and obese, but otherwise healthy adults (47.42 ± 9.75 yrs, BMI 29.70 ± 3.36). Weight gain since age 20 and weight history (loss & gain) in the previous 5 years were self-reported. Total fat and lean mass, cardiorespiratory fitness, and skeletal muscle strength were determined through dual energy x-ray absorptiometry, metabolic gas analysis during a graded exercise test, and upper and lower body strength measurements. **RESULTS:** Participants had an average body fat of 39.2 ± 5.4% having gained 9.3 ± 4.4 kg since the age of 20 years. Maximal oxygen consumption was 2.18 ± 0.5 L/min. No relationship existed between percentage of weight gain since 20 (25.96 ± 11.10%) and current maximal oxygen consumption (r = -0.08). **CONCLUSIONS:** Based on this pilot data it does not appear that fitness determines weight gain after age 20. Future studies will determine if type of weight progression over time (e.g. gradual vs fluctuation) and weight loss history are related to cardiorespiratory and/or muscular fitness and if fitness can predict success in exercise-induced weight loss programs in overweight or obese individuals.

3897 Board #214 May 30 9:00 AM - 10:30 AM
Differences In Exercise Behaviors By Diabetes Status: Implications For Diabetic Americans
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Background: In Kansas, 10% of adults have type one or type two diabetes (T1D, T2D). Although Federal physical activity (PA) guidelines including aerobic and strength training exercises are recommended for T2D; guidelines lack for T1Ds. A better understanding of differences in exercise behaviors amongst between populations is needed. **Purpose:** This study compared exercise behaviors of T1D, T2D, and non-diabetics (ND). **Methods:** Male (n=68) and female (n=267) participants ages 18-64 were recruited via social media (e.g. Facebook, Instagram) and newsletters and indicated consent prior to participation in the online survey. Data were collected for demographics, anthropometrics, diabetes status, and exercise (PA) behaviors. One-way ANOVAs, with Games-Howell post hoc tests were used to determine differences in aerobic activity and strength training between T1D, T2D, and ND participants. **Results:** Participants included 48 T1Ds, 24 T2Ds, and 240 NDs. Statistically significant differences existed for moderate aerobic PA between groups, $f(2,304)=3.9$, $p=0.021$, where T2D reported fewer weekly minutes (109.2±88.8) than ND (215.7±186.5; $p=0.021$). T1D (179.0±171.7) were not significantly different. No significant vigorous PA differences were found ($p=0.242$; T1D=66.3±80; T2D=41.7±60.5; ND=73.8±94.8 min/week). Strength training days/week differed between groups, $f(2,314)=3.6$, $p=0.028$ with T1D (1.8±2.0) reporting significantly more than T2D (0.7±1.0; $p=0.024$); no significant differences for ND (1.5±1.7). **Conclusion:** Although statistically similar to T2D/ND, T1D's mean moderate activity was over the recommended 150 min/week. T1D did report significantly more strength training days/week than T2D approaching recommended 2 days/week. Participants' most popular PAs were walking (51%), and strength training (18%), thus Kansans should consider walking and strength training exercises.

3898 Board #215 May 30 9:00 AM - 10:30 AM
Montmorency Tart Cherries Influence The Urinary Metabolome But Not Vascular Function In Healthy Individuals
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There is accumulating evidence that Montmorency tart cherry (MC) polyphenols possess vasomodulatory properties and their intake has been shown to reduce a number of cardiovascular risk factors. Despite this our understanding of the overall mechanisms of action and compounds that exert these benefits has yet to be fully elucidated.

Purpose: The aim of this study was to characterise the effects of 4-week MC supplementation on vascular function in healthy adults and provide potential mechanistic evidence from urinary metabolite profiling. **Methods:** Twenty three healthy non-smoking individuals took part in a study in which they consumed either 30 mL of MC concentrate or an isocaloric placebo (PLA) bi-daily for 4 weeks. The study employed a randomised, double-blind, placebo-controlled, parallel design; mean ± SD age was 25 ± 4 years in the MC group (n = 12) and 22 ± 2 years in the PLA group (n = 11). Blood pressure, arterial stiffness (pulse wave velocity and digital volume pulse) were measured pre- and post- supplementation. Spot urine samples were also collected at the corresponding time points to determine the effect of the intervention on the urinary metabolite profiles. **Results:** There were no differences in blood pressure or arterial stiffness following the 4-week supplementation with MC compared to PLA. However, metabolite profiling highlighted changes to the urinary metabolome following MC consumption ($P < 0.001$ within and between groups). Several discriminatory metabolites of interest were putatively identified as metabolites of the tryptophan and histidine pathways. **Conclusions:** These findings suggest that bi-daily MC supplementation for 4-weeks has no influence on blood pressure or arterial stiffness in healthy individuals, but does exert distinct metabolic changes. Specifically, MC concentrate appears to influence amino acid metabolism which warrants further investigations.

3899 Board #216 May 30 9:00 AM - 10:30 AM

Traditional Intervention Versus Nutritional Coaching: Which Approach Was More Efficient In Health Promotion?Ana Paula Troccoli Noronha, Luciana Oquendo Pereira-Lancha, Danielle Kallas, Paula Helena Dayan-Kanas, Antônio Herbert Lancha Jr.. *Universidade de São Paulo, São Paulo, Brazil.**(No relevant relationships reported)***Traditional Intervention Versus Nutritional Coaching: Which Approach Was More Efficient In Health Promotion?**

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The worldwide prevalence of overweight and obesity has shown a rapid and progressive increase in the last decades, being characterized as a true world epidemic. In attempt to reduce it, a lot of new diets has been proposed in recent years as strategies for weight loss. However, studies report that 95% of overweight people fail in the maintenance of weight loss diets and then regain part of this weight later. In this context, new approaches such as nutritional coaching, oriented towards behavior change, assume an increasingly important role, specifically in its application to the nutrition sciences. **PURPOSE:** This study aimed to analyze the effectiveness of the use of coaching techniques in health parameters such as body weight, fat mass and waist circumference in physically active women, overweight, pre menopausal, compared to the traditional model of diet prescription. **METHODS:** 10 participants were assigned to the Nutritional Coaching group (NC; n=5), which received weekly care, or Traditional Group (TG; n=5), which received monthly care, for a 3 months intervention study. The physical activity protocol was composed by 40 minutes of resistance training and 20 minutes of treadmill. An individual diet plan was established to create an energy deficit of 750 kcal per day. **RESULTS:** The average of weight loss in NC group was 4.02 kg, in comparison to TG group (1.46 kg). The average of fat mass loss in the NC group was 4.02 kg in comparison to TG group (2.38 kg). Finally, the average of the reduction in waist circumference in the NC group was 4.5 cm in comparison to the TG group (2.0 cm). **CONCLUSION:** Nutritional Coaching was effective in promoting weight loss, improving body composition and reducing waist circumference. Nutritional coaching has effective tools that can be used by health professionals to help in promoting behavior change and, consequently, weight loss.

3900 Board #217 May 30 9:00 AM - 10:30 AM

Dietary Intake Is Associated With Ankle-brachial Index, Inflammation, And Ambulation In Peripheral Artery Disease PatientsPolly Montgomery¹, Ming Wang¹, Biyi Shen¹, Ana Casanegra², Federico Silva- Palacios³, Allen Knehans³, Andrew Gardner¹.¹Penn State COM, Hummelstown, PA. ²Mayo Clinic, Rochester, MN. ³OUHSC, Oklahoma City, OK.*(No relevant relationships reported)*

The aims of this study were (a) to determine whether the daily dietary intake of nutrients by patients (pts.) with peripheral artery disease (PAD) met recommended levels for adults 50 years or older, and (b) to determine whether meeting recommended levels of nutrients was associated with ankle-brachial index (ABI), inflammation, and ambulation of PAD pts. **Methods:** 48 pts. were assessed on their dietary intake of 20 nutrients during a three-day period. Pts. were also characterized on demographic variables, comorbid conditions, cardiovascular risk factors, ABI, 6-minute walk distance, and high-sensitivity C-reactive protein (hsCRP). **Results:** Few pts. met the daily recommended intakes for calcium (4%), fiber (6%), vitamin E (6%), trans fatty acids (13%), vitamin A (15%), total sugars (19%), potassium (23%), sodium (29%), saturated fat (29%), and vitamin C (31%), and none of the pts. met the daily recommended intake of vitamin D (0%). Overall, pts. met few of the 20 dietary recommendations. Only 17 of 48 pts. met more than 7 of the recommendations. The ABI regression model adjusted for age, sex, race, smoking, hypertension, dyslipidemia, body mass index, and percentage body fat, total sugars was the only significant predictor ($p < 0.001$) as pts. who did not meet the recommendation had lower ABI values. The hsCRP adjusted regression model, omega-3 polyunsaturated fatty acids ($p = 0.001$) was the strongest significant predictor, indicating that those who did not meet the recommendation had higher hsCRP values. Finally, the 6-minute walk distance adjusted regression model, folate ($p = 0.011$), and dietary score index ($p = 0.014$) were significant predictors, as those who did not meet the recommendation for folate and those who met five or fewer of the 20 recommendations had shorter 6-minute walk distances. **Conclusions:** PAD pts. consume a low nutrient dense diet that is deficient in many vitamins, calcium, fruits, and vegetables, and contains too much added sugar, saturated and trans fats, and processed foods. Additionally, more severe PAD, greater inflammation, and ambulatory dysfunction are independently associated with aspects

of a low nutrient dense diet, such as too much intake of added sugars, low intake of omega-3 polyunsaturated fatty acids and folate, and only meeting the recommended intakes of five or fewer nutrients.

3901 Board #218 May 30 9:00 AM - 10:30 AM

The Superoxide Scavenger And Antioxidant, L-Propionyl-carnitine, Is Metabolically Enhanced Following Exercise In HypoxiaGareth W. Davison¹, Maria Vinaxia², Rose McGovern¹, Anna Novials³, Xavier Correig², Conor McClean¹. ¹Ulster University, Belfast, United Kingdom. ²Rovira i Virgili University, Tarragona, Spain. ³Hospital Clinic de Barcelona, Barcelona, Spain.

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L-Propionyl-carnitine, a propionyl ester of L-carnitine, is known to scavenge the superoxide anion, inhibit lipid peroxidation, and protect against H₂O₂-induced DNA strand scission. While exogenous L-propionyl-carnitine supplementation modulates lipid peroxidation in humans, the endogenous metabolic response following exercise is currently unknown. **PURPOSE:** To investigate the metabolic profile of L-propionyl-carnitine following exercise in hypoxia. **METHODS:** Twenty-four ($n=24$) apparently healthy male participants were recruited (age 28 ± 5 years; mass 74 ± 8 kg; stature 177 ± 6 cm; $_{2max}$ hypoxia 45 ± 2 ml·kg⁻¹·min⁻¹; normoxia 60 ± 9 ml·kg⁻¹·min⁻¹), and completed 1 hr of exercise at a workload corresponding to 75% of pre-determined $_{2max}$ in hypoxia ($F_{iO_2} = 0.16\%$), and repeated in normoxia ($F_{iO_2} = 0.21\%$). Serum L-propionyl-carnitine was quantified using a LC ESI-qTOF-MS untargeted metabolomics approach at pre-, post-exercise and 3 h post-exercise (Recovery). **RESULTS:** Exercise performed in hypoxia and normoxia independently increased L-propionyl-carnitine metabolism ($p < 0.05$, pre vs. post-exercise), and hypoxia *per se* did not induce a selective metabolic change when compared to normoxia ($p > 0.05$). Recovery from exercise was similar for both hypoxia and normoxia ($p < 0.05$, post vs. 3 hrs post-exercise). There was a main effect for time observed for pooled hypoxia and normoxia values (pre vs. post-exercise vs. 3 hrs post-exercise, $p < 0.05$). **CONCLUSION:** This is the first data to show a metabolic response in L-propionyl-carnitine following exercise. As such, we propose the increased mobilisation of L-propionyl-carnitine may be beneficial to counteract deleterious free radical production and protect against vascular exercise-induced oxidative stress.

3902 Board #219 May 30 9:00 AM - 10:30 AM

Diets High In Fish And Sugar-sweetened Beverages Affect Energy Expenditure And Energy Balance.Cassie M. Mitchell, Paolo Piaggi, Jonathan Krakoff, Susanne B. Votruba. *National Institutes of Health, Phoenix, AZ.*

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BACKGROUND: Recent evidence indicates that dietary patterns, independent of macronutrient and total calorie consumption, alter body weight. This implies an effect of dietary pattern on 24-hour energy expenditure (24hrEE) and energy balance (EnBal). **PURPOSE:** To evaluate whether a 12-week weight maintaining, macronutrient stable dietary intervention that varies only by meat, fish or sugar sweetened beverages (SSBs) consumption alters 24hrEE and EnBal. **METHODS:** 32 healthy males were recruited to participate in a 12-week in-patient study and were randomized to a weight-maintaining dietary intervention that contained a varying combination of meat, fish or SSBs in a factorial design. Macronutrient composition across all dietary intervention groups was: 50% carbohydrate; 30% fat; and 20% protein. Twenty-four hour EE and EnBal were measured in a human metabolic chamber (e.g. room calorimeter). All measurements were performed at baseline and week 12. Descriptive statistics and analyses of co-variance were performed to characterize participants at baseline and quantify the changes in 24hrEE and EnBal over time. **RESULTS:** 28 males (age: 46.6 ± 10.4 years; body mass index 26.9 ± 4.1 kg/m²; predicted energy needs: 2311 ± 241 kilocalories/day [kcal/d]) completed all measurements. Fish consumption resulted in higher 24h EE by 127.4 ± 51.4 kcal/d compared to no fish consumption ($p = 0.0217$). SSB consumption had a 24hEE that was 136.3 ± 52.4 kcal lower ($p = 0.0166$). Approximately 85% of the decrease in 24hEE with SSB consumption was due to lower awake, inactive EE ($p = 0.0003$) and had greater 24hr EnBal when compared to groups without SSBs ($p = 0.0489$). **CONCLUSION:** Our data indicate that protein and carbohydrate quality (as reflected by fish versus SSB consumption), rather than % daily intake, influence 24hr EE and inactive EE, and thus EnBal. If so, this would imply a metabolic effect of SSB consumption independent of total calories or macronutrient composition that might contribute to overall increasing adiposity rates. Supported by intramural funding from NIDDK.

3903 Board #220 May 30 9:00 AM - 10:30 AM

Energy Balance During The Postpartum Period Is Associated With Metabolic Adaptation

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Previous studies have demonstrated that perturbations in body weight result in modified resting metabolic rate (i.e. metabolic adaption) that attempts to return the body to its customary weight (i.e. the set-point theory). How body weight changes during pregnancy impacts resting metabolic rate (RMR) and subsequently affects the ability to return to pre-pregnancy weight postpartum has not been investigated. **PURPOSE:** To examine if metabolic adaptation occurs during the postpartum period. **METHODS:** RMR and body composition were measured after an overnight fast in 26 women (mean age 34, range 26-40; mean BMI 28.1 ± 6.0 kg/m²) at 3, 6, 9 and 12 months postpartum. Energy balance over the postpartum period was calculated as the sum of the change in both fat mass (FM) and fat-free mass (FFM) multiplied by their respective energy densities. The ratio of RMR to FFM was used to assess the degree of metabolic adaptation. The degree of linearity between weight change and energy balance with metabolic adaptation was assessed using Pearson correlation. **RESULTS:** Weight loss (mean weight loss: -3.4 ± 3.6 kg) was positively associated ($\rho = 0.4$, $p = 0.03$) with metabolic adaptation (mean RMR/FFM: 31.8 ± 2.8 kcal/d/kg). Total energy balance (mean energy balance: -28719 ± 29546 kcal) was positively associated ($\rho = 0.5$, $p = 0.01$) with metabolic adaptation, indicating that a greater negative energy balance is associated with a lower resting metabolic rate relative to metabolically active fat-free mass (i.e. a greater metabolic efficiency). This relationship was independent of whether or not women had returned to their pre-pregnancy (i.e. set-point) body weight. **CONCLUSION:** The acute perturbation in body weight away from the set-point as a result of pregnancy contributes to the presence of metabolic adaptation during the postpartum period. The increase in metabolic efficiency in relation to greater weight loss during this time may contribute to difficulty in continuing to lose weight, or maintaining lost weight, after childbirth.

3904 Board #221 May 30 9:00 AM - 10:30 AM

Cardiovascular And Metabolic Responses Of US Army Soldiers During Heavy Military Rucksack Carriage

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Military leaders require accurate information on the physiological stress induced by modern equipment loads in order to optimize planning for dismounted operations. **PURPOSE:** Evaluate the effects of heavy rucksack loadings on physiological responses of Soldiers during incremental treadmill walking. **METHODS:** Six male US Army Soldiers (age, 20 ± 1 years; height, 176 ± 6 cm; body mass (BM), 74 ± 5 kg) performed incremental treadmill walking while unloaded and carrying three proportional rucksack loads (22, 44, and 66% of BM). Treadmill speed was initially set at 4.2 km/h for 3 min then increased by 0.3 km/h every 2 min. Tests were terminated if volunteers completed the highest treadmill speed (7.1 km/h), reached volitional fatigue, or if their respiratory exchange ratio (RER) exceeded 1. Volunteers wore a chest-strap heart rate monitor and breathed into a metabolic cart that measured oxygen consumption. **RESULTS:** Volunteers completed all walking speeds while unloaded (7.1 km/h). While speed did not decrease significantly when carrying 22% BM (6.9 ± 0.3 km/h; $p = 0.09$); volunteers finished at significantly slower speeds when carrying 44% BM (6.2 ± 0.5 km/h; $p = 0.01$) and 66% BM (5.5 ± 0.6 km/h; $p < 0.01$). Peak heart rate during the unloaded walk ($133 \pm$ bpm) was significantly lower than load carriage with 22% BM (157 ± 12 bpm; $p < 0.01$), 44% BM (162 ± 14 bpm; $p < 0.01$), and 66% BM (161 ± 16 bpm; $p < 0.01$). Peak oxygen consumption for the unloaded walk (1.85 ± 0.23 L/min) was significantly lower than when carrying 22% BM (2.25 ± 0.36 L/min; $p = 0.02$) but not 44% BM (2.27 ± 0.55 L/min; $p = 0.09$) or 66% BM (2.40 ± 0.65 L/min; $p = 0.06$). **CONCLUSION:** Heavy military rucksack loads severely impair marching pace and induce considerable cardiovascular and metabolic stress. Our results provide preliminary evidence that heart rate may be a superior work intensity indicator than oxygen consumption for Warfighter tasks. The views expressed in this abstract are those of the authors and do not reflect the official policy of the Department of Army, Department of Defense, or the U.S. Government.

3905 Board #222 May 30 9:00 AM - 10:30 AM

Measured And Estimated Energy Cost Of Sedentary And Active Activities

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Physical inactivity represents a public health problem in an endemic obesity scenario worldwide. Therefore, it is relevant to estimate the energy cost of daily activities for nutritional and physical activity assessment and guidance. **PURPOSE:** To measure the energy expenditure (EE) of sedentary (typing) and daily activities (organizing bookshelves, climbing up and down stairs and walking for pleasure and exercise) and to compare the results with the ones estimated from the Compendium of Physical Activities (CAF) and FAO/WHO tables. **METHODS:** Data are from 80 adult subjects (age ≥ 20 years) from a larger study measuring total daily EE by various methods (accelerometry and double-labeled water) participated in the study. EE was measured with a portable calorimeter during resting (MET), typing, standing, arranging books on a shelf, going up and down stairs (8 floors) and walking on the treadmill at three speeds (for pleasure, pleasure - 0.8 km/h, and exercise) on different visits to the laboratory. Basal metabolic rate (BMR) was also measured early in the morning with the subjects in the fasting state after 8hr sleep. BMR and MET values were used to estimate EE by CAF and FAO/WHO tables. Anthropometric and % body fat (%BF, DXA) assessment was also obtained. **RESULTS:** The mean (SD) age was 29.9 (10.4) years with a mean BMI of 23.8 (3.8) kg/m² and %BF of 30.0 (8.8). The EE (kcal/min) of typing was 1.41 (0.48) and it was the only nonsignificantly different value in comparison to either method of estimation. The EE of going up stairs was underestimated by 3.01 (1.69) kcal/min by both methods. **CONCLUSIONS:** Based on the measured values, it can be concluded that the values described in the CAF or FAO/WHO overestimate the EE, except for the sedentary activity of typing, even when BMR or MET are measured. Health professionals should be aware of the inaccuracy of their activity EE of daily activities. **FUNDING:** CNPq (310461-2016-20 and FAPERJ (E-26/202.514/2018; E-26/203.068/2017)

3906 Board #223 May 30 9:00 AM - 10:30 AM

Assessment Of Metabolic Responses To Exercise In Elite Professional Cyclists Using High-throughput Metabolomics

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The field of sports medicine and performance has benefited from the implementation of innovative strategies to study physiological responses to exercise in elite athletic populations. Over the last decade, the field of metabolomics has emerged as a powerful tool to precisely measure multiple metabolic pathways at the cellular level, fostering great strides in many fields. Therefore, the possibilities of deploying metabolomics to the field of sports medicine and performance offers tremendous opportunities to improve understanding of metabolic responses to exercise. **PURPOSE:** To evaluate the metabolic responses to exercise in elite professional cyclists using high-throughput mass spectrometry-based metabolomics. **METHODS:** 24 international-level World Tour professional cyclists (PS) performed a graded exercise test to exhaustion on a cycling ergometer. Both prior to and after exercise, 100 μ l of whole blood were collected for metabolomics analysis using high-throughput mass spectrometry-based methodologies developed by our group. Since blood lactate ([La⁻]) concentration is an accurate surrogate for metabolic efficiency (*San-Millan and Brooks, 2018*), cyclists were divided into two groups for multivariate analyses based on a whole blood [La⁻] above or below 5 mmol·L⁻¹ at an exercise intensity of 5 W·kg⁻¹. Group A consisted of 12 cyclists that were all able to pedal beyond this exercise intensity, whereas Group B (n=10) contained only one. **RESULTS:** We observed significant changes between baseline and maximal exercise in glycolytic intermediates, TCA cycle metabolites and amino acids ($p < 0.05$). Group A cyclists showed higher baseline levels of ketogenic amino acid in particular. In addition, this group possessed higher levels of succinate at rest ($p = 0.08$) and lower levels after exercise ($p = 0.06$) showing improved metabolic efficiency. Oxidized glutathione (GSSG) is higher both pre and post-exercise ($p < 0.0001$ and $p < 0.01$, respectively), suggesting increased basal activation of oxidative stress management pathways. **CONCLUSIONS:** High-throughput metabolomics offers an efficient methodology to assess metabolic changes during exercise, as well as the opportunity to identify metabolic parameters that can distinguish cyclists of different performance levels.

3907 Board #224 May 30 9:00 AM - 10:30 AM
Energy Expenditure And Body Composition In Mexican Female Recreational Dancers Of Latin, Zumba, And Twerk

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Caloric surplus has been associated with issues in body composition and weight management. In Mexico, 36% of women over 18 years of age reported performing some type of physical activity (PA). This troubling data are related to the overweight/obesity prevalence among female Mexican adults. Dance like, Latin, Zumba, and Twerk appears as an attractive form of PA for women. However, the effect they may have on energy expenditure and body composition remains unknown.

Purpose

To investigate energy expenditure and body composition in Mexican female recreational dancers of Latin, Zumba, and Twerk.

Method

77 women agreed to participate: Latin, 36, age 32.64 ± 13.16, BMI 24.41 ± 6.53, Zumba, 18, age 42.78 ± 16.55, BMI 26.63 ± 4.92, and Twerk, 23, age, 24.39 ± 5.38, BMI, 22.57 ± 1.45. Inclusion criteria included participation for more than 4 weeks and at least four times per week. Body fat percentage and fat-free mass were calculated bio impedance (BIA). Total Kcal spent during the session were measured with a pedometer. The BMI was calculated using weight and height. The analysis consisted of ANOVA.

Results Based on BMI standards, all (but the Zumba participants) were classified as normal. Body fat percentage: Latin 22.62 ± 7.65, Zumba 27.68 ± 7.86 and Twerk 23.59 ± 4.53 ($p = 0.043$). Fat-free mass: Latin 23.62 ± 7.65, Zumba 23.23 ± 3.92, and Twerk 28.63 ± 9.58 ($p = 0.031$). Total Kcal spent: Latin 62.84 ± 15.47, Zumba 67.22 ± 16.91, and Twerk 32.18 ± 7.90 ($p = 0.000$).

Conclusion

The overweight/obesity prevalence in Mexican women and its health implications have precipitated an increased awareness in the value of exercise prescription and adherence. These preliminary results show that Zumba generates greater energy expenditure. They also reveal that Zumba is more popular among older participants with higher BMI and fat percentage. Future studies should be longitudinal, investigate the effects of intensity of exercise and dietary habits on weight loss, and include participants of other weight classifications and dance fitness classes. Possible limitations include small sample size and unequal sample sizes.

3908 Board #225 May 30 9:00 AM - 10:30 AM
Fuel Use In Boys And Girls During Prolonged Submaximal Exercise

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Some research has suggested that women may depend more on fat for energy during prolonged exercise compared to men. However, the extent to which this fuel use pattern exists in children is not as well understood. Specifically, the effect of sex on fuel use patterns in children during prolonged exercise is not well-understood. **PURPOSE:** This study examined fat and carbohydrate (CHO) metabolism during the latter half of a 40-minute bout of exercise in boys ($n=9$; 10.8±1.0 years, 148.5±6.7 cm, 46.6±17.2 kg) and girls ($n=10$; 10.6±1.2 years, 140.4±8.3 cm, 37.5±8.6 kg). It was hypothesized that there would be no difference between boys and girls with respect to fuel metabolism during exercise. **METHODS:** Participants reported to the laboratory for two separate visits. On the initial visit, body composition using dual x-ray absorptiometry and $\dot{V}O_{2max}$ were assessed. On the experimental visit, participants completed two 20-minute exercise bouts separated by a 10-minute rest. Bout 1 consisted of 10 minutes at 50% $\dot{V}O_{2max}$ and 10 minutes at 75% $\dot{V}O_{2max}$. Bout 2 consisted of 20 minutes at 50% $\dot{V}O_{2max}$. Fat oxidation rate (FOR) relative to fat-free mass [mg·kgFFM⁻¹·min⁻¹] and carbohydrate oxidation rate (COR) relative to fat-free mass [mg·kgFFM⁻¹·min⁻¹] were measured at 5, 10, 15, and 20 minutes of Bout 2 and averaged. **RESULTS:** There was no difference in $\dot{V}O_{2max}$ between the boys (38.9±8.7 ml·kg⁻¹·min⁻¹) and the girls (37.1±5.6 ml·kg⁻¹·min⁻¹) nor were there any differences in the relative intensity (% $\dot{V}O_{2max}$) during exercise. FOR relative to FFM was 5.3±0.9 mg·kgFFM⁻¹·min⁻¹ in boys and 5.5±1.2 mg·kgFFM⁻¹·min⁻¹ in girls ($p>0.05$). Proportional fat use was 35.9±7.7% in boys and 37.9±8.4% in girls ($p>0.05$). COR relative to FFM was 24.1±4.9 mg·kgFFM⁻¹·min⁻¹ in boys and 23.0±4.2 mg·kgFFM⁻¹·min⁻¹ in girls ($p>0.05$). Proportional CHO use was 64.1±7.7% in boys and 62.1±8.4% in girls ($p>0.05$). **CONCLUSION:** In this age range, boys and girls do not display differences in fat and CHO metabolism relative to FFM during the latter half of a prolonged bout of exercise. Future research should investigate the influence of physical maturity on potential sex differences in metabolism.

This study was supported by the Ball State University ASPIRE Graduate Student grant program.

3909 Board #226 May 30 9:00 AM - 10:30 AM
Serum MOTs-c Concentrations Are Higher In Older Females Compared To Older Males But Is Not Affected By Physical Activity Status Or Cardiorespiratory Fitness In Young And Older Adults

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Recently, MOTs-c, a mitochondrial-derived peptide with effects on metabolic health, was identified. However, few data exist in humans including factors that affect circulating concentrations. **PURPOSE:** The aim of this study was to discern if serum MOTs-c concentrations were different between physically active and inactive young and older adults, or affected by cardiorespiratory fitness, body composition, hemoglobin A1c (HbA1c), and sex. **METHODS:** Forty-one healthy Young (18 – 30 yrs; $n=26$) and Older (55 – 70 yrs; $n=15$) adults participated in the study. Young and Older groups were further divided into Active and Inactive groups. Serum MOTs-c concentrations, maximum oxygen consumption ($\dot{V}O_{2max}$), body composition, and HbA1c were measured. Independent student's t-tests were performed to determine group mean differences in serum MOTs-c concentrations between: Young and Older groups, Active and Inactive Young, Active and Inactive Older, males and females, Young males and females, and Older males and females. An α -level of ≤ 0.05 was set a priori. Pearson's correlations were performed between MOTs-c concentrations and the following: $\dot{V}O_{2max}$, HbA1c, percent body fat, fat mass, and lean mass. **RESULTS:** There were no differences in serum MOTs-c concentrations between Young and Older subjects, between Active Young and Inactive Young or Active Older and Inactive Older subjects. Serum MOTs-c was also not correlated with $\dot{V}O_{2max}$, percent body fat, lean body mass, fat mass or HbA1c, which were in normal ranges. When sexes were analyzed separately, MOTs-c levels in Older females were significantly higher than Older males (419.9±43.3 vs 354.0±63.7 ng/mL, respectively; $p=0.03$). These findings suggest that circulating MOTs-c concentrations are not affected by physical activity status, cardiorespiratory fitness, body composition, or normal HbA1c in healthy young and older adults, however, vary between sexes in older adults.

3910 Board #227 May 30 9:00 AM - 10:30 AM
A Dietary Assessment Of Mid-Spectrum Chronic Kidney Disease

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BACKGROUND: Diets of adult individuals with mid-spectrum Chronic Kidney Disease (CKD) remain understudied. The 2015-2020 Dietary Guidelines for Americans food patterns based on the Recommended Dietary Allowances (RDA) in concert with the National Kidney Foundation Kidney Disease Outcomes Quality Initiative (NKF KDOQI) guidelines are advised to individuals with CKD. Estimated glomerular filtration rate (eGFR) remains the best method for tracking CKD progression, yet relationships between self-reported dietary intake and eGFR are understudied. **PURPOSE:** To assess the self-reported dietary pattern in patients with stage 3 or 4 CKD in contrast to the RDA and NKF KDOQI dietary guidelines and to identify predictors of eGFR. **METHODS:** Twenty participants with stage 3 or 4 CKD [$n = 6$ male (M); $n = 14$ female (F)]; age 62.0 ± 9.9 years; weight 80.9 ± 16.2 kg; body fat 37.3 ± 8.5% of weight; eGFR 51.5 ± 6.82 mL/min/1.73m²) completed self-reported dietary assessments for an average of 5 days. Diet was assessed using the ESHA Food Processor Software, Version 11.1. Micro- and macronutrient analyses for males and females were compared to the RDA and NKF KDOQI guidelines to identify malnutrition, and stepwise multiple linear regression models were used to identify predictors of eGFR, p -values were considered significant at the $\alpha = 0.05$ level. **RESULTS:** On average, all subjects met the RDA and NKF KDOQI guidelines for caloric intake. Average consumption of saturated fat (F = 24.3 ± 10.8g, M = 34.1 ± 6.0g), sodium (F = 3780 ± 2510mg, M = 4210 ± 386mg) and protein (F = 65.0 ± 23.5g, M = 107.3 ± 27.3g) was high while the average consumption of fiber (F = 13.6 ± 4.1g, M = 14.8 ± 7.3g), calcium (F = 573 ± 325mg, M = 720 ± 224mg), potassium (F = 240 ± 1800mg, M = 940 ± 492mg) and phosphorous (F = 628 ± 1320mg, M = 425 ± 314mg) was low. Significant predictors of eGFR were age ($\beta = -0.29$, $p = 0.023$), calcium ($\beta = 0.02$, $p < 0.001$), body fat percentage (BF%) ($\beta = -1.47$, $p = 0.001$),

protein intake ($\beta = -1.20, p < 0.001$), weight ($\beta = 0.42, p = 0.033$), and daily caloric intake ($\beta = -0.36, p = 0.045$). **CONCLUSION:** When compared to the RDA and NKf KDOQI guidelines, CKD patients had poor nutritional quality. Increased protein intake and BF% were the strongest predictors of reduced eGFR. Future interventions in CKD patients should improve diet quality to concomitantly improve body composition and eGFR.

3911 Board #228 May 30 9:00 AM - 10:30 AM
RELATIONSHIP BETWEEN INSULIN RESISTANCE, BODY COMPOSITION, AND PHYSICAL ACTIVITY IN OLDER ADULTS

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(No relevant relationships reported)

There are 27 million adults in the U.S. with type II diabetes mellitus, a condition associated with significant morbidity and mortality. Existing therapies can be costly, have side effects and may not achieve adequate disease control. Therefore, it is useful to identify lifestyle factors such as physical activity (PA) that may mitigate insulin resistance. Key clinical indicators of insulin resistance include fasting blood glucose (FBG), hemoglobin A1c (HbA1c) percentage, and the homeostatic model assessment of insulin resistance (HOMA-IR). **PURPOSE:** To evaluate the relationships among insulin resistance indicators, body composition, and objective and subjective measures of habitual physical activity in older adults. **METHODS:** In 82 generally healthy nondiabetic adults (≥ 58 years, 23 m/59 f), body composition (bioelectrical impedance), fasting blood glucose (glucometer), serum insulin (enzyme-linked immunosorbent assay), HbA1c (HbA1c Analyzer), objective PA (7-day accelerometry), and subjective PA (Community Healthy Activities Model for Seniors (CHAMPS)) were measured. Controlling for age and body fat percentage, partial correlations between insulin resistance indicators and biometrics were determined (Significance was set as $\alpha < 0.05$). **RESULTS:** Mean values were (mean \pm sd): age (68.5 \pm 6.3 y), BMI (26.2 \pm 6.0 kg/m²), visceral fat (119.2 \pm 68.4 cm²), FBG (96.9 \pm 8.3 mg/dL), HOMA-IR (2.6 \pm 0.8), HbA1c (5.3 \pm 0.2%), and accelerometry (cts/min: 114.1 \pm 56.5; sedentary-to-moderate PA ratio: 12.8 \pm 6.1). FBG was significantly correlated with serum insulin ($r = 0.26$), visceral fat area ($r = 0.40$), cts/min ($r = -0.29$), and sedentary-to-moderate ratio ($r = 0.24$). HOMA-IR was significantly correlated with visceral fat ($r = 0.41$). No significant correlation was found between HbA1c and any measured variable. **CONCLUSIONS:** These preliminary data support previous findings that serum markers of insulin resistance are associated with physical activity and body composition. These findings suggest a potential role for using body composition and physical activity as clinical end points when managing patients with insulin resistance. Randomized controlled studies are needed to more rigorously assess the impact of physical activity on clinical indicators of diabetes mellitus in older adults.

3912 Board #229 May 30 9:00 AM - 10:30 AM
The Influence Of Heat On Appetite Regulating Hormones

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Leptin has been established as an energy-controlling hormone because of its role in activating the JAK-STAT3 pathway. Temperature has its own prominent role governing appetite regulation and thus, energy expenditure. Previous research has demonstrated consistent decreases in leptin while in a fasted state. Exercising in the heat (1-hour of cycling @60% VO_{2max} in 33°C) has also shown reductions in leptin. However, in order to elucidate the influence of environment, independent of exercise, a fasted resting investigation is needed.

PURPOSE: Determine the impact of environmental temperature (33 vs. 20°C) on adipose derived appetite-regulating hormones (leptin and adiponectin) and the impact on energy expenditure.

METHODS: 10 college-aged males (27.3 \pm 5 y, 86.7 \pm 13 kg, and 1.83 \pm 4.3 m; 25.8 \pm 0.9 kg/m²) completed two randomized, resting experimental trials in the Heat (HT, 33°C) and at Room Temperature (RT, 20°C) at 60% humidity. Blood draws were taken before intervention and after 3 hours for analysis of leptin and adiponectin. Oxygen consumption was measured at 1-, 2-, and 3-hr time-points.

RESULTS: HT trial temperatures were greater than RT for both core (mean \pm SEM; 37.17 \pm 0.08 vs. 36.89 \pm 0.08°C, $p = 0.002$) and skin (37.59 \pm 0.10 vs. 32.65 \pm 0.48°C; $p < 0.001$). Oxygen consumption in HT was greater than RT during the 2nd (4.37 \pm 0.14 vs. 4.13 \pm 0.15 ml/kg/min, $p = 0.037$) and 3rd hours (4.95 \pm 0.26 vs. 4.28 \pm 0.19 ml/kg/min, $p = 0.002$). Fasting leptin concentrations in RT decreased to a greater extent than

in HT (mean $\Delta \pm$ 95% CI; -2.05 \pm 1.72 vs. -0.89 \pm 1.67 ng/ml; $p = 0.036$, respectively); however, after adjustment for plasma volume shifts (-7.5%) the interactive effect dissipated (-1.79 \pm 1.72 vs. -0.89 \pm 1.6 ng/ml; $p = 0.068$).

CONCLUSIONS: The reduction of heat stress increased energy expenditure and attenuated the leptin reaction. These data may have implications for appetite control and weight management.

3913 Board #230 May 30 9:00 AM - 10:30 AM
Agricultural Activities Affect The State Of Body Characteristics In Peri-urban Kenya

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PURPOSE: The research aims to find out the relationships between agriculture and health state in peri-urban Kenya.

METHODS: We randomly selected 70 households who were former of vegetable and crop cultivation and mixed farming (vegetable and crop cultivation and husbandry) (male: 46 \pm 10 yrs, n=35, female: 41 \pm 9yrs, n=37) in Wangige region (peri-urban setting), Republic of Kenya. Participants Data on body characteristics, daily activity by wearable devices, food consumption by the 24-hour recall, and well-being were collected by trained enumerators. **RESULTS:** In the research, there were positive correlation between weight (M = 72.1 kg, SD = 14.8) and intaking of home garden foods in men (M = 37.2 % SD = 16.5), $r = .35, p < .05, n = 35$. And weight (M = 74.2 kg, SD = 14.8) and time of over of activity level 2 (M = 88.1 min, SD = 95.3) in women, $r = .34, p < .05, n = 37$, and And time of over of activity level 2 (M = 88.1 min, SD = 95.3) and number of agricultural fields (M = 1.3, SD = 0.6) in women, $r = .55, p < .001, n = 37$. There was negative correlation between weight (M = 74.2 kg, SD = 14.8) and intaking of home garden foods (M = 37.8 %, SD = 13.3), $r = .27, p < .05, n = 37$, and Body Mass Index (BMI) (M = 28, SD = 5) and intaking of home garden foods (M = 37.8 %, SD = 13.3), $r = .38, p < .05, n = 37$, in woman.

CONCLUSIONS: In the Peri-Urban setting in the Republic of Kenya, the cause of increasing weight and BMI suggested that affect the decreasing intaking of home garden foods and the number of agricultural fields in the female. Much of people works agriculture of main or side job in Kenya. Agricultural activity of role in peri-urban settings might affect daily activities and food consumption for the prevention of non-communicable diseases. The research was supported by academic cloud funding*Academist*, Doctor support fund in Tokyo University of Agriculture, Global readership training program at United Nations University, Research Fund, Resilience at Works.

3914 Board #231 May 30 9:00 AM - 10:30 AM
Effects Of Acute Exercise On Appetite Regulation And Energy Intake In Men And Women

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PURPOSE: Compare energy intake and appetite regulation responses between men and women following acute bouts of aerobic (AEx) and resistance exercise (REX).

METHODS: Men and women (n=12 each) with overweight/obesity matched on age (32.3 \pm 2 vs. 36.8 \pm 2 yrs, $p=0.14$) and BMI (28.1 \pm 1.2 vs 29.0 \pm 1.5 kg/m², $p=0.64$) completed 2 conditions; 1) AEx (65-70% of age-predicted maximum heart rate for 45 min) and 2) REX (1-set to failure on 12 exercises). Each condition was initiated in the post-prandial state (35 minutes post breakfast). Appetite (visual analog scale for hunger, satiety and prospective food consumption [PFC]) and hormones (ghrelin, PYY, and GLP-1) were measured before and every 30 minutes for 3 hours following consumption of a standardized breakfast. Post exercise *ad libitum* energy intake at the lunch meal was also measured.

RESULTS: There was no difference in relative *ad libitum* energy intake between men and women following either AEx (43.4 \pm 5 vs. 45.4 \pm 4% of total energy needs, $p=0.80$) or REX (48.3 \pm 3 vs. 46.6 \pm 3% of total energy needs, $p=0.81$). In the AEx condition there were no differences in area under the curve (AUC) for satiety or PFC between men and women, although men reported higher PFC vs women at the 30 (33.3 \pm 5 vs. 17.5 \pm 4mm, respectively, $p=0.03$) and 90 min (49.8 \pm 6 mm vs 30.2 \pm 6 mm, respectively, $p=0.03$) post-prandial time points. Additionally, in the AEx condition, a greater hunger AUC was detected in men vs women (7815 \pm 638 vs 5428 \pm 762 mm, respectively, $p=0.02$), which was driven by men reporting significantly greater hunger vs women at the 90 min post-prandial time point (42.7 \pm 5 vs. 16.6 \pm 4 mm, $p<0.001$). No differences

in AUC for ghrelin, PYY, and GLP-1 were noted between men and women following either AEx or REx (all $p > 0.05$). However, significantly higher ghrelin was observed in women vs. men at the 150 (807.6 \pm 37 vs. 652.2 \pm 41 pg/mL, respectively, $p = 0.01$) and 180 min (812.4 \pm 39 vs. 677.5 \pm 49 pg/mL, respectively, $p = 0.05$) post-prandial time points. **CONCLUSIONS:** The data suggest that men report greater hunger and PFC than women following acute AEx, and that women have higher ghrelin levels than men following acute REx. Future work is needed to examine if sex-based differences in appetite regulation and energy intake are present with chronic exercise of differing modalities.

3915 Board #232 May 30 9:00 AM - 10:30 AM
Reliability And Validity Of A Mobile Setup For Metabolic Syndrome Diagnosis Using Point-of-care Analyzers
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The metabolic syndrome (MetS) is a worldwide public health concern and is characterized by having three or more of these risk factors: high blood glucose (Glc), increased waist circumference (WC), high blood pressure (BP), reduced serum high-density lipoprotein (HDL) and increased serum triglycerides (TG). As certain rural regions lack the required infrastructure for optimal medical care, mobile diagnostics using point-of-care analyzers could help by identifying people at risk for MetS.

PURPOSE: Test the reliability and validity of MetS risk factor analysis using point-of-care analyzers in a mobile examination unit.

METHODS: Fifty participants (18 test-retest; 52 \pm 7 y; 170 \pm 10 cm; 80 \pm 19 kg) were enrolled in the study. Agreement of Glc, HDL and TG of three point-of-care analyzers (A, B, C) against a reference lab (REF) were analyzed by Bland-Altman (bias, Limits of Agreement (LoA)) and McNemar's test (MN). Further, MetS diagnosis by the mobile setup was tested for inter-session reliability by Spearman's ρ and test-retest variability (TRV%).

RESULTS: The range of systematic bias was for Glc -21 to -8 mg/dl, for TG -90 to 3 mg/dl and for HDL -8 to 9 mg/dl. Device C was excluded from further analyses due to missing values. Device A was chosen for additional analysis based on smallest bias and LoA (Glc: -8 [LoA -27 to 11] mg/dl; TG: 3 [LoA -40 to 46] mg/dl; HDL: -3 [LoA -16 to 11] mg/dl) and best agreement of MetS diagnosis with REF (MN: A vs. REF: $p > .05$; B vs. REF: $p < .05$). Test-retest analysis for risk factor classification and MetS diagnosis was performed in a mobile examination unit using device A. No inter-session differences for risk factor and MetS diagnosis were shown (MN day 1 vs. 2: $p > .05$). Spearman's ρ and TRV for risk factors were: TG: $r = .734$ ($p < .05$); 3.3%; HDL: $r = .893$ ($p < .05$); 6.8%; Glc, $r = .076$; 1.9%; systolic BP: $r = .372$; 1.7%; diastolic BP: $r = .457$; 3.3% and WC: $r = .950$ ($p < .05$); 1.1%.

CONCLUSIONS: The mobile setup showed no inter-session difference in MetS diagnosis. TRV was low for all risk factors and test-retest reliability was acceptable for TG, good for HDL and excellent for WC. Inter-session variations in Glc and BP did not influence the overall risk factor classification and MetS diagnosis. A mobile setup using a point-of-care analyzer for blood analysis is a valid and reliable method for a near-to-home MetS screening.

3916 Board #233 May 30 9:00 AM - 10:30 AM
Abstract Withdrawn

3917 Board #234 May 30 9:00 AM - 10:30 AM
Nutritional Group Counseling Or Individualized Prescription? Anthropometric, Metabolic, Nutritional And Mental Health Responses: A Longitudinal Study
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PURPOSE: The aim of the present study was to investigate the effects of nutritional counseling in a group (NCG) or an individualized nutritional prescription (INP) on physical health (inferred from anthropometric, body composition and metabolic responses), nutritional and mental health of overweight or obese women. **METHODS:** Seventy-four women aged 40-59 years underwent pre-intervention evaluations. The women were randomized into NCG and INP. Twenty-seven women completed the 12-week interventions, 11 being in the NCG and 16 in the INP. The groups were submitted to the same concurrent exercise protocol. They were measured before and after for body weight (BW), body mass index (BMI), fat mass (FM), body fat percentage (BF), lean mass (LM), lipid profile, hemoglobin A1c (A1C), insulin and liver transaminases (AST and ALT). The dietary record was applied, and the following were calculated:

total caloric intake (TCI), carbohydrates (CHO), proteins (PTN), lipids (LIP), and saturated and polyunsaturated fats. For mental health, it was measured dissatisfaction with body image, anxiety levels, self-esteem and the presence of pathological eating attitudes.

RESULTS: After the intervention, reductions in BW, BMI, FM, BF, TCI, CHO, PTN, LIP, body dissatisfaction, anxiety, and saturated and polyunsaturated fats ($p < 0.05$) were identified. No differences were identified for LM, metabolic variables, self-esteem and pathological eating attitudes ($p > 0.05$).

CONCLUSIONS: Both nutritional interventions combined with concurrent exercise were effective in promoting improvements in anthropometrics, body composition, food intake and some mental health parameters. Therefore, the choice of the method of nutritional intervention should be based on the preference of the participants.

3918 Board #235 May 30 9:00 AM - 10:30 AM
Effects Of Nutritive And Nonnutritive Sweeteners And Exercise On Blood, Lipid, And Glucose Profiles
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 (No relevant relationships reported)

Nonnutritive sweeteners are widely used as low-calorie replacements for nutritive sweeteners. Despite widespread use, it is unclear how nonnutritive sweeteners, when combined with exercise, influence plasma lipids and glucose. **PURPOSE:** To investigate the effects of nutritive and nonnutritive sweeteners on plasma lipid profiles, complete blood counts, and glucose content following exercise.

METHODS: Ten healthy, college aged, individuals (4 females and 6 males) participated in the randomized, double-blinded, cross-over design study. Participants consumed 8 oz of sweetened drink, equivalent to three sodas worth of sweetener, containing either 445mg of stevia, 507mg of aspartame, 169mg of sucralose, or 110,000mg of sucrose in four separate occasions. After 30 minutes of each sweetened drink, participants completed a single bout of aerobic exercise on a cycle ergometer at 70% of HRmax for 45 minutes. Overnight fasting blood samples were collected at baseline, 30-min post-consumption of sweetened drink, and immediately post-exercise.

RESULTS: Sucrose resulted in significantly higher glucose content (115.8 \pm 6.14 mg/dL) than either sucralose (87.2 \pm 7.09 mg/dL, $p = .032$) or stevia (86.1 \pm 5.79 mg/dL, $p = .010$) at the 30-min post-consumption of the sweetened drink; however, this difference was no longer significant immediately post-exercise. Total cholesterol (TC), triglyceride (TG), and HDL-C were elevated following exercise (TC: 152.7 \pm 9.66 to 158.6 \pm 9.26 mg/dL, $p < .001$; TG: 69.5 \pm 5.78 to 76.8 \pm 5.83 mg/dL, $p = .002$; and HDL-C: 51.5 \pm 2.47 to 53.9 \pm 2.40 mg/dL, $p < .001$, respectively). Neutrophils increased (53.7 \pm 2.67 to 59.1 \pm 1.93%, $p = .012$) and lymphocytes decreased (36.8 \pm 2.56 to 31.3 \pm 1.56%, $p = .016$) from baseline to thirty minutes post-consumption.

CONCLUSIONS: The nonnutritive sweeteners did not change glucose content from baseline through exercise. However, a nutritive sweetener resulted in a spike in glucose 30-min post-consumption, which returned to baseline levels immediately after exercise, suggesting that glucose may be used as a substrate during exercise. Elevated neutrophils, paired with decreased lymphocytes, may be indicative of an acute immune response to exercise.

3919 Board #236 May 30 9:00 AM - 10:30 AM
Short- And Long-term Effects Of High Intensity Interval Training On Dietary Intake In Cardiac Rehabilitation
 Jenna L. Taylor, Jeff S. Coombes, FACSM, Shelley E. Keating, David J. Holland, Michael D. Leveritt. The University of Queensland, Brisbane, Australia. (Sponsor: Professor Jeff Coombes, FACSM)
 (No relevant relationships reported)

PURPOSE: The aim of this study was to investigate short- and long-term compensatory effects on dietary intake following high intensity interval training (HIIT) compared with usual care moderate intensity continuous training (MICT) during and following a cardiac rehabilitation (CR) program.

METHODS: Ninety-three patients with coronary artery disease enrolled in a 4-week CR program and were randomised to 1) 4x4-minute HIIT; or 2) 40-minutes of MICT (usual care). Patients were instructed to complete 3 weekly sessions (2 supervised, 1 home-based) for 4-weeks, and 3 weekly home-based sessions thereafter for 48-weeks. Only CR group-based dietary advice was provided. Dietary intake was measured by telephone-based 24-hour recall over two days at baseline, 4-weeks, 3-months, 6-months, and 12-months. The Three-Factor Eating Questionnaire was used to measure dietary behaviour, and fasting appetite was assessed by a 100mm visual analogue scale. Appetite hormones (ghrelin, PYY, leptin) were also analysed at baseline and 3-months. Data are mean change (95% confidence interval).

RESULTS: There was no change over the study period or differences between HIIT and MICT for daily energy intake at 4-weeks [-0.1(-0.8,0.5) vs -0.4(-1.0,0.2) MJ; $p = 0.549$] or 12-months [0.4(-0.6,1.3) vs 0.1(-0.9, 1.0) MJ; $p = 0.848$]. There were also no group differences for macronutrients, saturated fat, or fibre. Over 4-weeks, an increase in dietary restraint for both HIIT and MICT [7(-1,15) vs 6(-2,16); time effect: $p = 0.028$], coincided with an increase in hunger [6(1,10) vs 5(1,10)mm; time effect:

$p=0.001$], but this was not evident at 12-months. There was a time x group effect for leptin with a reduction for HIIT and increase for MICT [-0.9(-1.9,0.2) vs 0.7(-0.3, 1.7) ng/ml; $p=0.029$], but no changes over time or group differences for ghrelin [7(-10,23) vs 4(-12,20) pg/ml; $p=0.815$] or PYY [13(-4,30) vs 2(-14,18) pg/ml; $p=0.354$].

CONCLUSIONS: Compared to moderate intensity exercise, HIIT did not result in compensatory increases of energy intake or indicators of poor diet quality. Furthermore, HIIT reduced leptin without compensatory effects on ghrelin or dietary intake. HIIT can therefore be included in CR programs as an adjunct or alternative to MICT, without concern for any undesirable dietary compensation. **Funded by Wesley Medical Research**

3920 Board #237 May 30 9:00 AM - 10:30 AM

Change In Left Ventricular Mass In A 12-month Behavioral Weight Loss Program With Varying Doses Of Physical Activity: The Heart Health Study

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(No relevant relationships reported)

Greater left ventricular mass (LVM) has been associated with incidence of cardiovascular events in cohort studies. LVM has been shown to be associated with larger body mass index (BMI), which may partially explain the association between obesity and cardiovascular disease (CVD). Moderate-to-vigorous physical activity (MVPA) is recommended in lifestyle interventions for weight loss; however, few studies have examined how the dose of activity during weight loss contributes to changes in LVM.

PURPOSE: To examine the change in LVM in response to a behavioral weight loss intervention with varying doses of physical activity.

METHODS: Data were examined from sedentary adults (N=383; BMI: 32.1±3.8 kg/m²; age=46.2±7.7 years) enrolled in a behavioral program and randomized to a reduced calorie diet (DIET, N=127), diet plus a moderate dose of MVPA (MOD-PA, N=129), or diet plus a high dose of MVPA (HIGH-PA, N=127). All groups received weekly intervention sessions in months 1-6 followed by 2 group and 2 telephone contacts per month in months 7-12 and were prescribed a diet to reduce energy intake (1200-1800 kcal/day). MOD-PA was prescribed unsupervised MVPA that progressed to 150 min/wk, whereas HIGH-PA was progressed to 250 min/wk. Assessment of body weight and LVM using cardiac magnetic resonance imaging were assessed at both baseline and 12 months.

RESULTS: Weight (LS mean [95% CI]) significantly decreased from across time (0 months: 90.3 [89.0, 91.7] kg; 12 months: 81.2 [79.8, 82.6] kg) ($p<0.001$), with no difference between groups (Group: $p=0.29$; Group X Time: $p=0.50$). Overall baseline LVM was 42.5±7.4g/m². At 12 months, LVM decreased in DIET (-0.25±0.53g/m²), with increases in LVM in MOD-PA (1.35±0.54g/m²) and HIGH-PA (0.91±0.54g/m²). Post hoc changes in LVM showed a significant difference between DIET and MOD-PA ($p=0.0159$), with no differences between DIET and HIGH-PA ($p=0.5063$), or MOD-PA and HIGH-PA ($p=0.0799$).

CONCLUSIONS: Following a lifestyle weight loss intervention, LVM mass was reduced in the diet only condition; however, when physical activity was added, LVM appears to increase. Of interest, 150 min/wk of MVPA may be favorable compared to 250 min/wk for enhancing LVM during weight loss. The clinical implications of these results warrant further investigation. Support: NIH (R01 HL103646)

G-38 Free Communication/Poster - Fat Metabolism

Saturday, May 30, 2020, 8:00 AM - 10:30 AM

Room: CC-Exhibit Hall

3921 Board #238 May 30 9:00 AM - 10:30 AM

The Effects Of One-week Exogenous Ketone Consumption On Short Distance Time Trial Running Performance

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(No relevant relationships reported)

Currently, there is equivocal knowledge concerning the effects of ketone salt supplementation on short distance running time trial (TT) performance in well-trained subjects. **PURPOSE:** To determine the effects of one-week exogenous ketone salt supplementation on 800m running TT performance during non-fatigued and pre-exhaustive states in endurance-trained subjects. **METHODS:** In a randomized, double-blind, placebo-controlled study, endurance-trained male and female participants were allocated to one of the following treatment groups for 8 days following an initial familiarization visit: Ketone supplementation (KET) (n=16) or placebo control (CON) (n=16). Subjects underwent two consecutive 800m TT before and after the 8-day treatment period on a self-propelled, non-motorized treadmill. Time-to-completion of the first (TT1) and second (TT2) TTs, the average time-to-completion across both TTs, and blood lactate response during the TTs were measured pre- and post-treatment. A mixed factorial ANOVA was used for data analysis. **RESULTS:** KET alone exhibited a significant increase in blood β -hydroxybutyrate from pre-post-treatment ($p<0.05$). A group x time interaction was only detected for TT2 performance ($p<0.05$) but not TT1. There was no pre- to post-treatment change in TT1 performance in either group. CON demonstrated no change in TT2 performance from pre- to post-treatment; however, KET improved TT2 performance as reflected by a 3.7% faster time-to-completion from pre- to post-treatment ($p<0.05$). When examining the average time-to-completion across both TTs, there was a significant group x time interaction ($p=0.04$). CON showed no change while KET demonstrated a faster average time-to-completion from pre- to post-treatment ($p<0.05$). Blood lactate response to TTs decreased ($p<0.05$) in KET but not CON. **CONCLUSIONS:** In endurance-trained subjects, ketone salt supplementation does not appear to affect short-distance running TT performance in a non-fatigued state reflective of competition scenarios. However, ergogenic effects may be observed in high-intensity exercise when some level of exhaustion or energy substrate depletion is experienced prior, such as during training or prolonged, intermittently high-intensity sporting bouts.

3922 Board #239 May 30 9:00 AM - 10:30 AM

Effect Of L-carnitine And Exercise On Fat-rich Dietmice PPAR α And LPL In Liver

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(No relevant relationships reported)

Effect Of L-carnitine And Exercise On Fat-rich Dietmice PPAR α And LPL In Liver

Abstract:Objective: To investigate the effects of L-carnitine and exercise on lipid metabolism in the liver. Methods: To establish fat-rich diet model by feeding high-fat diets to mice. Fat-rich diet mice were divided into 4 random groups, the high-fat control group(HC group),the high-fat L-carnitine group (HL group), the high-fat exercise group(HE group)and the high-fat exercise combined with L-carnitine group(HEL group).Six weeks later, PPAR α ,LPL,FFA, TG, TC in liver and TG,TC in blood serum were tested. Results: Compared with control group, TG,TC in blood serum and TG,TC,FFA in liver was significantly low in the HE and HEL groups, at the same time, LPL and PPAR α was increased significantly in the HE and HEL groups. Compared with HE group, TC in blood serum and FFA in liver was decreased in HEL group, PPAR α significantly up-regulated in HEL group. Conclusion: 1) Long-term aerobic exercise up-regulated expression of PPAR α and LPL in liver, promoted FFA oxidative utilization. 2) In addition to PPAR α , regulation of L-carnitine supplement to LPL may be affected by other factors. 3) L-carnitine can increase the expression of PPAR α and decrease the content of FFA on athletic mice, to play its role in adjusting lipids.

Key words: L-Carnitine; exercise; lipid metabolism

3923 Board #240 May 30 9:00 AM - 10:30 AM
Effects Of Extra-Virgin Olive Oil And Exercise Training On Inflammation In Rats Fed A High-fat Atherogenic Diet

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Extra-virgin olive oil (EVOO), commonly seen in Mediterranean diet, has been shown to exert anti-inflammatory effect in chronic disease prevention. Long-term high-fat diet increases chronic inflammation, which leads to cardiovascular diseases and metabolic syndrome. **PURPOSE:** The purpose of the study is to evaluate the effects of 12-week EVOO supplementation and exercise training on circulatory inflammatory markers in rats fed a high-fat diet. **METHODS:** Female Sprague-Dawley rats (age 4 week, n=36) were randomly divided into 3 groups. One group was fed a basal diet (C, N=12) with added cholesterol (1.25%) and cholic acid (0.5%) for 12 wks. While on the basal diet, two groups were supplemented with 20% EVOO, half group being trained (T, N=12) on treadmill for 12 wks (25m/min, 10% grade for 60 min/day, 5 days/wk), and the other half being sedentary (S, N=12). Plasma inflammatory cytokines were measured by Multiplex immunoassays on Luminex 200. Data were analyzed using two-way ANOVA. **RESULTS:** EVOO supplementation elevated 1.91-fold on macrophage colony stimulating factor (M-CSF) level ($P < 0.05$), but this effect was decreased 3.34-fold by T ($P < 0.05$). A significant increase in granulocyte-macrophage colony stimulating factor (GM-CSF) was found in EVOO vs. C (5.9-fold, $P < 0.05$). Monocyte chemoattractant protein-1 (MCP-1) level in plasma was decreased 1.46-fold in EVOO/T vs. C ($P < 0.05$). Plasma interleukin-1 β (IL-1 β) and tumor necrosis factor- α (TNF- α) levels did not change in EVOO ($P > 0.05$), but TNF- α was decreased 1.46-fold in EVOO/T vs. C ($P = 0.077$). **CONCLUSION:** Dietary supplementation of EVOO resulted in an augmentation of plasma inflammatory cytokines levels in the sedentary rats fed a high-fat atherogenic diet, but these adverse effects were significantly reversed by chronic exercise training.

3924 Board #241 May 30 9:00 AM - 10:30 AM
Unique Medium Chain Triglyceride Product Rapidly Enhances Brain Function: A Pilot Investigational Study

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 (No relevant relationships reported)

PURPOSE: Medium Chain Triglyceride (MCT) compounds are purported to increase brain energy based upon the relationship between MCT products and ketone production, especially for older individuals or those on low-carbohydrate diets. Little evidence exists that MCT products positively affect brain function, short-term. In this pilot study, Intervention Group (IG) subjects were tested prior to ingestion of a proprietary MCT product, and then 90 minutes later using the same electroencephalographic (EEG) device and compared to a control group (CG). **METHODS:** Eight (8) IG volunteers, aged 49-68 years old, (male = 5, female = 3) were compared to three (3) CG volunteers, aged 48 to 68 years old, (male = 3). Study subjects completed standard EEG testing prior to ingestion of the compound, and 90 minutes after consuming the compound or placebo. Testing consisted of a P300 audio reaction time test and two visual decision making/reaction tests. **RESULTS:** The IG increased brain function as measured with evoke potentials, time to task and graphic representations compared to the control group. The decrease for the IG in the audio reaction time test was 340 milliseconds to 314 milliseconds. In addition, the tens of millivolt (μ V) activation during the auditory reaction time test increased from 7.5 μ V to 12.9 μ V, indicating increased brain functional activity. The CG showed essentially no voltage changes. The IG decreased times in the first trail making test from 94 to 57 seconds, and decreased time to complete the second trail making test from 113 to 93 seconds. Descriptive statistics revealed the measures for the IG had statistical significance ($P < 0.5$) for the second trail making test and strong positive trends for all other parameters. Topographic brain maps from the test revealed a representative picture of the changes from taking the supplement. **CONCLUSIONS:** In this pilot study, consumption of a proprietary MCT combination produced marked enhancement in brain activity 90 minutes after ingestion with significant increases in relation to topographical brain maps. Further investigation is warranted to determine optimal ingestion conditions and time to effect for this and similar products across various populations. EEG measurements show promise as assessment biomarkers for the effects of nutritional supplements on brain function.

3925 Board #242 May 30 9:00 AM - 10:30 AM
Exercise Priming: Effect Of Morning Exercise On Fat Oxidation During Afternoon Walking

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Reduced fat oxidation is emerging as a predictor for obesity-related diseases; therefore, interventions that increase fat oxidation may have clinically important health benefits. Previous research suggests that exercise priming may provide a novel solution by augmenting fat oxidation during subsequent exercise. **PURPOSE:** To investigate the effects of morning Reduced-Exertion High-intensity Interval Training (REHIT) on fat oxidation during afternoon Low-intensity Steady State (LISS) walking. **METHODS:** Twelve sedentary or recreationally active university students (7 male, 5 female) participated in 2 randomly assigned morning interventions, REHIT (two 20-second sprints on a cycle ergometer separated by 4-minutes of active recovery) or rest, on two separate days. On both occasions, participants returned to the lab in the afternoon (4 hours later) to complete a 45-minute treadmill walk at 5.6 km/h. Participants remained fasted for both morning and afternoon trials. Blood and gas samples were collected pre-, during, and post-LISS exercise. **RESULTS:** After 45 minutes of LISS walking, plasma non-esterified fatty acids (NEFA) was greater in the REHIT trial compared to control (REHIT, 1.03 ± 0.39 mmol/L; Control, 0.75 ± 0.43 mmol/L; $p = 0.03$; Cohen's $d = 0.67$). However, lipid oxidation was not concomitantly elevated ($p = 0.35$). Furthermore, plasma glucose, carbohydrate oxidation, respiratory exchange ratio (RER) and energy expenditure remained consistent between the trials across all time points ($p = 0.40$; $p = 0.98$; $p = 0.92$; $p = 0.81$, respectively). **CONCLUSION:** Exercise priming may not influence fat oxidation during subsequent bouts of LISS exercise; however, plasma NEFA may be greater suggesting changes in substrate availability. Relatively long rest intervals between the morning and afternoon trials and insufficient exercise workload could explain similarities in substrate oxidation. Isotopic research is required to understand the metabolic fate of the elevated substrate concentrations.

3926 Board #243 May 30 9:00 AM - 10:30 AM
PREPRANDIALEXERCISE DOES NOT MODIFY HIGH FAT MEAL INDUCED INFLAMMATION IN YOUNG AND OLD ADULTS

William S. Wiseman¹, Elizabeth S. Edwards, FACSM¹, Hannah Frick¹, Sam R. Emerson², Morgan Medeiros¹, Camden Sutton¹, Michael White¹, Steven K. Malin, FACSM³, David Edwards³, Stephanie P. Kurti¹. ¹James Madison University, Harrisonburg, VA. ²Oklahoma State University, Still Water, OK. ³University of Virginia, Charlottesville, VA. (Sponsor: Elizabeth Edwards, FACSM)
 (No relevant relationships reported)

An up-regulation of pro-inflammatory cytokines (i.e. IL-6, TNF α , IL-1 β , IL-8) and lower anti-inflammatory cytokines (IL-10) are associated with development of cardiovascular disease. While a single high-fat meal (HFM) can transiently increase systemic postprandial inflammation (PPI) in young adults (YA), the effect of a HFM or acute exercise on PPI in older adults (OA) is not clear. **PURPOSE:** To determine if preprandial exercise attenuates PPI in YA and OA. **METHODS:** 12 YA (23.3 ± 3.9 years, $n = 5$ M/7 F) and 12 OA (67.7 ± 6 years, $n = 8$ M/4 F) completed an incremental exercise test to determine VO_{2peak} and then two HFM challenges (HFM alone or acute exercise prior to a HFM (EX+HFM)) in a randomized order. Prior to the HFM (12 kcal/kg body weight: 57% fat, 39% CHO, 4% PRO), participants abstained from strenuous physical activity for 48 hours and adhered to a 12 hour overnight fast. Inflammatory cytokines were measured at baseline, 3, and 6 hours during the HFM. In EX+HFM, participants completed an exercise session on a cycle ergometer 12 hours prior to the HFM at 65% VO_{2peak} until caloric expenditure matched 75% of the caloric content of the HFM. **RESULTS:** There was a significant main effect of time as a quadratic function for IL-6 and IL-8, which decreased by 28% and 8% (respectively) at three hours post-HFM, and then increased near baseline levels at six hours post-HFM ($p < 0.05$). TNF α , IL-10, and IL-1 β exhibited significant decreases over time from baseline to six hours ($p < 0.05$). Specifically, TNF α decreased by 12%, IL-10 decreased by 7%, and IL-1 β decreased by 14% ($p < 0.05$). TNF α was greater in OA at baseline compared to YA ($p = 0.036$), however there was no difference post-HFM at either three or six hours ($p > 0.05$). There was no difference in inflammation between HFM and EX+HFM at any time point for any inflammatory marker ($p > 0.05$). **CONCLUSION:** Contrary to our hypotheses, a HFM did not elicit PPI in YA or OA. Additionally, acute exercise did not impact inflammation at any timepoint. Future work should be performed to elucidate the mechanism by which a HFM raises cardiovascular disease risk.
 Supported by 4-VA grant

3927 Board #244 May 30 9:00 AM - 10:30 AM
A Short Bout Of Moderate- Or High-intensity Cycling Can Influence Postprandial Triglyceride Metabolism
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 (No relevant relationships reported)

PURPOSE: Examine the effects of high-intensity interval cycling (HIIC) and moderate-intensity continuous cycling (MICC) on postprandial glucose, insulin, and triglyceride (TG) concentration. **METHODS:** Each male subject ($n = 12$; age = 21.9 ± 1.8 yrs; body mass = 90.1 ± 16.8 kg) completed 1) REST, 2) MICC, and 3) HIIC in a randomized order. Each bout was separated by 1 week. Rest involved sitting quietly. MICC required continuous cycling at 60% maximal work rate (WR_{max}). HIIC involved 15-second cycling sprints (@ 120% WR_{max}) followed with 45 seconds of passive cycling. Each bout was performed for 20 minutes on the afternoon of Day 1. A mixed meal (50% carbohydrate (CHO) and 35% fat) was provided 30 minutes (Day 1) and 16 hours (Day 2) following the completion of each bout. Blood samples on Day 1, following a 4-hour fast, were acquired just prior to each bout and at 0, 0.5, 1, and 2 hours post-meal. Blood samples on Day 2, following a 10-hour fast, were acquired at 0, 2, and 4 hours post-meal. Blood samples were analyzed for glucose, insulin, and TG concentration. Postprandial (PP) responses were quantified via the total (AUC_T) and incremental area under the curve (AUC_I) using the trapezoidal method. Significant differences ($p < .05$) between the bouts were determined using a one-way, repeated measures ANOVA and Bonferroni post-hoc test. **RESULTS:** Average work (Watts) was similar between MICC (122.5 ± 25.4) and HIIC (110.3 ± 14.7) ($p = .091$, ES = .51). On Day 1, there was no significant difference in the PP glucose, insulin, or TG response between the 3 bouts. On Day 2, MICC reduced the TG AUC_T ($442.9 \pm 76.4 \text{ mg} \cdot \text{dl}^{-1} \cdot 4\text{hr}^{-1}$) when compared to rest ($487.4 \pm 104.4 \text{ mg} \cdot \text{dl}^{-1} \cdot 4\text{hr}^{-1}$) ($p = .02$, ES = .43). HIIC elicited a non-significant reduction the TG AUC_T ($454.8 \pm 72.3 \text{ mg} \cdot \text{dl}^{-1} \cdot 4\text{hr}^{-1}$), however the reduction was trending towards significance ($p = .076$, ES = .31). **CONCLUSION:** A brief bout of MICC and HIIC does not influence the PP response when completed just prior to a mixed meal. There may be a delayed response to exercise as MICC and (to a lesser degree) HIIC appear to reduce the PPTG response when completed 16 hours prior to a mixed meal. The lack of change in the PP glucose and insulin response might be explained by a wide inter-individual variance as half of the participants appeared to have responded to the exercise bouts based on their PP glucose and insulin concentration.

3928 Board #245 May 30 9:00 AM - 10:30 AM
Metabolic Flexibility During Exercise In Overweight/ obese Children Vs. Lean Children
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 (No relevant relationships reported)

Metabolic flexibility (MF) is the ability of the body to alter its reliance on fat or carbohydrate for energy purposes in response to a stimulus. The inverse, metabolic inflexibility, has been associated with type II diabetes and obesity. Given the prevalence of these disorders, assessing and improving MF is important. However, MF during exercise, particularly with respect to fat metabolism, in children remains poorly understood. **PURPOSE:** This study examined MF with respect to fat metabolism during exercise in lean ($n=11$; 10.9 ± 0.9 years) and overweight/obese (OW/OB; $n=8$; 10.4 ± 1.2 years) children. It was hypothesized that MF with respect to fat metabolism during exercise would be impaired in the OW/OB group as indicated by reduced use of fat as an energy source. **METHODS:** Participants were grouped based on BMI percentiles for age and sex (Lean $< 85^{\text{th}}$ percentile, OW/OB $\geq 85^{\text{th}}$ percentile). On the experimental visit, participants completed two 20-minute exercise bouts separated by a 10-minute rest. Bout 1 consisted of 10 minutes at 50% VO_{2max} and 10 minutes at 75% VO_{2max} . Bout 2 consisted of 20 minutes at 50% VO_{2max} . Absolute fat oxidation rate (FOR; [$\text{mg} \cdot \text{min}^{-1}$], FOR relative to body mass [$\text{mg} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$], FOR relative to fat-free mass [$\text{mg} \cdot \text{kgFFM}^{-1} \cdot \text{min}^{-1}$], and proportional fat use (% Fat) were measured at 10 minutes of Bout 1 and at 5, 10, 15, and 20 minutes of Bout 2. **RESULTS:** There was a main effect for time for % Fat and for each expression of FOR, with fat oxidation values generally higher during the second bout, suggesting that exercise can be used to assess MF in children. Absolute FOR was higher in the OW/OB group (range: 121.6 ± 57.6 to $213.7 \pm 45.7 \text{ mg} \cdot \text{min}^{-1}$) than in the Lean group (81.1 ± 32.2 to $152.2 \pm 38.2 \text{ mg} \cdot \text{min}^{-1}$), however there were no main effects for group or interactions for % Fat (OW/OB: 29.0 ± 14.4 to $51.1 \pm 8.5\%$; Lean: 23.9 ± 10.9 to $41.8 \pm 6.5\%$), FOR relative to body mass (OW/OB: 2.4 ± 1.3 to $4.1 \pm 0.7 \text{ mg} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$; Lean: 2.5 ± 1.0 to $4.5 \pm 1.0 \text{ mg} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$), or FOR relative to FFM (OW/OB: 4.15 ± 1.97 to $7.12 \pm 1.17 \text{ mg} \cdot \text{kgFFM}^{-1} \cdot \text{min}^{-1}$; Lean: 3.49 ± 1.54 to $6.29 \pm 1.13 \text{ mg} \cdot \text{kgFFM}^{-1} \cdot \text{min}^{-1}$). **CONCLUSION:** OW/OB children in this age range do not display impaired MF with respect to fat metabolism during exercise. Future research should examine a broader range of children as well as the effects of different exercise characteristics (e.g. intensity) on MF.

3929 Board #246 May 30 9:00 AM - 10:30 AM
Different Exercise Models Affect White Adipose Browning Through Mechanism Of Irisin Molecular Pathway
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 (No relevant relationships reported)

Background: The white adipose browning can improve fat burning and accelerate fat consumption. Irisin which is cleaved by Fibronectin Type III Domain-Containing protein 5(FNDC5) derived from muscle can act on white adipose tissue to promote the expression of Uncoupling Protein 1(UCP1). However, it is unclear which exercise models is better to contribute to produce Irisin. **Purpose:** To discuss whether High-Intensity Intermittent Exercise (HIIT) is better than Medium-Intensity Continuous Exercise (MICT) on the effect of improving white fat production of UCP1 and the mechanism of molecular biology. **Methods:** Thirty-two 4-week-old C57BL/6J mice were fed with high-fat diet(D12492) for 8 weeks and randomly divided into three groups: control group (GC, $n=8$), MICT group (GM, $n=8$), and HIIT group (GH, $n=8$). Then, GM got an 8-weeks MICT training (10min warm-up, 45min 60% VO_{2max} speed, 6 times/week) and GH had an 8-weeks HIIT training (10min warm-up, 1set=1min 90% VO_{2max} speed + 2min 60% VO_{2max} speed, 12sets). 24 hours after the last training, anesthesia was dissected. Muscle tissue contained PGC-1 α mRNA, FNDC5mRNA, and Irisin. It was also taken by blood index. Irisin and UCP1mRNA were measured by subcutaneous white adipose tissue. The data were compared by using one-way analysis of variance. **Results and Discussions:** (1) Muscle: Comparing with GC, GM and GH both have a higher expression of PGC-1 α mRNA but there is no significant difference, yet FNDC5mRNA of GM is more than GC (7.53 ± 5.36 vs. 1.00 ± 1.13 , $p < 0.01$) and GH (7.53 ± 5.36 vs. 1.01 ± 1.16 , $p < 0.01$). Irisin of GM (32.22 ± 2.88 vs. $25.99 \pm 4.50 \text{ pg/mg}$, $p < 0.05$) and GH (32.10 ± 4.04 vs. $25.99 \pm 4.50 \text{ pg/mg}$, $p < 0.05$) are more than GC. (2) Serum: The Irisin level of GH is very significantly higher than GM (55.41 ± 1.19 vs. $51.83 \pm 2.47 \text{ pg/ml}$, $p < 0.01$). (3) Subcutaneous white adipose tissue: In respect of Irisin, GH is more than GM (37.68 ± 3.55 vs. $29.77 \pm 2.89 \text{ pg/mg}$, $p < 0.01$); UCP1mRNA, GH is more than GM (16.67 ± 6.65 vs. 0.69 ± 0.42 , $p < 0.01$). **Conclusion:** (1) Exercise can promote the production of Irisin upstream regulated factor, PGC-1 α and FNDC5. (2) HIIT compared with MICT has a greater effect on improving the white adipose tissue browning through the molecular pathway of PGC-1 α -FNDC5-Irisin-UCP1.

3930 Board #247 May 30 9:00 AM - 10:30 AM
Exercise Duration Affects Maximal Fat Oxidation In Post- Menopausal Women: Implications For Exercise Prescription
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 (No relevant relationships reported)

The relative exercise intensity at maximal fat oxidation (FAT_{max} , % VO_{2max}) is used for exercise prescription for weight loss and metabolic health. In young men, FAT_{max} is affected by exercise duration, with more prolonged testing protocols leading to higher values. **PURPOSE:** Since no data exist on post-menopausal women, we determined the effect of exercise duration on FAT_{max} in this population. **METHOD:** 18 non-obese women (54 ± 4 years; 4 ± 3 years from menopause; 22 ± 3 BMI) performed on a cycle ergometer a ramp test and 30-min steady-state trials at 40, 50, 60, 70 and 80% of the pre-determined VO_{2max} . Based on VO_2 and respiratory exchange ratio we calculated and compared (2-way RM ANOVA) absolute fat oxidation (FO , $\text{g} \cdot \text{min}^{-1}$) across intensities and duration. We compared FAT_{max} derived from ramp ($FAT_{max,r}$), 5 ($FAT_{max,5}$) and 30-min data ($FAT_{max,30}$) (1-way RM ANOVA). We estimated FAT_{max} using exercise duration (1, 5 and 30 min) and $FAT_{max,r}$ as explanatory variables. **RESULTS:** FO was significantly affected by exercise duration, intensity and their interaction (for all $p < 0.001$). Any exercise between 40 and 70% VO_{2max} , > 30 min, lead to an identical MFO (overall $0.21 \pm 0.09 \text{ g} \cdot \text{min}^{-1}$). $FAT_{max,r}$ occurred at a significantly higher % VO_{2max} ($57 \pm 10\%$) than FAT_{max} and $FAT_{max,30}$ (44 ± 6 and $49 \pm 9\%$, not different). FAT_{max} can be predicted from the linear combination of exercise duration ($p < 0.001$) and $FAT_{max,r}$ ($p = 0.01$) as independent explanatory variables ($r = 0.69$, $SEE = 8.8\%$). **CONCLUSIONS:** In post-menopausal women exercises at 40-80% VO_{2max} of longer durations are associated with higher FAT_{max} compared to ramp or short, steady-state sessions. Moreover, any intensity greater than $FAT_{max,r}$ will maximize fat oxidation for exercises > 30 min. Finally, the intensity that maximizes fat oxidation can be predicted by exercise duration and $FAT_{max,r}$. This approach offers a valid approach for individualized exercise intensity prescription for weight loss and metabolic health in postmenopausal women.

3931 Board #248 May 30 9:00 AM - 10:30 AM
Wild Blueberries Increase Fat Oxidation Rate During Moderate Intensity Exercise

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 (No relevant relationships reported)

Fruits high in anthocyanins, such as wild blueberries (WBs), have been documented to decrease oxidative stress in active and sedentary populations and has more recently demonstrated the ability to influence lipolytic enzymes and increase the rate of fatty acid oxidation (FA-ox) during rest. To date, changes in FA-ox during exercise has only been examined with blackcurrants. **PURPOSE:** To examine the effect of freeze dried WBs on the rate of FA-ox and lipid peroxidation during moderate intensity exercise. **METHODS:** 11 healthy, aerobically trained males (26.6 ± 7.9 yrs, 74.7 ± 8.2 kg, 10.2 ± 3.4% BF) completed an incremental cycle test to determine $\dot{V}O_{2peak}$ (54.4 ± 7.9 ml/kg/min) followed by a 2-wk washout avoiding foods high in anthocyanins. Participants completed a control (C) exercise protocol of cycling at 65% of $\dot{V}O_{2peak}$ for 40 min. Urinary F2-isoprostanes (~ 50 mL) and capillary blood FA, glycerol, creatinine and free/total carnitine (~ 250 µL) were collected pre and post sessions. Ventilation, RER, lactate, HR, power output, RPM and RPE were collected before and at 10 min increments. Next, participants consumed 12.5 g freeze dried WB powder, 2x/day (25 g total) for 2-wks, then repeated the exercise protocol. Repeated measures ANOVAs were used to determine differences between conditions. **RESULTS:** WBs reduced lactate at 20 (C: 3.0 ± 1.1 mmol vs WB: 2.6 ± 1.0 mmol; p=0.005), 30 (C: 2.9 ± 1.0 mmol vs WB: 2.2 ± 0.9 mmol; p=0.005) and 40 min (C: 2.5 mmol ± 0.9 vs WB: 1.9 ± 0.8 mmol; p=0.013) and carbohydrate oxidation by 10.1% at 20 (C: 2.17 ± 0.46 g/min vs WB: 1.95 ± 0.42 g/min; p=0.024), 19.2% at 30 (C: 2.24 ± 0.52 g/min vs WB: 1.82 ± 0.48 g/min; p=0.014) and 14.8% at 40 min (C: 2.10 ± 0.54 g/min vs WB: 1.79 ± 0.45 g/min; p=0.045) while resulting in higher FA-ox by 19.7% at 20 (C: 0.45 ± 0.16 g/min vs WB: 0.53 ± 0.13 g/min; p=0.049), 43.2% at 30 (C: 0.41 ± 0.14 g/min vs WB: 0.58 ± 0.15 g/min; p=0.010) and 31.1% at 40 min (C: 0.45 ± 0.17 g/min vs WB: 0.59 ± 0.13 g/min; p=0.012). No differences were found between C and WB trials for all other variables. **CONCLUSION:** Results indicate that WBs may increase the rate of FA-ox during moderate intensity activity in healthy, active males. Potential complications with blood sample preparation may have led to unreliable results. Further, the exercise intensity may have been too low to see significant changes in urinary F2-isoprostanes.

3932 Board #249 May 30 9:00 AM - 10:30 AM
Exercise Training Adaptations In Metabolic Syndrome Individuals On Chronic Statin Treatment

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Statins reduce atherogenic dyslipidemia and cardiovascular disease (CVD) risk in metabolic syndrome individuals (MetS). Exercise-training could also contribute to reduce CVD by improving cardiorespiratory fitness (i.e., $\dot{V}O_{2MAX}$) and fat oxidation. However, some reports sustain that statin use could interfere with training adaptations. **PURPOSE:** To determine the therapeutic impact of an exercise-training program on fat metabolism and cardiorespiratory fitness (CRF) in a group of MetS individuals chronically medicated with statins in comparison to a well-matched control group statin-naïve. **METHODS:** One hundred and six MetS were divided into statin users (STATIN group, n=46) and statin-naïve (CONTROL group, n=60). Groups were matched by age, weight, and MetS components. All subjects completed 16 weeks of high intensity interval training (HIIT). Before and after HIIT, muscle biopsies were collected to assess mitochondrial content (citrate synthase (CS) activity) and the activity of the rate limiting β oxidation enzyme (3-hydroxyacyl-CoA-dehydrogenase (HAD)). Fasting plasma glucose, insulin, TG, HDL-c and LDL-c concentrations were measured. Exercise maximal fat oxidation (FO_{MAX}) and oxygen uptake ($\dot{V}O_{2PEAK}$) were determined. **RESULTS:** Training improved MetS components similarly in both groups (MetS Z-score -0.26±0.38 vs -0.22±0.31; P<0.001 for time and P=0.60 for time x group). Before training, STATIN had reduced muscle HAD activity and whole body FO_{MAX} compared to CONTROL (P=0.038 and P=0.002 for group, respectively). However, 16-weeks of HIIT increased HAD and FO_{MAX} in both groups (32% and 20% in STATIN and 3% and 10% in CONTROL; both P<0.03 for time and P>0.05 for time x group, respectively). $\dot{V}O_{2PEAK}$ improved less in STATIN than in CONTROL group (12% vs 19%; P=0.013 for time x group). Conversely STATIN did not prevent the increases in CS with HIIT (38%; P<0.001 for time, P=0.199 for time x group). **CONCLUSIONS:** Our findings suggest that chronic statin use in MetS does not interfere with exercise training improvements in fat oxidation and neither with the

muscle enzyme mediators of these responses (i.e., CS and HAD). However, STATIN attenuated the improvements in $\dot{V}O_{2PEAK}$ with training. ClinicalTrials.gov identifier: NCT03019796

3933 Board #250 May 30 9:00 AM - 10:30 AM
Effect Of Aerobic Exercise On The Proteins Of Ubiquitin System In Different Adipose Tissues Of Obese Rats

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PURPOSE: To observe character of the different adipose tissue ubiquitin system in obese rats and explore the role of ubiquitin system in regulation of 8-week moderate intensity aerobic exercise on the autophagy of different adipose tissue of obese rats. **METHODS:** After 8 weeks high fat feeding (D12451) and standard feeding (D12450B), 20 obesity 11weeks SD were randomly assigned to sedentary (OS, n=10) and exercise (OE, n=10) groups; 20 normal weighty also were randomly assigned to sedentary (CS, n=10) and exercise (CE (n=10) group. During the following 8 weeks, CS and OS groups were CE and OE groups did the 60%-70% $\dot{V}O_{2max}$ treadmill training (5 days/week, 1 hour/day). The $\dot{V}O_{2max}$ of exercise groups were remeasured every two weeks. The protein expressions of LC3II, LC3I, ATG7, ATG5, ATG12 and ATG12-ATG5 in white adipose tissue of groin and brown adipose tissue of scapular were measured by Western blotting. **RESULTS:** (1) In the white adipose tissues, the protein expressions of ATG7, ATG5, ATG12, ATG12-ATG5 (p<0.05) and LC3II/I (p<0.01) in OS group were significantly increased than CS group, but the protein expressions of ATG7, ATG5, ATG5-ATG12 and LC3II/I in OE group were significantly decreased (p<0.05) than OS group. (2) In the brown adipose tissues, compared with CS group, the protein expressions of ATG5, ATG12, ATG5-ATG12 in CE group increased significantly (p<0.05), but the LC3II/I (p<0.01) and ATG5-ATG12 (p<0.05) in OS group decreased significantly. The ATG7, ATG12, ATG5-ATG12 and LC3II/I of OE group were significantly higher than OS group (p<0.05). **CONCLUSIONS:** There was tissue specificity of adipose tissue autophagy in obese rats. The ubiquitin system of ATG5-ATG12 involved in activation of white fat autophagy. 8 weeks moderate intensity aerobic exercise can inhibit the autophagy of subcutaneous white fat and strengthen the autophagy of scapular brown fat.

3934 Board #251 May 30 9:00 AM - 10:30 AM
Magnesium Supplementation Combined With Hypoxic Training In Improving Hepatic Lipid Metabolism In Obese Mice

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PURPOSE: To explore the effect of hypoxic training on magnesium level, investigate the mechanism of magnesium supplementation combined with hypoxia training on hepatic lipid metabolism in obese mice. **METHODS:** Forty high-fat diet induced C57BL/6J mice were assigned into four groups (n=10 each): Diet-induced obesity (DIO); hypoxia training (HT), living and training in normobaric hypoxic conditions; magnesium supplementation (Mg), the 100mg/kg/d dose of magnesium chloride added to drinking water; hypoxia training+magnesium supplementation (HT+Mg). And set up a chow diet control group (CON). The intervention lasted for 4 weeks. All comparisons were made using two-way ANOVA analysis. **RESULTS:** 1) Serum magnesium in HT group (63.17±0.86 ppm vs 71.85±3.06 ppm) was decreased; femur magnesium in Mg group (2287.71±88.48 ppm vs 2106.89±41.68 ppm) were significant increased after 4 weeks intervention. And the femur magnesium was significantly negatively correlated with body weight (p<0.01, r=-0.645). 2) Compared with DIO group (1.80±0.32 g), liver weight of HT group (1.32±0.17 g), HT+Mg group (1.38±0.23 g) were significantly decreased; 3) Compared with DIO group (19.10±1.82 ng/ml, 8.58±0.41 U/L), serum ATGL level in Mg group (25.43±1.71 ng/ml), HT+Mg group (31.56±2.46 ng/ml) and serum CPT-1 level in HT+Mg group (17.46±1.56 U/L vs) were significantly increased. 4) Compared with DIO group (1.01±0.19), liver PPARα mRNA expression in HT group (1.30±0.28), HT+Mg group (2.32±0.75) were significantly increased; liver ATGL (3.68±2.20 vs 1.04±0.31), LPL (7.72±3.14 vs 1.02±0.21), CPT-1 (6.85±3.89 vs 1.03±0.30) mRNA expression in HT+Mg group were significantly higher than DIO group. Moreover, the PPARα, CPT-1 mRNA expression level was significantly higher than HT group (1.43±0.46). **CONCLUSIONS:** 1) Hypoxic training can significantly reduce femur magnesium, increase the loss of magnesium while effectively losing weight. 2) 4 weeks of hypoxic training combined with magnesium supplementation intervention can effectively reduce the liver weight and hepatic free fatty acid in obese mice; 3)

Hypoxic training combined with magnesium supplementation may promote liver lipolysis and fatty acid beta oxidation by activating liver PPAR α and its downstream factors, improve liver lipid metabolism in obese mice.

3935 Board #252 May 30 9:00 AM - 10:30 AM
Does Varying The Fatty Acid Composition Of A High-fat Meal Modify Postprandial Lipemia?

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(No relevant relationships reported)

PURPOSE: The western diet is typically high in saturated fats (SF) or omega-6 polyunsaturated fatty acids (O6) with insufficient amounts of omega-3 polyunsaturated fatty acids (O3). When chronic, this diet has been associated with an increased risk of cardiovascular, metabolic, and respiratory diseases. The purpose of this study was to examine the effect of varying the fatty acid composition of an acute High-Fat Meal (HFM) on postprandial lipemia.

METHODS: Fifteen individuals [6 M, 9 F; body mass index (BMI) = 25.3 \pm 6.6 kg/m²] consumed three HFM smoothies separated by a minimum of 48 hours. The three smoothies were high in SF [63% total fat, <0.02% from O3 and O6], O6 [15:1 O6 to O3], and O3 [15:1 O3 to O6]. All were standardized to 12 kcal/kg body weight, 63% total fat, and 0.72 g/kg sugar. Blood triglycerides (TG) were collected at baseline, 2 hr and 4 hr postprandially.

RESULTS: There was a significant main effect of time for SF HFM and O3 HFM in TG from baseline to 4 hr (P=0.001 and 0.006), and a quadratic effect in TG from baseline to 4 hours in O6 HFM, where TG increased from baseline to 2 hr and returned near baseline values at 4 hr (P<0.001). There was an interaction effect between condition and time effect for TG (P<0.05) and no difference between O3 and O6 TG concentrations at any time point (P>0.05). The TG concentrations were significantly lower from 2 hr to 4 hr postprandially in the high O6 (P=0.005) and high O3 HFMs (P=0.033) compared to the SF HFM, which was increased from 2 to 4h.

CONCLUSIONS: O6 and O3 HFMs led to a more accelerated peak in postprandial TG and trended towards baseline by 4 hr. The SF HFM resulted in a sustained elevation in TG with significantly higher concentrations at 4 hr than at baseline. These findings suggest that varying types of fatty acids can lead to markedly different metabolic responses and that diets high in SF could have prolonged exposure to high blood triglycerides, increasing the risk of atherosclerosis and other chronic diseases.

3936 Board #253 May 30 9:00 AM - 10:30 AM

Association Of Leptin And RMR In Obese Elderly Adults With Different Levels Of Physical Activity

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PURPOSE: The aims of this study were 1) to examine potential sex-related differences in leptin, resting metabolic rate (RMR) and metabolic markers 2) to assess differences in leptin, RMR and metabolic markers between low MVPA group and high MVPA group 3) to assess whether being physically active may play a role in the associations between leptin, RMR and physical activity.

METHODS: The subjects were 73 women (age=64.1 \pm 6.1 years, percent body fat=39.1 \pm 4.8%) and 37 men (age=66.3 \pm 5.6 years, percent body fat=29.7 \pm 4.7%). RMR was measured by indirect calorimetry (Metamax 3B-R2 Metabolic Measurement system, German) and body composition by the DXA (GE Lunar Prodigy, USA). Serum leptin and lipid and glucose metabolism makers' levels were determined by radioimmunoassay. Waist-mounted triaxial accelerometer Actigraph GT3X-BT was used to make objective 7-day recordings of physical activity. Based on the mean of the minutes spent in MVPA (180 min/week), subjects were divided into low MVPA group (n=50, percent body fat=37.1 \pm 7.0%) and high MVPA group (n=56, percent body fat=34.5 \pm 6.1%).

RESULTS: Leptin and HDL cholesterol levels were higher in women than men (both p<0.01), while men presented higher fat free mass and RMR (both p<0.01) than women. Leptin, insulin, HOMA-IR, percent body fat were higher in low MVPA than high MVPA group (all p<0.05), RMR and metabolic markers, however, were not found significant differences (all p>0.05). Leptin levels was associated with RMR negatively and PBF positively (r=-0.36, p=0.013; r=0.645, p=0.0001) in low MVPA group, leptin levels was associated with RMR negatively and PBF positively (r=-0.511, p=0.0001; r=0.631, p=0.0001) in high MVPA group. The negative association of RMR with proportion of sedentary (r=-0.304, p=0.027) and the negative association of leptin with proportion of MVPA (r=-0.303, p=0.023) were only found in high MVPA group.

CONCLUSIONS: Leptin may play a role in energy metabolism in overweight and obese elderly adults. Obesity is associated with energy metabolism and metabolic markers both in women and men. The relationship of leptin with energy

metabolism and insulin resistance might be moderated by levels of physical activity.

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3937 Board #254 May 30 9:00 AM - 10:30 AM
Cyclooxygenase 2 Regulates Isoprenaline Induced Adipolysis In Brown Adipocytes

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(No relevant relationships reported)

PURPOSE: By converting fat into heat, brown adipocytes (BAC) play as an energy expenditure in mammalian. Cyclooxygenase 2 (COX2) is a key factor of Uncoupling protein 1 (UCP1) synthesis which is essential for dissipates energy into heat via adipolysis. Isoprenaline (ISO) can induce adipolysis in brown adipocytes (BAC); however, whether COX2 takes part in ISO induced adipolysis remains unclear.

METHODS: C₃H₁₀T_{1/2} cells were differentiated into brown adipocytes. BACs were treated with 10 μ M ISO or 10 μ M ISO and 100 μ M NS-398 (COX2 inhibitor) for 0 (as control), 1, 3, 6, 12 or 24 hours. For lipid droplet (LP) size analysis, cells were fixed and stained with Oil Red O. Images were captured with a Leica CTR 4000 microscope with 10x objectives. All images were thresholded for LPs signal and watershed for individual LP size analysis using Image J. Data were loaded into GraphPad Prism 8 for LP size analysis and size frequency distribution. BACs were collected for UCP1 expression detection after 6-hour-incubation (beta tubulin as loading control). All results are presented as means \pm std. error of mean. Statistics were performed in SPSS using Student's t test.

RESULTS: Average LP size decreased as ISO incubation time prolonged (113.67 \pm 2.40, 115.69 \pm 2.21, 83.61 \pm 1.69, 35.00 \pm 0.88, 31.60 \pm 0.69, 34.28 \pm 0.77 μ m² after 0, 1, 3, 6, 12, 24 hours incubation, respectively). Incubation of ISO and NS-398 slowed down the rate of LP size reduction (95.08 \pm 1.65, 107.73 \pm 2.26, 85.22 \pm 1.87, 56.97 \pm 1.49, 41.32 \pm 0.87, 37.43 \pm 0.65 μ m² after 0, 1, 3, 6, 12, 24 hours incubation, respectively; slope (-53.04 \pm 1.21 vs. -65.45 \pm 1.33) LP size frequency distribution showed a shift of LP size towards smaller LPs following incubation with ISO.

Inhibition of COX2 activity can delay the occurrence of left shift (became smaller) of LP size frequency distribution (12h vs. 3h). UCP1 expression were lower following ISO and NS-398 incubation than those treated with ISO only (0.74 \pm 0.08 vs. 1.00 \pm 0.00, p<0.05).

CONCLUSION: COX2 inhibition can repress ISO induced adipolysis in BACs and may related to a decrease in UCP1 expression.

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3938 Board #255 May 30 9:00 AM - 10:30 AM
Correspondence Between Indexes Of Maximal Fat Oxidation From Ramp Vs Steady-state Protocols In Postmenopausal Women

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Maximal fat oxidation (MFO, in g^l·min⁻¹) is an index of metabolic flexibility and the relative exercise intensity at MFO (FAT_{max} as % maximum oxygen consumption (VO_{2max})) is used for exercise prescription for weight loss and metabolic health. The time-consuming, steady-state protocol required for MFO/FAT_{max} determination hinders the extensive use of these indexes. Alternative, ramp testing has been validated for MFO/FAT_{max} determination in healthy, young males only. **PURPOSE:** to validate ramp testing for MFO/FAT_{max} measure in post-menopausal women.

METHODS: 18 sedentary, postmenopausal women (54 \pm 4 years; 4 \pm 3 years from menopause; 22 \pm 3 BMI) performed on a cycle ergometer: i) a ramp incremental test; ii) steady-state trials at 40, 50, 60, 70 and 80% of the VO_{2max} as determined by the incremental test. We measured VO₂, respiratory exchange ratio (R) and heart rate (HR). Based on VO₂ and R from the ramp test (breath-by breath data) and steady-state protocol (5th minute of each trial) we measured absolute fat oxidation (FO, in g^l·min⁻¹); then, we determined MFO in absolute units (in g^l·min⁻¹) and the relative intensity corresponding to MFO, i.e. FAT_{max}, that was expressed relative to VO_{2max} and directly determined maximal HR (HR_{max}). MFO and FAT_{max} from the ramp (MFO_{ramp} and FAT_{max,ramp}) were compared to the values from the steady-state protocol (MFO_{ss} and FAT_{max,ss}) by paired t-Test.

RESULTS: The MFO was significantly lower than MFO (0.39 \pm 0.13 vs 0.19 \pm 0.07 g·min⁻¹ p<0.001). On the contrary, the FAT_{max} and FAT_{max} occurred at an identical %VO_{2max} (45 \pm 6 vs 47 \pm 7% VO_{2max} p=0.17) and %HR_{max} (61 \pm 6 vs 62 \pm 6% HR_{max} p=0.54).

CONCLUSIONS: In agreement with previous studies conducted in young males, our data confirm that only steady-state protocols allow accurate MFO quantification. On the contrary, accurate measures of FAT_{max} can be obtained indifferently from both ramp and steady-state protocols in post-menopausal women. Therefore, ramp testing offers a valid alternative to more time-consuming steady-state protocols for the identification of

optimal exercise intensity for weight loss and metabolic health. Time-efficient testing strategies have a high practical value for longitudinal/large-scale evaluation of fat metabolism in postmenopausal women offering the means for individualized exercise prescription.

3939 Board #256 May 30 9:00 AM - 10:30 AM
The Effects Of Exercise, Estrogens, And Diet On Hepatic Protein Expression In Type 2 Diabetes

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Exercise can ameliorate Type 2 Diabetes (T2D), and studies also show that estrogens may prevent the onset of T2D. Thus, postmenopausal women may be at a greater risk for T2D. While the effects exercise, estrogens, and diet on whole body risk factors for T2D are established, little is known about the cellular changes in the liver that account for these whole body beneficial effects. **PURPOSE:** To examine the effects of exercise, estrogens and diet on hepatic protein expression. **METHODS:** Female Wistar rats were fed a standard diet (SD) or a high-fat diet (HFD) for 10 weeks. A subset of the rats had their ovaries removed via ovariectomy (OVX). The rats were given treatment of treadmill exercise (25 minutes/day at 40 cm/s for 5 days/week (Ex)) or estradiol replacement (E₂; 1.4 µg/day). At the end of the study, the liver was removed and homogenized in cell extraction buffer, and the protein was isolated. Western blot analyses were performed to measure the expression of the following proteins involved in lipid metabolism and mitochondrial function: acetyl-coA carboxylase (ACC), fatty acid synthase (FAS), hormone sensitive lipase (HSL), lipoprotein lipase (LPL), citrate synthase, and cytochrome c oxidase (COX) IV. **RESULTS:** The HFD decreased the ACC expression compared to the SD (0.59 vs. 0.93 AU, p<0.05), and E₂ treatment restored these values (0.81 AU, p<0.05). Similarly, the HFD decreased the FAS expression compared to the SD (0.44 vs. 1.58 AU, p<0.05), and E₂ treatment restored these values (0.75 AU, p<0.05). The HFD increased the LPL expression compared to the SD (1.58 vs. 1.15, p<0.05), and E₂ treatment decreased the LPL expression (1.32 AU, p<0.05). There was no effect of Ex on the ACC, FAS, or LPL expression. The expression of HSL, citrate synthase, and COX IV did not change with diet, E₂ replacement, or Ex. **CONCLUSION:** Two proteins that stimulate de novo fatty acid synthesis (ACC and FAS) decreased with the HFD, likely due to the exogenous intake of fats. Notably, E₂ replacement increased the ACC and FAS expression, even though the HFD was still being consumed. LPL is a protein that stimulates fat storage. Consumption of the HFD increased the LPL expression to increase fat storage, and E₂ replacement decreased the LPL expression. Thus, E₂ may provide benefits by decreasing fat storage. Supported by NIH Grant P20GM103443 and NSF Grant IIA-1355423.

3940 Board #257 May 30 9:00 AM - 10:30 AM
Ethnicity Mediates Change In Fat Oxidation In Response To High Intensity Interval Training (hiit)
Ethnicity Mediates The Magnitude Of Change In Fat Oxidation In Response To High Intensity Interval Training (hiit)

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Ethnicity Mediates The Magnitude Of Change In Fat Oxidation In Response To High Intensity Interval Training (HIIT)

One response to high intensity interval training (HIIT) is increased fat oxidation (FOX) (Astorino et al. 2017) which is due to enhanced oxidative capacity and activity of β-HAD (Talanian et al. 2007). In the U. S., Hispanic adults have a higher rate of obesity than Caucasians (Hales et al. 2017), and have twofold higher rate of diabetes (CDC 2018). It is unknown if ethnicity alters FOX responses to HIIT. **PURPOSE:** To assess the role of ethnicity in mediating FOX changes with HIIT. **METHODS:** Eleven inactive Caucasian (C) and 7 Hispanic women (H) (age = 25 ± 6 yr) participated in the study. Initially, VO₂max and peak power output (PPO) were determined. On two separate days after a minimum 6 h fast, they completed five stages of progressive exercise at 10 - 50 %PPO during which gas exchange data were acquired to calculate RER, FOX, and carbohydrate oxidation (CHOOx). Fingertip blood samples were used to measure blood lactate concentration (BLA). HIIT consisted of 9 sessions of cycling at 85 %PPO separated by 75 s recovery. **RESULTS:** HIIT increased VO₂max by 10 and 8 % in C and H with no effect of ethnicity (p = 0.69). RER increased during exercise (p < 0.001) and timeXtraining (p = 0.001) and timeXtrainingXgroup

interactions (p = 0.012) were shown. Fat oxidation differed during exercise (p = 0.001) and there was a timeXtrainingXgroup interaction (p = 0.03). Post hoc analyses showed significantly higher FOX post-HIIT at 10 (0.19 ± 0.04 g/min vs. 0.16 ± 0.04 g/min) and 20 %PPO (0.17 ± 0.03 g/min vs. 0.14 ± 0.04 g/min) versus baseline in H. Data showed a 10 - 35 % reduction in CHO oxidation (p = 0.01) after HIIT and a timeXtraining interaction (p = 0.01), but no timeXtrainingXgroup interaction (p = 0.32) was shown. BLA increased during progressive exercise (p < 0.001) and there was a reduction in BLA during exercise in response to training (p = 0.002) that was similar in C and H (p = 0.28). **CONCLUSION:** These preliminary data obtained in inactive women suggest that ethnicity may alter changes in energy metabolism observed in response to short-term interval training. Further work is needed to examine the mechanisms underpinning this potential effect of ethnicity on adaptation to training.
 This work was funded by a Research and Scholarly Activity Grant

3941 Board #258 May 30 9:00 AM - 10:30 AM
Dietary Fat Retention In Cortical Bone In Rats Fed High Fat Diet

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Excess adiposity during childhood and adolescence are associated with poorer bone quality and increased risk of fracture. A high fat diet (HFD) may promote marrow adipogenesis at the expense of osteogenesis and may also promote excess lipid accumulation in osteoblasts and osteocytes. Exercise is prescribed for bone health primarily because of its mechanical loading attributes, but little is known about how obesity or exercise training status affects nutrient trafficking and retention in bone. **PURPOSE:** To determine the effects of obesity and exercise on fat retention in bone. **METHODS:** Female Wistar rats, 5 weeks in age (n=18), were fed a high fat diet (HFD) for 20 weeks and designated as obese (OB) or lean (LN) based on weight gain. OB and LN rats performed treadmill running (EX) (5 d/w, 1h/d, 15 m/min) or sedentary control (SED) for 10 weeks. In a 24-hour tracer study, rats were given ad libitum access to 14C oleate and 14C palmitate blended in food. Marrow was removed from hind limb bones and lipid was extracted from the remaining cortical bone. Data are mean ± SEM. **RESULTS:** Fat intake was not different between groups. Obesity status had no significant effect on fat retention in cortical bone. Lipid in hindlimb cortical bone was higher in EX compared to SED (EX: 6.66 ± 1.64 vs SED: 1.50 ± 1.47 mg, p<0.05). LNEX had the highest dietary fat retention in cortical bone lipid compared to other groups (LNEX: 0.69 ± 0.14, OBEX: 0.24 ± 0.14, LNSED: 0.27 ± 0.13, OBSED: 0.41 ± 0.13 mg, interaction p<0.05). The proportion of the meal retained, and the magnitude of lipid turnover did not differ between groups. Dietary fat retention in bone was positively (p<0.05) associated with fat intake, bone mineral density and bone mineral content (BMC; r=0.51-0.64). BMC in bone was associated (r=0.54, p<0.05) with total energy expenditure. **CONCLUSION:** Although cortical bone constitutes a minor fraction of overall dietary fat retention, we demonstrate that fat is trafficked to and retained in cortical bone in proportion to meal size and bone size. Future work is needed to test whether fat accumulation influences the ability to adapt to mechanical loading.

G-39 Free Communication/Poster - Ketogenics

Saturday, May 30, 2020, 8:00 AM - 10:30 AM
 Room: CC-Exhibit Hall

3942 Board #259 May 30 9:00 AM - 10:30 AM
Effect Of A 21-day Well-formulated Ketogenic Diet On Women's Metabolic Health: Glow Pilot Trial

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Cardiovascular disease (CVD) is a pandemic that is the leading cause of death for women in the United States. This is particularly alarming as the primary etiologies for CVD are lifestyle related Nutrition interventions, such as well-formulated ketogenic diets (WKFD), improve metabolic health and reduce risk factors associated with CVD but it is unknown if these improvements in health can be observed within the first three weeks of carbohydrate restriction. **Purpose:** The purpose of this study was to examine the effectiveness of a WKFD on women's metabolic health. **Methods:** Twenty-two women (Age (yr.) 42.2 ± 8.1, Ht. (cm) 164.2 ± 5.9, BMI 27.3 ± 6.0) participated in a 21-day, eucaloric diet study. Anthropometrics, body composition (InBody 570), fasted capillary-blood ketones, glucose (BG), and cholesterol panel, and diet records were

collected before (PRE) and after (POST) intervention. **Results:** Women maintained calories (PRE: 1938kcal vs POST: 1836kcal) and protein levels (PRE: 17% vs POST: 20%) but decreased dietary carbohydrate (PRE: 36% vs POST: 13%) and increased dietary fat (PRE: 45% vs POST: 65%) PRE to POST ($p < 0.05$). Weight (PRE: 73.9kg vs POST: 72.3kg) and body fat (PRE: 56.9kg vs POST: 54.0kg) significantly decreased but there were no differences in lean body mass PRE to POST ($p \leq 0.05$). BG (PRE: 94.0mmol/L vs POST: 89.9mmol/L) decreased significantly, with 73% of women decreasing BG from PRE to POST ($p \leq 0.05$). Ketones increased significantly and 58% of women reached nutritional ketosis by POST testing ($p \leq 0.05$). There were no differences in cholesterol panel except for LDL, which increased from PRE (111.1mg/dL) to POST (124.2mg/dL) ($p \leq 0.05$). **Conclusion:** Women's metabolic health is an immediate concern for the silent killer known as CVD in this population. Finding safe, systemic interventions to this pandemic are imperative. WFKD improved some, but not all, metabolic markers within 21 days. This highlights the initial shifts in metabolic health related to WFKD nutritional interventions and calls for additional research to help better understand the underlying mechanisms of WFKD on metabolic health, especially as it relates to cholesterol metabolism, and the timeline of these events.

3943 Board #260 May 30 9:00 AM - 10:30 AM
Effects Of Ketogenic Diet Containing Medium-chain Triglyceride And Endurance Training On Metabolic Enzyme Adaptations.

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Purpose:

Long-term intake of very low-carbohydrate, high-fat (ketogenic) diets enhance production and utilization of ketone bodies, which are more energy-efficient fuels for skeletal muscle. However, adaptation to the extremely low-carbohydrate diet has been shown to upregulate pyruvate dehydrogenase kinase 4 (PDK4) content in skeletal muscle, which is a negative regulator of glycolytic flux, resulting in the impaired high-intensity exercise capacity. Because medium-chain triglyceride (MCT) can produce more ketone bodies than long-chain triglyceride (LCT), incorporating MCT into the diet may allow more carbohydrates yet preserving ketosis and exert less inhibitory effect on muscle glucose metabolism. The purpose of this study was therefore to examine the effects of long-term feeding of ketogenic diet containing MCT on the endurance training-induced adaptations in metabolic enzymes of rat skeletal muscle.

Methods:

Male Sprague-Dawley rats (7-week-old) were placed on a standard diet (PFC ratio = 21:16:63), LCT-containing ketogenic diet (LKD, PFC ratio = 12:87:1) or MCT-containing ketogenic diet (MKD, PFC ratio = 16:66:18) for 8 wks. Half the rats in each group performed 2-h swimming exercise, 5 days a week for 8 wks. After the 8-week intervention, protein expressions of 3-oxoacid CoA transferase 1 (OXCT, a ketolytic enzyme) and PDK4 in epitrochlearis muscle were measured.

Results:

Despite the lower lipid content in the diet, plasma β hydroxybutyrate concentration in the MKD-fed rats increased to a level similar to that attained in the rats fed the LKD (85 ± 7 vs. 83 ± 8 mmol/L day, $p = 0.99$). Endurance training significantly increased OXCT protein content in epitrochlearis muscle and moreover, intake of the MKD additively enhanced the endurance training-induced increase in OXCT protein content. PDK4 protein level in skeletal muscle was substantially increased after the LKD consumption. However, such increase in the PDK4 was not observed in the MKD-fed rats regardless of endurance training status.

Conclusion:

Long-term intake of ketogenic diet containing MCT may additively enhance endurance training-induced ketone bodies utilization capacity in skeletal muscle without exerting inhibitory effects on glucose metabolism.

3944 Board #261 May 30 9:00 AM - 10:30 AM
Beta-hydroxybutyrate (bhb) Ketone Salt Supplement Alters Energy Metabolism, Blood Glucose And Ketone Levels

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 (No relevant relationships reported)

Ketone supplements were found to produce acute nutritional ketosis (defined as having a blood ketone level of 0.5-3.0 mM), suppress appetite, lower plasma ghrelin levels and perceived hunger. **PURPOSE:** To determine the acute effect of beta-hydroxybutyrate (BHB) ketone salt (KS) on appetite profile, energy metabolism, blood glucose and ketone levels and subsequent energy intake. **METHODS:** Twenty-two healthy females (age: 26 ± 7 y, BF%: 28.6 ± 8.2 , BMI: 26.1 ± 8.6 kg/m²) were recruited to participate in a single-blind crossover study design. Participants were randomly assigned to consume either 0.25g/kg of KS or flavor matched placebo (PL).

During each visit, participants completed an appetite profile survey using a visual analogue scale (VAS) before, at 0, 30, 60 and 90 minutes. Indirect calorimetry using ventilated hood technique was used to measure thermic effect of a supplement at 30-45 and 75-90 minutes. Blood glucose, ketone levels and affect were measured before, at 0, 45 and 90 minutes. Energy intake following an ad libitum breakfast was recorded. A repeated measures ANOVA was used for analysis with significance accepted at $p < 0.05$. **RESULTS:** A significant difference over time ($p < 0.001$) but not between supplements ($p > 0.05$) was observed for appetite profile. A significant interaction supplement over time was observed for VO₂ ($p = 0.007$) but not RQ ($p = 0.28$). A significant supplement effect was observed for blood glucose (KS: 83 ± 10 , 84 ± 8 , 82 ± 8 mg/dL and PL: 88 ± 10 , 89 ± 8 , 86 ± 9 mg/dL, $p = 0.04$) and ketone levels (KS: 0.3 ± 0.2 , 0.5 ± 0.2 , 0.4 ± 0.2 mM and PL: 0.3 ± 0.3 , 0.2 ± 0.2 , 0.2 ± 0.2 mM, $p < 0.001$) at 0, 45 and 90 min, respectively. However, no significant difference in energy intake at breakfast ($p = 0.94$) was observed between KS: 200 ± 116 kcal and PL: 203 ± 107 kcal. **CONCLUSIONS:** Ketone salt supplement caused modest elevation in blood ketone levels and reduced glucose, suggesting improved glycemic control, however, did not have an effect on perceived satiety or energy intake.

3945 Board #262 May 30 9:00 AM - 10:30 AM
Combined Effects Of 5-week Ketogenic Diet With Different Exercise Interventions On Lipid Metabolism In Skeletal Muscle Of Obese Mice

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PURPOSE: To determine the effect of ketogenic diet with exercise on the expression of lipid metabolism related to proteins and genes in skeletal muscle of obese mice.

METHODS: 45 twelve-week obese male C57BL/6J mice were divided into ketogenic diet group (KD), ketogenic diet combined with HIIT group (KH) and ketogenic diet combined with MICT group (KM), 15 mice in each group. Exercise was performed on the treadmill without slope, 6 days a week, 1 hour a day. Both groups started with warm-up exercise, in KH group, followed by 10 rounds of 4-minute high-intensity treadmill exercise and 2-minute active rest between; In KM group, moderate intensity continuous running with the same distance as KH was performed. The energy composition of ketogenic diet was: protein 10%, fat 90%, carbohydrate 0%. Western blot was used to detect the protein contents of pAMPK α , AMPK α (Thr172), PGC-1 α , PPAR α and CPT-1 in skeletal muscle, and RT-PCR was used to detect the mRNA expression of Acadl and Acox1 genes. One-way ANOVA was used for the data analysis.

RESULTS: Compared with KD group, the expression of all protein and mRNA in KH group increased significantly ($P < .05$). Compared with KD group, the expression of pAMPK α /AMPK α ratio, PGC-1 α , CPT-1 protein and Acadl mRNA in KM group increased significantly ($P < .05$). Compared with KM group, the expression of pAMPK α /AMPK α ratio and PPAR α protein in KH group increased significantly ($P < .05$; see Table 1 for details:

Table 1. Statistical summary of relative expression of protein and gene in skeletal muscle of mice

Group	KD (M \pm SD)	KH (M \pm SD)	KM (M \pm SD)
pAMPK α /AMPK α	1 \pm 0.16	2.52 \pm 0.4 [#]	1.92 \pm 0.15 ^{###}
PGC-1 α	1 \pm 0.24	3.15 \pm 0.39 [#]	3.06 \pm 0.34 [#]
PPAR α	1 \pm 0.05	1.27 \pm 0.14 [#]	0.78 \pm 0.09 ^{**}
CPT-1	1 \pm 0.28	3.01 \pm 0.41 [#]	2.14 \pm 0.35 [#]
Acadl	1 \pm 0.40	1.57 \pm 0.21 [#]	1.48 \pm 0.19 [#]
Acox1	1 \pm 0.23	1.57 \pm 0.23 [#]	1.37 \pm 0.11

Note: Compared with KD group, [#] $P < .05$, ^{###} $P < .01$; Compared with KH group, * $P < .05$, ** $P < .01$.

CONCLUSION: Ketogenic diet combined with exercise was more effective than ketogenic diet alone in enhancing the lipid metabolism of skeletal muscle. Compared with KM, KH is more effective in enhancing the lipid metabolism level of skeletal muscle in mice, mainly through the enhancement of AMPK-PGC-1 α -PPAR α mediated lipid metabolism pathway.

3946 Board #263 May 30 9:00 AM - 10:30 AM
Extended Ketogenic Diet Is Necessary For Increases In Protein Acetylation

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Decline in mitochondrial function is associated with a decrease in lifespan. We have previously demonstrated that a long-term ketogenic diet (KD) improves mitochondrial function and longevity. However, a life-long KD is difficult to maintain and an intermittent KD might be more viable long term.

PURPOSE: Determine how long it takes before a ketogenic diet alters muscle metabolism so that intermittent diets can be developed.

METHODS:

Four C57BL/6 mice were fed a control diet or 1 or 7 days of continuous KD. At the time of sacrifice, livers, gastrocnemius, brain and kidneys were extracted and frozen in liquid nitrogen before being powdered and homogenized in sucrose lysis buffer and prepared for western blot analysis to determine total acetylated lysine content, total OXPHOS protein, or acetylated p300 content.

RESULTS: Following one day of KD, neither acetylated, nor mitochondrial proteins were different than control diet. By seven days of continuous KD diet, total acetylated proteins increased in the liver, kidney and gastrocnemius muscle. Specifically, acetylation of p300 was 3.4±0.89-fold greater following 7 days of KD. Unlike the other tissues the brain showed no difference in acetylated proteins by 7 days. An increase in mitochondrial mass was only seen in the liver at 7 days of KD.

CONCLUSIONS:

A short term ketogenic diet can be used to rapidly alter protein acetylation in the liver, kidney and muscle. These data suggest that an intermittent keto diet may be useful in promoting a biochemical change in muscle that promotes mitochondrial function and may benefit long-term muscle function.

G-40 Free Communication/Poster - Resting Energy Expenditure

Saturday, May 30, 2020, 8:00 AM - 10:30 AM
 Room: CC-Exhibit Hall

3947 Board #264 May 30 9:00 AM - 10:30 AM
Metabolic Rest Rate (mrr) Prediction By Linear Regression

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PURPOSE: The aim of this study is to evaluate the validity of the prediction equation of the Metabolic Rest Rate (MRR) prescribed in an indirect way. This measure would be very helpful in the nutritional counseling, because many people don't have access to indirect calorimetry tests (ICT).

METHODS: 143 volunteers were selected. They made the ICT using the Metacheck® calorimeter, equipped with the gas analyzer. The MRR was collected as well as the Body Weight (BW) - kg, Height (H) - cm, and Age (A) - years. We also calculated the Body Mass Index (BMI) - kg/m². These metrics were used considering the MRR as an independent variants and the others (BW, H, A, BMI) as dependent variables. A linear regression was made to obtain a prediction equation to estimate the MRR.

RESULTS: After made all the necessary verifications for using the multivariate data analysis, a linear regression was made using the Stepwise method. The final equation was $MRR = -690,55 + (12,65 \times BW) + (897,71 \times H) - (5,03 \times A)$. The "R" of the equation was 0.901 and the determinant coefficient was 0.812.

	Age	Weight	Height	BMI	MRR
Mean	36,74	74,62	1,65	27,23	1.551,18
Standard Deviation	11,23	17,78	0,91	5,42	301,26

CONCLUSIONS: This trial showed that is possible to estimate the MRR through equations, since the determinant coefficient is adequated. In this trial, we worked with a general equation, but it is possible to work with equations for specific populations, regarding the sex, age, gender and other aspects

3948 Board #265 May 30 9:00 AM - 10:30 AM
Evaluating The Accuracy Of Basal Metabolic Rate Prediction Equations For Masters Athletes

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Basal metabolic rate (BMR) is the energy required to perform basic metabolic functions at rest. Indirect calorimetry is one method of measuring BMR, but it can also be predicted using BMR prediction equations. Depending on the equation used, a prediction can take into account a combination of different factors (e.g., age, body weight, height, lean body mass, fat mass). These equations tend to overestimate BMR. However, most of the researchers relied on small sample sizes or specific populations.

PURPOSE: To determine the accuracy of BMR prediction equations for Masters Athletes. **METHODS:** Two hundred and eighty-five athletes (157 women, 128 men; ≥ 26 years of age) representing a number of sports and physical activities, who exercised at least twice a week and were non-smokers, participated in our cross-sectional study. Resting metabolic rate (RMR) was measured using indirect calorimetry. Prior to measuring RMR, participants fasted and refrained from caffeine for 12 hours, avoided alcohol and exercise for 24 hours, and rested in a recliner for 15 minutes prior to data collection. Body composition was determined using dual-energy X-ray absorptiometry (DXA). We compared the Mifflin-St. Jeor, Harris-Benedict, Cunningham, and Owen to indirect calorimetry using one-way analysis of variance (ANOVA) with repeated measures. **RESULTS:** We found that indirect calorimetry measured significantly lower ($p < 0.001$) kilocalories (kcal) compared to any of the four prediction equations. The Mifflin-St. Jeor equation was more closely aligned with indirect calorimetry for all participants combined and women (mean difference, percent accuracy: 115, 54.8%; 95, 57.2%, respectively) compared to indirect calorimetry. However, the Owen equation was more accurate for men (98, 61.3%). The Cunningham equation generated the highest mean difference and lowest percent accuracy for all participants combined, women, and men (234, 29.1%; 221, 23.6%; 250, 35.9%, respectively). **CONCLUSIONS:** We found that the four BMR prediction equations analyzed significantly over-predicted BMR compared to indirect calorimetry. Our results emphasize the need for a more appropriate BMR prediction equation for athletes. This study was not funded

3949 Board #266 May 30 9:00 AM - 10:30 AM
Comparison Between Measurement Of Resting Metabolic Rate By Indirect Calorimetry And Predictive Equation

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PURPOSE: The aim of this study is to evaluate the validity of the predictive equation of the Metabolic Rest Rate (MRR) with the utilization of a bioimpedance equipment in comparison with the results obtained with indirect calorimetry test (ICT).

METHODS: 27 subjects (17 female and 10 male), all volunteers, were selected. As the first step of the trial, the volunteers had their MRR calculated by a tetrapolar bioimpedance equipment (Biodynamics 310A®) - MRRbio. Afterwards, the volunteers undergone an ICT (Metacheck®) with a gas analyzer - MRRcal.

RESULTS: Differences were found in the measures of 12 of the 27 volunteers. The effect size was calculated between the measures and the result was 0.0083, demonstrating a very low value. However, this number is deceptive, as the variation in the results can be positive or negative. We had the impression of a small difference between the groups that is not true, and it can be verified when we work the variations in modules ($|\Delta\% MRR|$). The highest positive variation was 332,5 calories (a variation of 27,31% between the MRRcal and MRRbio) and the highest negative variation was 271,2 calories (negative variation of 18,46%).

	Age	Body Weight	Height	BMI	MRR (Cal)	MRR-cal-MR-Rbio	$ \Delta\% MRR $
Mean	38,70	77,04	1,65	28,21	1.598,42	2,94	7,77%
SD	12,45	20,00	0,09	6,88	304,84	146,24	6,40%

CONCLUSIONS: This trial showed that the estimated MRR through equations can have a wide range of variability, with the possibility of significant errors in the clinic point of view. Because of this, the indirect calorimetry test with a gas analyzer is recommended whenever is possible to minimize errors in the measurements

3950 Board #267 May 30 9:00 AM - 10:30 AM
Resting Energy Expenditure In Crossfit® Practitioners: Indirect Calorimetry Versus Predictive Equations

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BACKGROUND: Indirect calorimetry (IC) is the gold standard method to assess individual resting energy expenditure (REE). However, due to its high cost and time demand, predictive equations are largely used to estimate energy requirements, which may vary according to different body compositions and health status. Crossfit® is a training program created by Greg Glessman in 1995 and consists of performing high intensity functional movements. Some studies have already reported increase of metabolic rates in this population.

PURPOSE: To measure REE in Crossfit® practitioners, using IC, and verify the most appropriate predictive equation to estimate this variable.

METHODS: 142 Crossfit® practitioners, 91 female (64.1%), aged between 16-59 years, underwent nutritional assessment, including weight, height, waist circumference (WC) and body mass index (BMI). Body composition was measured by a portable ultrasound. REE was measured by IC (mREE) and predicted by six different equations (pREE): Harris-Benedict, World Health Organization (WHO), Henry and Rees, Cunningham (1980), Cunningham (1991), and Mifflin-St.Jeor. Statistical analysis were carried out by Kolmogorov-Smirnov Test, Student's *t* test and Bland and Altman plots.

RESULTS: The mean age was 33.0 ± 6.3 years of age, without difference between men and women. The mean BMI was 24.7 ± 3.5 kg/m². The mean mREE was 1583.2 ± 404.4 kcal, and the pREE ranged from 1455.5 ± 230.9 kcal to 1711.3 ± 285.5. The best REE predictive equations for Crossfit® practitioners were the Cunningham (1991) (*P*=0.338), WHO equation (*P*=0.494) and Harris-Benedict (*P*=0.705). Harris-Benedict presented the smaller difference comparing with IC (12.9 ± 307.6 kcal), Cunningham (1991) showed better adequacy (102.5%) and WHO equation presented greater percentage of accuracy (59.9%). The same equations remained adequate when data were stratified by gender.

CONCLUSIONS: This study showed that Cunningham (1991), WHO (1985) and Harris-Benedict (1919) equations were the most appropriated REE equations for Crossfit® practitioners. Further studies should investigate more suitable methods to determine the energy requirements in Crossfit® and should, perhaps, create and propose a specific equation for this population.

3951 Board #268 May 30 9:00 AM - 10:30 AM
Comparison Of The Effects Of Sprint Interval Vs. Steady State Exercise On Resting Metabolic Rate

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(No relevant relationships reported)

Exercise is a modality that may result in an elevation of resting metabolic rate (RMR) due to homeostatic disruption. Sprint Interval Training (SIT) exercise is widely recognized as a time efficient, low-volume, high-intensity alternative to endurance training and, in acute phases, may elevate RMR for longer durations. **PURPOSE:** To compare the effects of an acute bout of SIT vs. steady state (SS) vs. control (CON) on 24-h RMR in recreationally active college-aged males. **METHODS:** In this randomized crossover design, 13 recreationally active males ages 18-30 yrs. (24.1 ± 2.3) participated in three exercise sessions using an electronically braked cycle ergometer: SIT (5, 30-sec. sprints, interspersed with 4-min. active recovery), SS (70% VO_{2 peak} for 30 min.) and CON. Exercise sessions were separated by one week. All sessions included 7 RMR measurements taken at the same times over a 24-h period (8am resting, 8:50am pre-ex, 10:10am post-ex, 12:10pm 2-h post-ex, 1:00pm 3-h post-ex, 4:00pm 6-h post-ex and 10:10am the following morning 24-h post-ex). RMR comparisons were made using two-way ANOVA with repeated measures. **RESULTS:** There was a significant main effect for group with regard to RMR (*F*=5.706; *p*=.043) with no effect of time (*F*= 5.351; *p*=.113) or group x time interaction (*F*=1.486; *p*=.066). There was a significant difference between SS (2116 kcal) and CON (1891 kcal) (*p*=.009) and SIT (2105 kcal) and CON (1891 kcal) (*p*=.012). SS (2116 kcal) and SIT (2105 kcal) were not different (*p*=.994). There was a significant effect for time between combined exercise (CE) condition vs. CON when comparing rest to pre (Δ CE = 582 kcal vs. Δ CON = 498 kcal) (*p*=.002), rest to post-ex (Δ CE = 628 kcal vs. Δ CON = 211 kcal) (*p*=.034), and rest to 6-h post (Δ CE = 716 kcal vs. Δ CON = 193) (*p*=.016). There was a significant group x time interaction for CE vs. CON (*p*= .034). Post-hoc analysis revealed statistical differences in measurements 2-h post (*p*= 0.018; 455 kcal), 3-h post (*p*= 0.002; 599 kcal) and a trend towards statistical significance at 6-h post (*p*=

.076; 340 kcal) and 24-h post (*p*=0.103; 313 kcal). **CONCLUSION:** A single bout of SIT may significantly elevate post-exercise RMR, and if repeated regularly, may confer longer-term benefits similar to that produced by 30 minutes of SS exercise.

3952 Board #269 May 30 9:00 AM - 10:30 AM
Effects Of Adiposity And Body Composition On Adjusted Resting Energy Expenditure In Women

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(Sponsor: Abbie Smith-Ryan, FACSM)

(No relevant relationships reported)

PURPOSE: To compare adjusted resting energy expenditure (REEa) and contributions of skeletal lean mass (SM) and fat mass (FM) to REEa in women at varying levels of adiposity.

METHODS: Resting energy expenditure (REE) was measured via indirect calorimetry (REEm). Body composition data was obtained from dual-energy X-ray absorptiometry in 182 female subjects (Mean ± SD; Age 24.2 ± 9.1 yrs, Ht 164.6 ± 6.0 cm, Wt 69.0 ± 22.5 kg, BMI 25.5 ± 8.3 kg·m⁻²). The sample was divided into tertiles by body fat percent (%fat); Tertile 1 (T1): %fat=18.5-28.4%; Tertile 2 (T2): %fat=28.5-33.8%; Tertile 3 (T3): %fat=34.0-61.0%. To normalize and compare groups, REE was predicted (REEp) to account for differences in FFM and age. Adjusted REE was then calculated from REEm, REEp, and mean REEm per tertile (REEt) using REEa=REEt+REEm-REEp. Contributions (mass × metabolic rate, kcal/kg/day) of FM and SM were calculated as percentages of REEa. One-way ANOVAS and a two-way ANOVA were conducted to analyze differences in body composition and differences between REEm and REEa [(REE (REEm vs REEa) × Group (T1 vs T2 vs T3)], respectively.

RESULTS: FM in T3 was significantly higher than T1 (Mean Difference (MD) ± SD; 22.6 ± 25.0 kg, *p*=0.001) and T2 (MD ± SD; 17.9 ± 25.0 kg, *p*=0.001). No differences occurred in SM (*p*>0.05). When evaluating REE and group, there was no significant interaction (*p*=0.191), or main effect for REE (REEm vs REEa) (*p*=0.995). There was a significant main effect for group (T1 vs T2 vs T3, *p*=0.001); REE was significantly higher in T3 versus T1 (MD ± SD; 281 ± 396 kcal/day, *p*=0.001) and T2 (MD ± SD; 215 ± 396 kcal/day, *p*=0.001). Expenditure attributed to SM in T1 was significantly higher than T3 (MD ± SD; 3.2 ± 8.6%, *p*=0.001). Difference in FM contribution between T1 and T2 lacked significance (*p*=0.210), but T3 had a significantly higher FM contribution than T1 (MD ± SD; 5.1 ± 7.0%, *p*=0.001) and T2 (MD ± SD; 3.9 ± 7.0%, *p*=0.001).

CONCLUSIONS: Despite similarities in SM, women with elevated %fat experienced lower SM contribution and higher FM contribution to REEa. As adiposity increases, REE increases; FM may explain more of the variance in REE between women of different levels of adiposity.

3953 Board #270 May 30 9:00 AM - 10:30 AM
Relationship Between Energy Availability And Basal Metabolic Rate In Free-living Competitive Girl Runners

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(No relevant relationships reported)

Decrease in energy availability (EA) theoretically reduce basal metabolic rate (BMR) with sacrificing reproduction or bone health. However, research in EA of Asians is scarce and there is no data of EA as a determinant of BMR in adolescent athletes.

PURPOSE: To reveal the relationship between BMR and EA in free-living Japanese competitive girl runners with a focus on female athlete triad.

METHODS: Consecutive 14 girl runners (16.6 ± 0.7 y/o, 161.0 ± 6.3 cm, 45.2 ± 5.4 kg) in the same competitive high school team were evaluated without control on food and exercise. Each runner was asked to report dietary records with photos and training logs for 7 days. Energy intake (EI) was assessed by registered nutritionists. The runners were tested on treadmill with indirect calorimeter to yield individual prediction equations for VO₂ by running velocity. Exercise energy expenditure (EEE) was calculated by the equations based on the training log. EA was calculated by subtracting EEE from EI for each day. The daily means of those variables were calculated. BMR was measured by whole room calorimeter in the early morning after overnight sleep at the night of the last day of the assessment inside the calorimeter. Body composition was measured by DXA. Bivariate correlation analyses and *t*-test were used to examine the relationships and the difference between variables and groups, respectively.

RESULTS: Percent body fat (%BF), fat free mass (FFM), and bone mineral density of TBLH (BMD) were 13.3 ± 4.5 %, 39.0 ± 3.5 kg, and 1.013 ± 0.04 g/cm², respectively. BMR, EI, EEE, and EA were 26.5 ± 2.4 kcal/kg·FFM/day, 2330 ± 479 kcal/day, 892 ± 245 kcal/day, and 37.4 ± 10.7 kcal/kg·FFM/day, respectively. EA was significantly

correlated with BMR ($r=0.60$, $p=0.02$). However, EA was not correlated with either %BF ($p=0.25$) or BMD ($p=0.16$) and did not differ between runners with oligo/amenorrhea ($n=7$; 40.8 ± 11.9) and eumenorrhea ($n=6$; 34.0 ± 9.8) ($p=0.29$).

CONCLUSIONS: The strong linear correlation between EA and BMR supports the theory that decrease in EA leads to compensatory adaptation in metabolism which may suppress reproduction or bone mineral accrual. However, arbitrarily evaluated EA in short-term was not related to the triad associated conditions. Those results were consistent with the evidences from adult Caucasian population.

G-41 Free Communication/Poster - Thermogenic Dietary Supplements

Saturday, May 30, 2020, 8:00 AM - 10:30 AM
Room: CC-Exhibit Hall

3954 Board #271 May 30 9:00 AM - 10:30 AM The Effect Of Thermogenic Nutritional Supplementation On Resting Metabolism In College Females

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(No relevant relationships reported)

BACKGROUND: Global increases in the incidence of obesity and the ensuing clinical co-morbidities has increased interest in the use of thermogenic supplements formulated to increase resting metabolism to increase energy expenditure and fat utilization. **PURPOSE:** The purpose of this study was to assess the effect of new capsaicin-based thermogenic supplements on resting oxygen consumption (VO₂), carbon dioxide production (VCO₂) and respiratory quotient (RQ). **METHODS:** Twenty-two untrained females (21.1±4.2 years) visited the lab on six occasions for measurements of pre-supplementation (PRE) resting energy expenditure (REE) for 30-60 min followed by the ingestion of a placebo or supplement (Shred, Shred 2.0, Capsimax 50, Capsimax 100, Capsimax 200) with at least three days separating conditions. Resting VO₂, VCO₂, and RQ were re-assessed for 90-120 minutes post-supplementation (POST). Changes in metabolic markers between treatment groups and over time were assessed in 5-minute intervals over the course of the 90-minute assessment using a two-way repeated measures ANOVA. **RESULTS:** PRE VO₂ ($2.5 \pm 0.3 \text{ ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$; $0.21 \pm 0.03 \text{ L}\cdot\text{min}^{-1}$), VCO₂ ($0.18 \pm 0.03 \text{ L}\cdot\text{min}^{-1}$), and RQ (0.85 ± 0.06) were lower than any given 5-minute interval POST ($p<0.05$). VO₂ ($\text{ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$) was elevated at 5 min POST ($2.99 \pm 0.5 \text{ ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$) compared to each subsequent 5 min interval ($p<0.05$) with no differences noted after 10 minutes ($2.7 \pm 0.4 \text{ ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$). VCO₂ and VO₂ ($\text{L}\cdot\text{min}^{-1}$) were elevated at 5 min POST compared to subsequent 5-minute intervals until 80 min (VCO₂; 0.22 ± 0.04 to $0.19 \pm 0.03 \text{ L}\cdot\text{min}^{-1}$) and 70 min (VO₂; 0.25 ± 0.04 to $0.23 \pm 0.03 \text{ L}\cdot\text{min}^{-1}$; $p<0.05$). There were no changes in VCO₂ at 10 minutes ($0.19 \pm 0.03 \text{ L}\cdot\text{min}^{-1}$) compared to any other time point POST. VO₂ ($\text{L}\cdot\text{min}^{-1}$) briefly increased from 35-45 minutes POST ($0.23 \pm 0.04 \text{ L}\cdot\text{min}^{-1}$) compared to 20 min POST ($0.22 \pm 0.03 \text{ L}\cdot\text{min}^{-1}$; $p=0.002$); no further changes occurred after 45 minutes. There were no changes in RQ during POST. There were no interaction effects (time*treatment) or treatment differences in metabolic markers. **CONCLUSIONS:** Observed time effects are postulated as a result of the elevated REE caused by changes in subject position during supplement consumption, rather than supplementation. This study suggests that new thermogenic supplementation has no effect on metabolism.

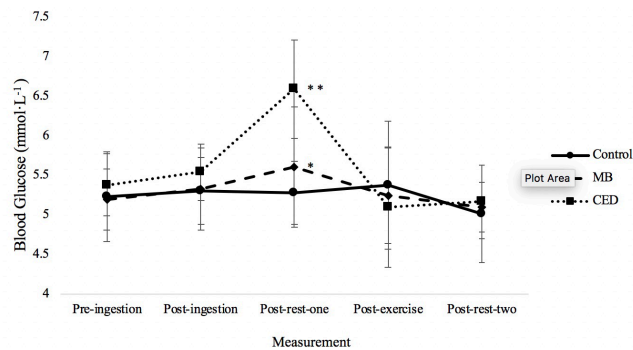
3955 Board #272 May 30 9:00 AM - 10:30 AM Effect Of Energy Drink Consumption On Heart Rate Variability And Blood Glucose In Relation To Exercise

Quinn Moberg, Greg Mulligan, Lynneth A. Stuart-Hill.
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(No relevant relationships reported)

There is high prevalence of adverse events associated with caffeinated energy drink (CED) consumption. **PURPOSE:** This study aimed to examine the acute physiological effects of CED in apparently-healthy volunteers, pre-, during-, and post-exercise. **METHODS:** A randomized cross-over double-blind design with three experimental conditions was used: a CED condition, a matched caffeine-carbohydrate beverage condition (MB), and a control beverage condition (CB). Participants underwent blood glucose, heart rate variability (HRV), and heart rate measures pre- and post-exercise. During the exercise component, participants increased cycling intensity to a respiratory exchange ratio of 0.96 to 0.98 and maintained the workload for 20-minutes. Blood glucose, HRV, and heart rate measures were compared using two-way ANOVA, and

exercise measures were compared using one-way ANOVA. **RESULTS:** As seen in Figure 1, an effect of condition on blood glucose ($p < 0.001$), an effect of time on blood glucose ($p < 0.001$), and an effect of condition x time on blood glucose ($p < 0.001$) was observed. Specifically, pre-exercise there was an increase in blood glucose in the CED condition relative to the MB condition (6.59 ± 0.63 vs. $5.61 \pm 0.76 \text{ mmol}\cdot\text{L}^{-1}$, $p < 0.001$), and in the MB condition relative to the CB condition (5.61 ± 0.76 vs. $5.28 \pm 0.40 \text{ mmol}\cdot\text{L}^{-1}$, $p = 0.045$). There was no effect of condition on HRV, heart rate, or exercise measures. **CONCLUSION:** Given the increased blood glucose in the CED condition relative to the MB conditions it is concluded that an ingredient in commercial CED must stimulate the endogenous release of glucose into circulation.

Fig. 1. Mean condition blood glucose concentration values over time. Effect of condition and time ($p < 0.001$), effect of condition x time ($p < 0.001$). * indicates statistical significance between conditions ($p < 0.050$).



3956 Board #273 May 30 9:00 AM - 10:30 AM Effect Of 5-hour Energy Shot® On Physiological And Performance Responses To Simulated Car Racing

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(No relevant relationships reported)

The 5-Hour Energy Shot® continues to be one of the more popular energy drinks on the market. The maker claims that it improves work and/or exercise performance. **PURPOSE:** To determine if ingesting one 5-Hour Energy Shot® compared to a placebo causes measurable improvement in performance related to physiological variables during a simulated driving task (SDT). **METHODS:** Nineteen (11 males, 8 females), college-aged (21.8 ± 1.55 yrs; 1.7 ± 0.11 m in ht; 72.9 ± 13.83 kg in wt), volunteers participated in a double-blind, cross-over, placebo-based study. The participants were tested prior to and then at 5 consecutive 1-hour intervals after ingesting either a randomly assigned non-caffeinated placebo (PL) (59 ml; 5 kcal) or the 5-Hour Energy Shot® (SHES) (59 ml; 4 kcal). The SDT was a solo-timed road race (Forza Horizon game) on an Xbox 360 gaming system. During each of the 6 data collection trials, heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), ear temperature (ETemp), skin temperature (STemp), drive time (DT), and number of crashes (#C) were recorded. Subjects were also evaluated for alertness and drink effectiveness at each of same time points. A 2-way repeated measures ANOVA was utilized to determine differences between the PL and the 5-HES treatments across the six test periods of the driving task. Significance was established at $p < 0.05$. **summary of RESULTS:** There was no statistically significant difference between PL and 5-HES across the six time periods relative to HR, SBP, DBP, ETemp, or #C driving tasks. However, the 5-HES group had a significantly lower STemp than the PL group at each time interval; with a 5-hour post-ingestion STemp of $89.55 \pm 2.30^\circ\text{F}$ in the 5-HES group compared to $90.27 \pm 1.96^\circ\text{F}$ in the PL group. The 5-HES group had a faster DT compared to the PL group at each of the time intervals; with a 5-hour post-ingestion DT of 197.47 ± 50.39 sec in the 5-HES group compared to 201.09 ± 52.38 sec in the PL group. **CONCLUSIONS:** When compared to a placebo, 5-Hour Energy Shot® did significantly improve driving time, along with a concomitant reduced skin temperature in college-aged participants during a simulated driving task.

- 3957** Board #274 May 30 9:00 AM - 10:30 AM
Effects Of Esport Specific Supplementation On Esport Performance And Physiological Measurements
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 (No relevant relationships reported)

Esports, or competitive video gaming, requires persistent cognitive functioning, alertness, quick reaction time, and mental clarity. As Esports has gained attention, more research is justified to elucidate performance enhancing strategies. Interestingly, Esport supplements aimed to improve reaction time, focus, and energy levels have yet to be heavily investigated. **PURPOSE:** To examine the impact of an Esport specific supplement on Esports performance and physiological responses. **METHODS:** Fifteen males (age = 22.0 ± 1.1 yrs, ht = 181.7 ± 10.2 cm, wt = 83.6 ± 14.5 kg, gaming = 13.9 ± 6.6 hrs) participated in the study. After completion of a baseline familiarization session including an Esports aim trainer (AT), subjects completed 2 performance sessions in a counterbalanced crossover design. Participants were given an Esports supplement (SUP) [caffeine, L-Theanine, Ginkgo Biloba, Vitamin B6, D3, B12] or placebo (PLA) 30 minutes prior to starting AT. During AT sessions, 3 rounds of 3 tests were completed each session: classic (CLA), reflex (RE), simple (SIM), and 1 round of time trial (TT). During each test, score (SCO), accuracy (ACC), and time per hit (TPH) were recorded, as well as time to completion (TTC) during CLA and TT. Before and after AT, BP and 5min resting HR and HrV were assessed. Subjects were asked mental fatigue and alertness prior to and after AT, along with SRPE after AT. Paired samples t-tests with an alpha level at p ≤ 0.05 were used to compare measurements of HR, HrV, BP, peak ACC, peak SCO, peak TPH, and peak TTC between SUP and PLA. **RESULTS:** There were no significant differences between SUP or PLA in regard to ACC (CLA 91.3 ± 3.0 vs 90.3 ± 4.4 %, RE 40.7 ± 12.9 vs 39.2 ± 12.0 %, SIM 61.7 ± 14.1 vs 61.7 ± 17.8 %, TT 48.0 ± 14.9 vs 49.7 ± 14.2 %, p ≥ 0.05), SCO (CLA 116357.1 ± 60706.9 vs 113642.9 ± 51013.7, RE 45839.3 ± 29161.1 vs 42339.3 ± 27287.2, SIM 40964.3 ± 22276.6 vs 38892.9 ± 24041.8, TT 16714.3 ± 20364.7 vs 20000.0 ± 18630.0, p ≥ 0.05), TPH (CLA 0.6 ± 0.1 vs 0.6 ± 0.1 sec, SIM 1.9 ± 0.5 vs 1.9 ± 0.5 sec, TT 1.8 ± 0.5 vs 1.7 ± 0.5 sec, p ≥ 0.05), and TTC (CLA 85.9 ± 23.1 vs 90.7 ± 15.4 sec, TT 177.5 ± 59.7 vs 161.7 ± 53.1 sec, p ≥ 0.05). **CONCLUSION:** SUP did not improve Esports performance during AT compared to PLA. This could be due to dosage, AT used, and level of experience of participants.

- 3958** Board #275 May 30 9:00 AM - 10:30 AM
Effect Of Dynamine With And Without Theacrine Supplementation Over Four Weeks On Blood Biomarkers
 Michaela G. Alesi¹, Matthew T. Stratton², Alyssa R. Bailly¹, Alyssa J. Holmes¹, Andrew Modjeski¹, Megan Barie¹, Yuri Feito, FACSM¹, Gerald T. Mangine¹, Karleena R. Tuggle¹, Tiffany A. Esmat¹, Garrett M. Hester¹, Katy Hayes¹, Matthew Lee¹, Katie Tran¹, Trisha A. VanDusseldorp¹. ¹Kennesaw State University, Kennesaw, GA. ²Texas Technical University, Lubbock, TX.
 (Sponsor: Yuri Feito, FACSM)
 (No relevant relationships reported)

Methylxerine (Dynamine; DYM) and theacrine (Teacrine; TCR) are purine alkaloids. Previous research on TCR reported increases in feelings of energy, focus, and concentration, and decreases in fatigue. Currently, there are no published human safety data on DYM. **PURPOSE:** The purpose of this study was to examine the effect of four weeks of DYM supplementation with and without TCR on blood biomarkers. **METHODS:** One-hundred twenty-five men (n = 60) and women (n = 65) were assigned to one of five groups: low dose DYM (100 mg), high dose DYM (150 mg), low dose DYM with TCR (100 mg + 50 mg), high dose DYM with TCR (150 mg + 25 mg), and 125 mg maltodextrin. Participants visited the laboratory fasted on two occasions (week 0 and week 4), separated by four weeks of supplementation, for a blood draw. Blood was analyzed by an independent third-party (i.e. LabCorp). **RESULTS:** Three-way repeated measures analyses of variance were performed for all blood biomarkers. Group × sex × time interactions (p < 0.05) with post-hoc analyses revealed differences for mean corpuscular hemoglobin (MCH) concentration with MCH being higher in men consuming the placebo than women consuming low dose DYM (p = 0.028) and high dose DYM with TCR (p = 0.011) at week 4. Group × time interactions (p < 0.05) revealed differences for platelets, blood urea nitrogen, total globulins, alanine transaminase, total proteins, triglycerides, and high-density lipoproteins. However, post-hoc analyses showed specific increases for blood urea nitrogen in groups consuming low dose DYM with TCR compared to low dose DYM participants, and an increase in high-density lipoproteins in the group consuming high dose DYM. Significant main effects for time were observed. Specifically, increases in mean corpuscular volume, MCH, basophils, absolute eosinophils, creatinine, and high-density lipoproteins from week 0 to week 4, while decreases in glomerular filtration rate, chloride, carbon dioxide, bilirubin, and alanine transaminase were seen.

CONCLUSIONS: While small changes were found in some biomarkers, in all cases values remained within normal clinical limits. This suggests that DYM alone or in combination with TCR consumed at the dosages used in this study does not appear to negatively impact blood biomarkers associated with health.
 Compound Solutions, Inc. grant

G-42 Free Communication/Poster - Vitamin D

Saturday, May 30, 2020, 8:00 AM - 10:30 AM
 Room: CC-Exhibit Hall

- 3959** Board #276 May 30 9:00 AM - 10:30 AM
Low-dose Vitamin D Supplementation Does Not Prevent 25(OH) Vitamin D Decline In College Students
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 (No relevant relationships reported)

Vitamin D deficiency is prevalent among active adults. Commonly, individuals opt to consume a multivitamin product to correct this deficiency. However, many multivitamins are often under-dosed compared to current evidenced-based recommendations. Furthermore, some companies offer a variety of vitamin formulations, with the claim of improving nutrient absorption. **PURPOSE:** To compare the effects of two different forms (liquid vs. capsule) of low-dose multivitamins on 25(OH) vitamin D status following 10-weeks of supplementation. **METHODS:** Thirty-two healthy males (n=15; 20.1y, 163cm, 71.7kg) and females (n=19; 22.1y, 153.4cm, 69.9kg) participated in this randomized, double-blind, placebo-controlled study. At the beginning of the 10-week intervention, participants provided a resting, fasted baseline blood sample and were randomly assigned to a liquid multivitamin supplement (LIQ; n=11), multivitamin capsule (CAP; n=11), or placebo group (PL; n=12). Participants took their respective supplement daily for 10 weeks. To maintain the double-blind study design, each participant consumed a combination of a liquid and capsule product. Placebo liquids and capsules were balanced so each group (LIQ, CAP, PL) consumed only their correct active (or placebo) treatment. The LIQ and CAP supplement both contained 268 IU of Vitamin D. Compliance was tracked by collecting empty supplement containers each week. After the 10-weeks, all participants reported back to the laboratory for a resting, fasted blood sample. Plasma samples were assayed for 25(OH) vitamin D concentrations. Data were analyzed using a 2-way repeated measures analysis of variance (ANOVA). **RESULTS:** There was a main effect for time (F=11.86, p=0.002, η²=0.227) with 25(OH) vitamin D concentrations significantly lower (Δ: -7.8±14.9ng/mL) at post-testing. Further, there were no significant differences between treatments (F=0.200, p=0.820, η²=0.013) in 25(OH) concentrations suggesting no benefit of LIQ or CAP supplementation over PL. **CONCLUSION:** It appears that a chronic low dose of vitamin D in liquid or capsule form is insufficient to maintain or elevate 25(OH)D concentrations in healthy, college-aged adults. Consumers should evaluate the dosing of their multivitamins compared to current evidence-based recommendations.

- 3960** Board #277 May 30 9:00 AM - 10:30 AM

EFFECTS OF ORAL VITAMIN D OR SIMULATED SUNLIGHT ON VITAMIN D METABOLISM DURING MILITARY TRAINING

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 (No relevant relationships reported)

25-hydroxyvitamin D (25(OH)D) is hydroxylated in the liver to its *biologically active* form, 1,25 dihydroxyvitamin D (1,25(OH)₂D), and its *catabolic* form, 24,25 hydroxyvitamin D (24,25(OH)₂D). The effect of vitamin D supplementation on the production of 1,25(OH)₂D and 24,25(OH)₂D is unknown. **PURPOSE:** To examine the effect of oral vitamin D supplementation *versus* simulated sunlight on vitamin D metabolites and parathyroid hormone (PTH) during 13-weeks of military training. **METHODS:** Eighty male infantry recruits (mean ± SD, age 22 ± 3 years, height 1.78 ± 0.07 m, body mass 77.9 ± 10.7 kg) received oral vitamin D₃ (OD₃, 1,000 IU·D⁻¹ for 4 weeks and then 400 IU·d⁻¹ for 8 weeks, n = 21), an oral placebo (OP, n = 19), solar-simulated radiation (SSR-D, 1.3 × standard erythemal dose in T-shirt and shorts, 3 d·wk⁻¹ for 4 weeks and 1 d·wk⁻¹ for 8 weeks, n = 22), or placebo SSR (SSR-P, n =

18). A blood sample was drawn in weeks 1, 5 and 13, and analysed for 1,25(OH)₂D, 24,25(OH)₂D and PTH. **RESULTS:** There was a significant effect of time ($P = 0.001$) but no effect of supplementation on 1,25(OH)₂D (group \times time interaction, $P = 0.345$). 1,25(OH)₂D was not different between week 1 and 5 (104.8 ± 25.7 pmol·L⁻¹, 102.9 ± 26.2 pmol·L⁻¹), but increased by week 13 (112.4 ± 3.7 pmol·L⁻¹, $P = 0.009$). There was a significant group \times time interaction for 24,25(OH)₂D ($P < 0.001$). In OD₃ and SSR-D, 24,25(OH)₂D increased from week 1 (3.4 ± 2.3 and 2.9 ± 2.3 nmol·L⁻¹) to week 5 (5.5 ± 2.5 and 5.1 ± 1.5 nmol·L⁻¹, $P < 0.001$) and week 13 (5.3 ± 1.3 and 5.6 ± 1.4 nmol·L⁻¹, $P < 0.001$). In OP, 24,25(OH)₂D decreased from week 1 (3.5 ± 2.2 nmol·L⁻¹) to week 5 (2.7 ± 1.4 nmol·L⁻¹, $P < 0.001$) and returned to baseline by week 13 (3.6 ± 1.3 nmol·L⁻¹). In SSR-P, 24,25(OH)₂D increased from week 1 (2.4 ± 1.6 nmol·L⁻¹) and week 5 (2.6 ± 1.6 nmol·L⁻¹) to week 13 (4.0 ± 1.4 nmol·L⁻¹, $P \leq 0.027$). 24,25(OH)₂D was higher in the OD₃ and SSR-D than their respective placebo groups at week 5 and week 13 ($P < 0.001$). There was a significant effect of time ($P < 0.001$) but no effect of supplementation on PTH (group \times time interaction, $P = 0.059$). PTH decreased from week 1 (4.7 ± 1.3 pmol·L⁻¹) and week 5 (4.8 ± 1.4 pmol·L⁻¹) to week 13 (4.3 ± 1.2 pmol·L⁻¹, $P \leq 0.003$). **CONCLUSION:** Oral vitamin D supplementation or simulated sunlight have no effect on the *biologically active* 1,25(OH)₂D, but increase the production of the *catabolic* metabolite 24,25(OH)₂D.

3961 Board #278 May 30 9:00 AM - 10:30 AM
Conducting Vitamin D3 Supplementation To Observe Serum 25(OH)D Levels, Body Composition, And Depression In Athletes

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 (No relevant relationships reported)

Vitamin D insufficiency is linked with muscle weakness and adequate levels can improve muscle performance. Secondly, Vitamin D is stored in fat via fat sequestration and has ties to depression. Athletes in preseason use copious amounts of muscle potentially altering body composition. Indoor athletes in particular, would benefit from supplementation due to their specific population risk of limited access to sunlight and living in a seasonally changing climate; both of which are indicators for inadequate Serum Vitamin D (25(OH)D) and depression. **PURPOSE:** To first examine 25(OH)D levels in an indoor athletic population with daily supplementation of Vitamin D3 (D3) to observe any potential relationships between supplementation, 25(OH)D, body composition, and depression levels. **METHODS:** Men's Basketball players at a Division II school were recruited during preseason. Subjects with 25(OH)D levels <40ng/mL were admitted and started on 4000IU/day D3 supplementation for 8 weeks, Visit 1 (V1). Visit 2 (V2) and Visit 3 (V3), were 4 and 8 weeks after V1, respectively. Visit 4 (V4) was 4 weeks after V3 and D3 completion. 25(OH)D via blood draws, body composition (BodPod), anthropometrics such as height, weight, and waist circumference were measured at all visits. Depression (CES-D Scale) was measured at screen and V4. **RESULTS:** Five (19.4±1.3yo, 25.6±1.1kg/m² BMI, 23.0±9.2ng/dL 25(OH)D) subjects completed. 25(OH)D increased from V2-V3 (27.7 ± 5.9 - 38.7 ± 3.6 , $p=0.02$) but not from V1-V2 nor V1-V3. A trend was noted with falling 25(OH)D from V3-V4 (38.7 ± 3.6 - 32.3 ± 7.7 , $p=0.06$), 4 weeks post supplementation. No changes were seen in any body composition measures over time nor in comparison with parallel 25(OH)D levels. Screen 25(OH)D was not different than depression at pre study (4.4 ± 2.3 , $p=0.67$) but trended towards a difference compared to post study (2.3 ± 1.7 , $p=0.06$). **CONCLUSION:** 25(OH)D eventually increased in Division II basketball players with continual supplementation, possibly improving rates of depression. Further research is warranted with a larger active athletic population over a longer period of supplementation to perhaps see any definitive relationships in 25(OH)D and depression or in comparison to body composition, and to continue detecting levels after stopped supplementation.

3962 Board #279 May 30 9:00 AM - 10:30 AM

Modulation Of Acute Metabolic And Inflammatory Responses To Resistance Exercise By Vitamin D3 Injection In Vitamin D-deficient Males

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Vitamin D deficiency has been previously associated with impaired metabolic functions which may impact the acute effects of resistance exercise (RE) on insulin sensitivity, inflammation, and muscle damage. The effects of exogenous vitamin D on the metabolic, inflammatory, and muscle damage responses to an acute bout of RE in vitamin D deficient subjects have yet to be explored. **PURPOSE:** To evaluate the effects of a single vitamin D3 injection on the metabolic, inflammatory and muscle damage responses to an acute bout of RE in vitamin D-deficient resistance-trained males. **METHODS:** Blood samples from 14 vitamin D-deficient resistance-trained males were obtained during two separate trials: lower vitamin D (LVD, after saline injection) and higher vitamin D (HVD, after vitamin D3 injection). Metabolic, inflammatory, and muscle damage markers were evaluated at baseline and immediately then one hour after RE. Differences in mean values for each variable between trials were compared by repeated measures ANOVA followed by LSD test for pairwise comparisons. **RESULTS:** There were significant trial \times time interactions for serum insulin and Homeostatic Model Assessment (HOMA) of Insulin Resistance which were both lower ($p < 0.05$) at 1-hour post-RE in the HVD compared to LVD trial. There was a significant decrease ($p < 0.05$) for blood sugar and increase ($p < 0.05$) for creatine kinase, lactate dehydrogenase, and interleukin 6 1-hour post-RE across both trials with no interaction of time. There were no significant changes in other inflammatory and cardiovascular markers following either trials. A single injection of vitamin D3 demonstrated efficacy in reducing insulin resistance following RE in previously vitamin D-deficient resistance-trained males. Conversely, muscle damage and inflammatory response to acute RE were not altered. **CONCLUSION:** Intramuscular vitamin D replacement in vitamin D-deficient resistance-trained males may have key implications for the promotion of glucose metabolism and lowering the risk of diabetes in this population.

3963 Board #280 May 30 9:00 AM - 10:30 AM

Effects Of Vitamin D And Resistance Training On Insulin Sensitivity And Neuromuscular Health In Obesity

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Vitamin D has been widely studied for its role in regulating calcium and bone metabolism. Increasing evidence shows that vitamin D has insulin-sensitizing and ergogenic properties, which are similar to the adaptations to resistance training (RT). **Purpose:** To evaluate the effects of a 10-week vitamin D administration with or without RT on systemic insulin sensitivity, inflammation and neuromuscular health in p62 deficient mice, a genetic obese animal model with reduced insulin sensitivity. **Method:** 24-week old p62 deficient male mice were assigned to the following groups (10/group) for 10-week interventions: control (p62C, no treatment), vitamin D (VD, 75 IU of vitamin D every 3 days), RT (ladder climbing 3x/wk), or combined treatment (VRT, VD + RT). Body weight and daily food intake were monitored biweekly. Body composition (Dual-energy X-ray absorptiometry), neuromuscular function (grip strength and sensorimotor function), and systemic glucose tolerance (2-hour oral glucose tolerance test) were measured pre- and post-intervention. Blood samples, the hindlimb muscles, and the spleen were collected post-intervention and analyzed for serum vitamin D levels, tissue wet weights, and myofiber cross-sectional area (CSA). **Results:** 10-week vitamin D administration significantly increased serum vitamin D levels in VD (+61.1%) and VRT (+34.0%, $p < 0.001$) compared to p62C. Total body mass significantly increased in three groups (p62C: +16.4%, VD: +13.5%, VRT: +8.6%, $p < 0.05$) except RT. Fat mass increased significantly in p62C (+33.0%, $p < 0.05$) but was not changed in the intervention groups. Lean mass was not affected by any intervention. Grip strength (-22.5%) and sensorimotor function (-12.8%) significantly decreased only in p62C ($p < 0.05$). RT preserved fasting blood glucose levels (BG). In addition, RT and VRT lowered 30-minute postprandial BG (RT: -40.9%, VRT:

-36.9%, $p < 0.05$), compared to p62C. The spleen mass was significantly lower in RT (-49.7%) and VRT (-45.1%, $p < 0.05$) compared to p62C. **Conclusion:** Vitamin D, RT, and when combined not only attenuated the progression of obesity but also preserved neuromuscular function in p62 deficient mice. However, only RT was effective in improving systemic insulin sensitivity and inflammation. Supported by Jiwon Co./FSU College of Human Sciences

G-43 Free Communication/Poster - Pedagogy Related to Exercise

Saturday, May 30, 2020, 8:00 AM - 10:30 AM
 Room: CC-Exhibit Hall

**3964 Board #281 May 30 8:00 AM - 9:30 AM
 Community, Connectedness, And Learning In Exercise Science: Does Classroom Context Matter?**

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Exercise science programs require rigorous academic preparation often taught in traditional classroom and lab settings. However, situated learning theory views learning as action in a community of practice, where the elements of social interaction, connectedness, and authentic participation transform cognitive understanding into meaningful knowing. Situated learning can have a complex effect on exercise science students' connectedness, understanding, theory application, and professional skills. Additionally, social networks (like Facebook) can provide a modern educative community in which to increase engagement and connection in the classroom. **PURPOSE:** The purpose of this quantitative research was to examine the relationship between learning environment type (situated versus traditional) and the use of Facebook on undergraduate exercise science students' perceived sense of overall classroom community, connectedness, and learning. **METHODS:** 69 undergraduate exercise science students (age [yrs] = 22.5 ± 2.1 , males = 37.7%; females = 60.9%) who had participated in either a traditional course, traditional course with Facebook, a situated course, or a situated course with Facebook completed Rovai's (2002) Classroom Community Survey at the end of their course experience. Multiple Regression was performed to determine if there were any significant differences between the four groups ($\alpha = .05$). **RESULTS:** Results demonstrated a situated learning classroom and a situated learning classroom with Facebook were significant positive predictors of students' perception of overall classroom community ($R^2 = .181$, $F(3, 65) = 4.794$, $p = .004$), connectedness ($R^2 = .130$, $F(3, 65) = 3.232$, $p = .028$), and learning ($R^2 = .186$, $F(3, 65) = 4.965$, $p = .004$). **CONCLUSIONS:** This research supports situated learning as a best practice for increasing classroom community in undergraduate exercise science programs. Students perceived higher levels of overall classroom community, connectedness, and learning when participating in a situated classroom and to an even greater extent a situated classroom with Facebook. Incorporation of these types of learning environments and teaching strategies in exercise science degree programs may enhance professional skill development and successful employment within the field.

**3965 Board #282 May 30 8:00 AM - 9:30 AM
 Service-learning Or Internship: A Mixed-methods Evaluation Of Experiential Learning Pedagogies**

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 (No relevant relationships reported)

Experiential learning pedagogies, including internship and service learning experiences, are becoming increasingly popular in higher education. An internship engages students with hands-on experiences that enhances their learning or skills within their fields of study while service-learning is as a type of experiential education in which students participate in service, typically within the community, and reflect on their involvement in such a way as to gain further understanding of course content and of the discipline as well as its relationship to societal needs. To date, no study has yet directly compared these teaching modalities. **PURPOSE:** To determine if a service learning experience or internship pose a more favorable effect on education-based self-efficacy. **METHODS:** The present study systematically evaluated a service learning experience against an internship experience using a mixed-methods model with the primary outcome being student self-efficacy. Sixteen students completed a community-based wellness internship with a subgroup (nine students) allocated to a service-learning component of internship which incorporated reflective assignments designed to improve self-efficacy. At the end of the semester, students completed a 15 item

online self-efficacy and satisfaction survey using a Likert scale. Three focus groups were conducted in which 3-4 participants responded to a series of nine questions which explored their internship experience. Qualitative data was analyzed via thematic analysis. **RESULTS:** Overall responses to the self-efficacy and satisfaction survey were favorable for both groups, but the internship group was more likely to agree or strongly agree with statements of self-efficacy. Focus groups found that the internship experience reinforced classroom learning, but the ability to work with different populations and ability levels was mentioned only by the service-learning group. Themes from reflective assignments, such as engaging with community members and professional exploration, were evident in the service-learning group responses only. **CONCLUSION:** When incorporating reflection assignments service learning experiences successfully connect the service experience to relevant course outcomes promoting student development and self-efficacy.

**3966 Board #283 May 30 8:00 AM - 9:30 AM
 Evaluation Of The Virtual Laboratory Of Exercise Physiology**

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Lab experience is one of the most important parts of Kinesiology courses; however, most California State University (CSU) campuses do not have the capacity for physical labs, adequate equipment, or funding to provide hands-on lab activities to their Kinesiology major students. **PURPOSE:** The purpose of this research was to compare student learning outcomes from Virtual Laboratory of Exercise Physiology (VLEP) with that from traditional exercise physiology laboratory activities. **METHODS:** 40 undergraduate Kinesiology students (mean±SD, age = 22 ± 3 , junior = 45%, senior = 55%) were randomly assigned to either experimental group 1 or group 2. Group 1 completed traditional laboratory activities, whereas group 2 completed the VLEP. Both groups then completed the same assessment to evaluate their understanding of aerobic (VO2max) and anaerobic (Wingate) power laboratory concepts. A one-way ANOVA was performed to determine if there were any significant differences between the two groups ($\alpha = .05$). The students were also asked to rate their experiences using a qualitative questionnaire. One of the relevant components of that questionnaire asked students to indicate which laboratory type they preferred. A second relevant component asked students to indicate how educational they thought the VLEP program was. **RESULTS:** Mean aerobic power lab activity assessment scores (%) were 81.5 ± 5.4 and 81.6 ± 6.6 and mean anaerobic power lab assessment scores were 82.5 ± 8.1 and 83.0 ± 6.5 for groups 1 and 2, respectively. There were no significant differences between the two groups in either aerobic power lab assessment scores or anaerobic power lab assessment scores. In this investigation, 47.5% of the students indicated a preference for the traditional laboratory activity, and the other 52.51% of the class either preferred the VLEP (27.5%) or did not prefer one laboratory type over another (25.0%). Students agreed that the VLEP was at least moderately educational (25.0%), and most students thought that the VLEP was very educational (75.0%). **CONCLUSIONS:** These findings support that VLEP instructs students as effectively as a traditional laboratory. We hope VLEP could remove enrollment bottleneck challenges and provide a lower cost, experiential, accessible alternative for Kinesiology major students in CSU.

**3967 Board #284 May 30 8:00 AM - 9:30 AM
 Classroom Teachers' Intentions To Provide Physical Activity Opportunities To Students: An Analysis Using Self-Determination Theory**

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PURPOSE: Providing opportunities for elementary school-aged children to be physically active during the school day is important for obesity prevention and overall health. Classroom physical activity (CPA) has been shown to be effective for increasing student PA, but is not widely practiced among teachers. This study examined teachers' perspectives on CPA, and intention to provide CPA, using a survey designed to measure constructs within the self-determination theory. **METHODS:** The constructs of Competence, Autonomy, Relatedness, and intention regarding CPA use were assessed using a survey of 173 elementary school teachers across 10 schools. The constructs were represented using the following subscales (each used a 6-point Likert-type scale from strongly disagree to strongly agree): Competence included three survey items ($\alpha = .94$), such as "I am capable of using activity breaks in my classroom;" Autonomy included three items ($\alpha = .83$), such as "I have a say in choosing whether to use activity breaks;" Relatedness included 4 items ($\alpha = .78$), such as "providing opportunities for children to be physically active in my classroom is consistent with my priorities as a teacher;" and intention to implement

CPA included 2 items ($\alpha = .77$): "I definitely plan to try using activity breaks in my classroom," and "I expect I will be able to use activity breaks regularly." Multiple linear regression was used to examine how the constructs of Competence, Autonomy, and Relatedness predicted intention to provide CPA to students.

RESULTS: Regression results indicated that the three predictors explained 44.1% of the variance ($R^2 = .44$, $F(3,173) = 44.74$, $p < .001$) in teacher intent to provide CPA. Competence ($B = .31$, $t(173) = 4.92$, $p < .001$) Autonomy ($B = .19$, $t(173) = 3.15$, $p = .002$) and Relatedness ($B = .18$, $t(173) = 3.40$, $p = .001$) each significantly predicted intention.

CONCLUSION: Competence was the strongest predictor of teachers' intent to provide CPA. However, feeling autonomous to implement CPA and viewing CPA as compatible with their teaching philosophy also predicted teachers' intention to provide CPA opportunities. Increasing teacher competence to provide CPA through professional development could be one effective method for increasing this practice. Supported by the Institute of Education Sciences grant R305A150277

3968 Board #285 May 30 8:00 AM - 9:30 AM
Effects Of Exercise On Plasma β -endorphin And Dsq In Methamphetamine Dependent Individuals

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PURPOSE: Methamphetamine is the main component of opioid drugs, which directly affects the central nervous system which leading to abnormal secretion of catecholamines. Physical exercise has been shown to benefit diverse medical and behavioral conditions. This study assesses the feasibility and efficacy of an 8-week aerobic and resistance training program on β -endorphin in plasma and desire for speed questionnaire (DSQ) for methamphetamine (MA) dependence.

METHODS: A total of 60 MA-dependent individuals were randomized to aerobic exercise group (AE, $n=30$) and resistance exercise group (RE, $n=30$). Each training group was trained over 8 weeks, 3 times/week, 90 minutes each time, which include formal training (70 minutes), warm-up (10 minutes) and recovery (10 minutes). The aerobic exercise intensity is 65%-85% HR_{max} and the muscle strength by 1-repetition maximum (1-RM) and endurance at 85% in resistant exercise group.

RESULTS: (1) After 8 weeks of exercise intervention, the β -endorphin levels in the group AE and group RE were significantly increased ($p < .01$). Inside, the level of β -endorphin in the group AE was increased from 154.7 pg/ml to 214.3 pg/ml, the rate of change of β -endorphin in plasma was 39.24%. The level of β -endorphin in the high-intensity group was increased from 158.4 pg/ml to 181.7 pg/ml, the rate of change was 14.76%. It is suggested that the effect of aerobic exercise on plasma β -endorphin is more effective than that of resistance exercise. (2) After 8 weeks of exercise intervention, MA-dependent have reduced their desires, The score of the DSQ in t both group were significantly decreased ($p < .05$). In the group AE the score was decreased from 105.40 to 75, and the score of the group RE was decreased from 111.4 to 77.7.

CONCLUSIONS: Both aerobic and resistance exercise can increase the level of β -endorphin in MA-dependent individuals, promote the formation of euphoria compensation mechanism, and reduce the desire for speed. The effect of aerobic exercise on plasma β -endorphin in methamphetamine dependent individuals was more obvious.

3969 Board #286 May 30 8:00 AM - 9:30 AM
Academic Burnout Amongst Exercise Science Students

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 (Sponsor: Monica Hubal, FACSMM)
 (No relevant relationships reported)

PURPOSE: Prior research shows that the psychological constructs of hope, optimism, and self-efficacy impact voluntary behavior, and quality of life. Academic burnout is prevalent among university students of all types. However, knowledge of what predicts burnout in undergraduate exercise science (ES) students is limited. Thus, the purpose of this longitudinal study was to examine the level of burnout at the beginning and end of the semester in ES students. Second, we examined the association of psychological factors and physical activity (PA) with burnout in ES students. **METHODS:** Students completed two online surveys within one Fall semester: one at the beginning and the other near the end. The first survey included the following questionnaires: Copenhagen Burnout Inventory, Adult Hope Scale, Life Orientation Test-Revised (optimism), Self-Efficacy to Regulate Exercise, Satisfaction with Life, and International Physical Activity Questionnaire (IPAQ). The second survey included the Copenhagen Burnout Inventory, IPAQ, and Satisfaction with Life. From the IPAQ, measures of moderate PA, vigorous PA, walking, and total PA were computed. Of the 169 participants, 59 were retained who completed both surveys and listed their major as ES. **RESULTS:** At the beginning of the semester 35.6% of students reported high burnout and 22.8% reported high burnout near the end of the semester. Predictors of burnout were

chosen based on significant correlations. Burnout at Time 1 negatively correlated with vigorous PA, optimism, and Life Satisfaction at Time 1. The regression revealed vigorous PA ($Beta = -.232$, $p = .037$), life satisfaction ($Beta = -.268$, $p = .04$), and optimism ($Beta = -.369$, $p = .005$) as predictors of burnout at Time 1. Burnout at Time 2 negatively correlated with GPA, optimism, life satisfaction, and hope at Time 1. Regressions showed life satisfaction ($Beta = -.359$, $p = .008$) and optimism ($Beta = -.415$, $p = .002$) at Time 1 as significant predictors of burnout at Time 2. **CONCLUSION:** ES students reported higher burnout at the beginning of the semester compared to the end of the semester. Higher levels of vigorous PA, optimism, and life satisfaction predicted lower burnout at the beginning of the semester. Greater optimism and life satisfaction at the beginning of the semester predicted lower burnout near the end of the semester.

3970 Board #287 May 30 8:00 AM - 9:30 AM
An Exercise-based Didactic Strategy In Physical Education Increases Motor Skills In Preschool Children: A Pilot Study

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Physical education (PE) in preschool aims for the corporal and motor skills development in children, nevertheless the evaluation strategies of acquired skills has been neglected in Mexican public school system. Since 2018 only PE teachers are responsible to teach classes, and a collaboration between public institutions allowed us to launch a pilot study of PE classes based on motor skills circuits called "motor action circuits" as an effective tool to develop motor skills. **PURPOSE:** To determine the effects of an exercise-based didactic strategy on the PE curricula on motor skills performance in children. **METHODS:** Five boys (Age = 5.2 ± 0.4 yr.) and nine girls (Age = 5.1 ± 0.3 yr.) participated in the study. Exclusion criteria for children were having a major pathology, pharmacological therapy, and enrollment in after-school physical activity programs. Children attended three 30-min lessons in non-consecutive days per week under the supervision of two trained female PE teachers. Motor skills were measured by the Movement Assessment Battery for Children (MABC-2) test. Two-way (2 genders x 2 measurements) mixed ANOVA were computed for motor skills performance using the GraphPad Prism software. **RESULTS:** The assumption of normality was met by the Shapiro-Wilk test for girls ($W = 0.849$) and boys ($W = 0.807$). A better performance was found on threading beads (Pre = 1.7 ± 0.5 vs. Post = 1.1 ± 0.5 min, $p = 0.0004$) and posting coins with the preferred hand (Pre = 26.5 ± 2.1 vs. Post = 21.8 ± 5.0 s, $p < 0.0001$). A significant improvement was found on throwing at a wall target with the right arm (Pre = 2.8 ± 0.1 vs. Post = 3.8 ± 0.2 hits, $p = 0.02$), the left arm (Pre = 2.4 ± 0.2 vs. Post = 3.8 ± 0.08 hits, $p = 0.0001$), throwing a bean bag into a box (Pre = 0.4 ± 0.2 vs. Post = 4.1 ± 1.2 hits, $p = 0.0038$), maintaining one-board balance with the preferred leg (Pre = 12.3 ± 8.4 vs. Post = 26.7 ± 7.7 s, $p = 0.0007$), and one-board balance with the other leg (Pre = 10.3 ± 5.9 vs. Post = 23.6 ± 6.9 s, $p = 0.0011$). **CONCLUSION:** Significant motor skill performance improvements were observed in children attending an exercise-based didactic strategy on the PE program, which highlights the need to increase physical activity at early ages in Mexican children.

3971 Board #288 May 30 8:00 AM - 9:30 AM
Pedagogical Considerations In Exercise Physiology Laboratory Courses

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 (No relevant relationships reported)

PURPOSE: To explore how pedagogical approaches in an undergraduate exercise physiology laboratory course may reflect test results. **METHODS:** A retrospective analysis was conducted using three course sections taught in two separate semesters (six total sections, taught by the same instructor), with 31 students enrolled per semester ($N = 62$). Didactic (lecture and discussion) and practical (demonstration, in-class skills practice) instruction was provided for exercise physiology laboratory theory and procedures. Additional skills practice throughout the course was achieved via fitness assessments performed on five peer subjects recruited by each student in the class over the semester. Fitness assessments required testing for height, weight, resting blood pressure, four site skinfolds (4SKF), YMCA Step Test, YMCA Bench Press Test, 1-Minute Curl-Ups, and Sit-and-Reach. Tests were selected to cover a spectrum of fitness attributes and skills, as well as in accordance with pragmatic considerations of available practice opportunities. Course assessment included two written examinations consisting of multiple choice and short response questions, administered at the middle and end of the course, covering different sets of theoretical content, and a practical skills examination scored by rubric conducted individually by the instructor at the end of the course.

RESULTS: Scores for both sets of written examination scores were combined, resulting in an average score of 21.6±4.1 points out of 30 possible points, or 72.1%. The practical exam average equaled 13.6±1.3 points out of 15 possible points, or 90.4%. Accordingly, it was noted that scores for student performance on the practical exam were higher than those for the written examinations ($p<0.05$).

CONCLUSIONS: While pedagogical approaches differ for theoretical and practical instruction due to the nature and need for specific instruction in an undergraduate exercise physiology laboratory course, it appears that additional skills practice opportunities may result in higher test scores and improved learning, as reflected by practical examination. Thus, adequate skills practice opportunities, in conjunction with traditional didactic instruction, are recommended to enhance student learning and competence in laboratory content.

G-44 Free Communication/Poster - Genetics, Immunology and Endocrinology in Athletes

Saturday, May 30, 2020, 8:00 AM - 10:30 AM

Room: CC-Exhibit Hall

3972 Board #289 May 30 9:00 AM - 10:30 AM

Association Between Muscle Stiffness And ESR1 Rs2234693, Rs9340799 And Actn3 R577X Polymorphisms In Collegiate Athletes

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(No relevant relationships reported)

Previous studies have reported that distinct gene polymorphisms (e.g. ACTN3 R577X, ESR1 rs2234693, rs9340799) are associated with muscle stiffness, amongst which ESR1 rs2234693 and rs9340799 polymorphisms are also associated with instances of muscle injury. **PURPOSE:** To investigate the association between muscle stiffness and ESR1 rs2234693, rs9340799 and ACTN3 R577X polymorphisms in collegiate athletes. **METHODS:** In this study, 40 athletes (33 men and 7 women), who had undergone resistance training, were evaluated for the occurrence of muscle stiffness (hamstring: biceps femoris, semitendinosus, and semimembranosus) by ultrasound shear wave elastography. Additionally, ESR1 rs2234693, rs9340799 and ACTN3 R577X polymorphisms were analyzed using the TaqMan SNP Genotyping Assay. Comparisons of muscle stiffness between the genotypes were performed using one-way ANOVA. The Hardy-Weinberg equilibrium was determined for the ESR1 rs2234693, rs9340799 and ACTN3 R577X polymorphism using a Chi-square test. **RESULTS:** Genotype frequencies of the ESR1 rs2234693 (CC 13%, CT 55%, TT 33%), rs9340799 (GG 3%, GA 25%, AA 72%) and ACTN3 R577X (RR 18%, RX 64%, XX 18%) polymorphisms were consistent with the Hardy-Weinberg equilibrium ($p=0.36$, $p=0.90$, $p=0.08$, respectively). However, there was no significant difference in muscle stiffness between ESR1 rs2234693 and ACTN3 R577X genotypes. Further, the GG or GA genotype of ESR1 rs9340799 polymorphism tend to exhibit greater muscle stiffness of the hamstring muscles compared with the AA genotype in collegiate athletes (27.2 ± 7.0 kPa vs. 22.4 ± 6.7 kPa; $p=0.054$). **CONCLUSIONS:** Our results suggested that ESR1 rs2234693, rs9340799 and ACTN3 R577X polymorphisms are not associated with muscle stiffness in collegiate athletes.

3973 Board #290 May 30 9:00 AM - 10:30 AM

Self-reported Stress And Well-being Impacts Immune Response To Maximal Exercise In Collegiate Swimmers

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(No relevant relationships reported)

Exposure to acute psychological and physiological stressors is associated with impairments in immune function including reduced exercise-induced mobilization of naïve (NA) T-cells and increased mobilization of antigen-specific, highly differentiated T-cells following maximal exercise. However, the impact of sustained stressors on the immune response to maximal exercise is unknown. **Purpose:** Characterize the impact of self-reported stress and well-being on lymphocyte responses to acute bouts of exercise in collegiate swimmers over six months. **Methods:** Blood samples were collected from fifteen NCAA D1 swimmers (7 M, 6 F: 19.8 ± 0.7 y) before and after maximal swims at two timepoints (V_1 : immediately post-season 1 and V_2 : early season 2). An additional mid-off season timepoint (V_3) was collected in a subset of nine swimmers. T-cells were quantified by flow cytometry, and self-reported measures

of sleep quality (PSQI), symptoms of upper respiratory tract infection (URTI, WURRS-21), and overtraining (DALDA) were collected. Linear mixed models were used to determine the effects of exercise, season timepoint, and their interaction on lymphocyte percentages ($\alpha=0.05$). Pearson's correlation coefficients were used to assess correlations between lymphocyte percentages and stress measures. **Results:** Lower sleep quality was correlated with greater resting and post-exercise senescent CD4+ T-cell percentages ($r=0.44$, $p=0.01$; $r=0.47$, $p=0.004$, respectively). Low sleep quality was also correlated with lower post-exercise NA CD4+ T-cells ($r=-0.35$, $p=0.04$). Higher ratings of self-reported symptoms of URTI ($r=0.38$, $p=0.02$) and overtraining ($r=0.38$, $p=0.02$) were correlated with greater post-exercise senescent CD4+ T-cell percentages. Compared to pre-exercise, post-exercise NA CD8+ T-cell percentages were lower at V_1 and V_2 , while CD8+ T-cell percentages were higher post-exercise ($p<0.01$). **Conclusion:** Elevations in stress and well-being at rest adversely impacted immune response to maximal exercise in collegiate swimmers. Impaired sleep quality and higher URTI and overtraining symptoms were associated with an exacerbated exercise-induced mobilization of senescent CD8+ T-cells, highlighting the importance of monitoring athlete stress level and overall well-being throughout the competitive season.

3974 Board #291 May 30 9:00 AM - 10:30 AM

Acute And Chronic Brain-Derived Neurotrophic Factor Responses During One Season Training In Young Swimmers

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(No relevant relationships reported)

It has been demonstrated that Brain-Derived Neurotrophic Factor (BDNF) is a mediator of neuroprotective and neuroplastic processes, and that serum BDNF is representative of central concentrations as well. Interestingly, there is evidence that BDNF levels are elevated in response to exercise.

PURPOSE: This study aimed at investigating the acute and chronic effects of a full season swimming training on serum BDNF, both at rest and after a maximal exercise bout in young athletes.

METHODS: Twelve well-trained male swimmers (14.08 ± 1.0 yrs) participated in the study. Measurements were carried out at the beginning of the training season (T1) as well as pre- and post-taper of each of the two competitive periods (i.e., T2, T3 for the first macrocycle, and T4, T5 for the second macrocycle, respectively). At each of the above time points, blood samples were collected pre- and 1 hour post a maximal, 400m swimming testing. Serum BDNF levels were measured by ELISA. Adjustment for exercise-induced plasma volume changes was performed before data analysis. Two-way ANOVA with repeated measures was used for statistics.

RESULTS: A significant pre-post testing difference was observed at T2 ($p=0.048$). In addition, a main effect of time was found among the 5 time points (T1-T5; $p=0.000$). Moreover, both pre- and post-testing responses had a similar profile exhibiting a decline from T1 to T3 (pre: $23,412 \pm 2,504$ pg/ml vs $3,433 \pm 669$ pg/ml, post: $23,004 \pm 3,410$ pg/ml vs $2,743 \pm 550$ pg/ml) and from T4 to T5 (pre: $19,428 \pm 1,097$ pg/ml vs $11,993 \pm 969$ pg/ml, post: $22,111 \pm 1,455$ pg/ml vs $12,838 \pm 1,763$ pg/ml), and an increase from T3 to T4 (pre: $3,433 \pm 669$ pg/ml vs $19,428 \pm 1,097$ pg/ml, post: $2,743 \pm 550$ pg/ml vs $22,111 \pm 1,455$ pg/ml).

CONCLUSIONS: To the authors' best knowledge this is the first study examining the acute and chronic BDNF responses during one season training in young athletes. These findings indicate that long-term swimming training can affect the resting and acute (pre-post testing) circulating BDNF in young swimmers.

3975 Board #292 May 30 9:00 AM - 10:30 AM

Hormonal And Heart Rate Changes To Maximal Exercise In Elite Adolescent Athletes

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One of the main biomarkers of stress is the steroid hormone cortisol (C), while testosterone (T) and estrogen (E) steroid hormones are associated with physical activity. **PURPOSE:** To determine the relationship between a maximal swimming exercise and hormone level changes and acute training's influence on the stress level in elite adolescent athletes. **METHODS:** The study was conducted with 31 participants (boys: $n=19$, mean age±SD: 16.34 ± 1.12 years; girls $n=12$, 15.17 ± 0.81 years) from the

field of water sports (swimming: n=10; water polo: n=21). The young elite athletes completed a maximal freestyle swimming test (200 meter) after a 25 minutes unified warm-up. Saliva samples were collected before (C1), immediately after the exercise (C2) and after a 30 minutes rest (C3). Free hormone levels in saliva were quantified by using IBL ELISA kits. Heart rate (HR) was measured throughout the whole procedure (Polar V800). We used the Brunel questionnaire to determine the participants' mood states after the field test. **RESULTS:** There was significant rise in boys' C levels compared to the C1 (0.176±0.134 µg/dl) with C2 (0.339±0.278 µg/dl; p=0.030) and C3 (0.426±0.319 µg/dl; p=0.001) measured results. Rise in girls' C level was not significant (p=0.057), however their C2 (r=0.71) and C3 (r=0.60) levels correlated with their peak HR in swimming test. Boys' T levels decreased significantly after the exercise (0.0046±0.0023 µg/dl) compared to basal levels (0.0061±0.0028 µg/dl) and T/C ratio also decreased (basal: 0.047±0.032 µg/dl; after exercise: 0.02±0.015 µg/dl). There was no significant difference in girls' E levels, however their C3 levels correlated with their happiness (r=0.62), and C3-C1 concentration difference correlated also with happiness (r=0.68) and calmness (r=0.71) items of the Brunel scale. **CONCLUSION:** These results justify the application of the swimming field test to monitor maximal performance induced hormonal changes in adolescent athletes. Changes in T and T/C levels go against the experienced trend in literature therefore we feel the need of further analysis of our results. Moreover, the repeated measures might be an effective way to register the alarming symptoms of the common overtraining syndrome in swimming. *Supported by the ministry of human capacities [ÚNKP-18-3-I-TE-6].*

3976 Board #293 May 30 9:00 AM - 10:30 AM
Assessment Of High-intensity Training Load And Exercise-induced Oxidative Stress In Professional Soccer Players.

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(No relevant relationships reported)

It is documented that intense periods of soccer can induce oxidative stress, the negative effects of which can compromise performance. However, few studies have explored the potential association between exercise-induced oxidative stress and training load intensity. **PURPOSE:** The aim of the study was to quantify oxidative stress relative to indicators of high-intensity training load in a cohort of professional soccer players throughout different phases of a competitive in-season. **METHODS:** Ten professional soccer players (age: 23±2yrs; body mass: 83.5±6.2kg; stature: 181.3±5.3 cm; $\dot{V}O_{2max}$: 57.2±6.7 mL·kg⁻¹·min⁻¹), representatives from an English Football League One team, participated in the study. Training load was assessed at three time points throughout a competitive in-season (T1: early in-season; T2: mid-season; T3: end of in-season [1st, 16th & 32nd microcycle]) using global positioning system (GPS) and heart rate (HR) based methods to quantify external (HETL) and internal high-intensity training load (HITL). Urine samples were collected at each time point and analysed for malondialdehyde (MDA) as a biomarker of oxidative stress. Data normalised to creatinine. Results presented as M ± SD. **RESULTS:** High-intensity training load varied significantly throughout the competitive in-season and was significantly higher at T2 compared to T1 (HETL: 18.56 ± 7.30 mmol⁻¹ vs. 6.72 ± 2.62 mmol⁻¹, an increase of 11.84 mmol⁻¹, 95% CI [4.33, 19.36], p = .004; HITL: 60 ± 34 %Time spent > 80% HR_{max} vs. 23 ± 15 %Time spent > 80% HR_{max}, an increase of 37 %Time > 80% HR_{max}, 95% CI [13, 60], p = .004; T2 vs. T1, respectively). Urinary MDA concentrations decreased significantly throughout the competitive in-season, $\chi^2(2) = 6.889$; p = .032, (T1: 0.76 ± 0.90 µMmmol⁻¹ vs. T3: 0.18 ± 0.12 µMmmol⁻¹, Z = -2.192, r = .52, p = .028). No significant correlations were observed between indicators of high-intensity training load and MDA. **CONCLUSION:** Chronic soccer training appears to promote an adaptive response as oxidative stress was attenuated over the competitive in-season, irrespective of the intensity of the training load. Monitoring urinary MDA may be a useful tool to provide coaches and sports scientists an insight into adaptive or maladaptive responses throughout a competitive season in soccer.

3977 Board #294 May 30 9:00 AM - 10:30 AM
Effects Of Recovery Using Cryotherapy On The Athlete'S Immune System After Repetitive Exhausting Aerobic Exercise

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Muscle damage and changes in immune cell numbers are induced by intensive repetitive and long-term physical stress leading to fatigue and decreased performance. It is widely suggested that cryotherapy (CT) is an effective strategy for accelerated

recovery. **PURPOSE:** Assessing the influence of CT compared to passive recovery on blood biomarkers after repetitive and exhausting aerobic running exercise. **METHODS:** Twelve moderately trained males (age: 28 ± 5.1 yrs) participated in this randomized cross-over study. After a graded exercise test the protocol comprised two visits including four exhaustive runs on a treadmill starting every 60 min with inclines being raised every 4 min. During the rest period of 20 min, participants rested passively or CT was applied using pants with an integrated cooling system (Aquila Sports GmbH, Switzerland). Heart rate (HR) was measured continuously and venous blood samples were taken before, immediately, 30 min, 1 h, 3 h, and 24 h after terminating the final run. The following parameters were analyzed: blood glucose (GLU), creatine kinase (CK), lactate dehydrogenase (LDH), total white blood cells (WBC), lymphocytes (LYM), granulocytes (GRA), interleukin 6 (IL-6), blood lactate concentration (La). **RESULTS:** Significant longer running times were found in the final run when using CT compared to passive rest (+ 5.8%, p = 0.036). GLU was significantly higher immediately after the final run and IL-6 was significantly higher 60 min after terminating the final run in CT (GLU + 362.5%, p = 0.006, IL-6 42.2%, p = 0.046). WBC and GRA were significantly higher in CT 180 min after the final run (WBC + 1.4%, p = 0.028, GRA + 13.7%, p = 0.010). No significant differences were found between recovery methods in HR, maximum La, CK, LDH and LYM (all at p > 0.050). **CONCLUSIONS:** Application of CT significantly elevated the resistance to fatigue of the participants. There is no evidence that this is due to reduced muscle damage as there has not been an effect in CK. According to the elevation of immune cells a higher activation of the immune system is suggested which in turn is counteracting to the frequently observed immune suppression after exhaustive exercise. Increased IL-6 levels can likely be explained by the increase of GRA. This study identified that there is a trend towards a positive effect of CT on the immune system.

3978 Board #295 May 30 9:00 AM - 10:30 AM
Increased Risk Of Symptomatic Respiratory Viral Infections In Athletes During Nordic World Ski Championships 2019

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PURPOSE: Respiratory symptoms are commonly recognized in athletes during winter sport games. There are no controlled studies on the occurrence and aetiology of the infections. Respiratory symptoms are commonly recognized in athletes during winter sport games. There are no controlled studies on the occurrence and aetiology of the infections.

METHODS: We performed a prospective controlled study of respiratory viral infections in Team Finland during 2019 Nordic World Ski Championships. There were 26 athletes and 36 staff members. Nasal swabs were taken from all team members on days 1, 7 and 13 during the Games which lasted 14 days. Respiratory symptoms were recorded daily. At the onset of a symptom two nasal swabs were taken. One swab was analysed within 60 minutes using a point-of-care test (POCT) for 15 viruses. The other swab was tested for 16 viruses in laboratory. Fifty-two matched control subjects were studied in Finland according to the same protocol.

RESULTS: Respiratory viruses were detected in 35%, 36% and 25% of the athletes, the supportive staff and the controls, respectively. Ten out of 26 (38%) athletes and 6 out of 36 (17%) staff members and 3 out of 52 (6%) control subjects experienced symptoms of respiratory infection (athletes vs staff p=0.048, athletes vs. controls p<0.01). Asymptomatic infections were identified in 4%, 19% and 21%, respectively (athletes vs staff p=0.07, athletes vs. controls p=0.03). The aetiology of the respiratory infections was detected in 84% of the cases. Four virus clusters were identified caused by rhinovirus, coronavirus 229E and NL63 and respiratory syncytial virus B.

CONCLUSIONS: The athletes had a 6-fold increase in risk of illness compared to normally exercising control subjects. The athletes had significantly less asymptomatic infections compared to staff and controls. Viruses circulated actively within the team.

3979 Board #296 May 30 9:00 AM - 10:30 AM
The Effects Of Acute Antigravity Treadmill Exercise On Inflammatory Markers In Elite Athletes

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PURPOSE: The aim of this study was to compare the responses of interleukin-8 (IL-8), tumor necrosis factor- α (TNF- α) and C reactive protein (CRP) to antigravity treadmill exercise and normal treadmill exercise in male football players. **METHODS:** Eleven male football players aged between 18- 22 years, with at least 2 years of football history and regularly trained were included in the study. $\dot{V}O_{2max}$ values of the athletes were calculated with 20 Meter Shuttle Test. The participants were randomly allocated to two groups. Half of the participants were exercised on the antigravity

treadmill and half of them were exercised on the normal treadmill for 45 minutes on % 70 of $\dot{V}O_{2max}$ values. After a week participants were exercised vice versa. IL-8, TNF- α and CRP levels were analyzed before, immediately after, 30 minutes and 2 hours after the exercises. **RESULTS:** CRP levels did not change with time in the antigravity and normal treadmill exercise and it was not different between the both groups ($P > 0.05$). TNF- α levels were lower 30 minutes after the exercise than the immediately after the exercise in the normal treadmill exercise ($P < 0.05$). However, it did not change with time in the antigravity treadmill exercise and was not different between the both groups ($P > 0.05$). IL-8 levels were higher 2 hours after the exercise than the before and immediately after the exercise in the antigravity treadmill exercise ($P < 0.05$). However, it did not change with time in the normal treadmill exercise and was not different between the both groups ($P > 0.05$). **CONCLUSIONS:** Antigravity treadmill exercise differently affects inflammatory processes than the normal treadmill exercise.

3980 Board #297 May 30 9:00 AM - 10:30 AM
Differential Responses Of Resting Vs. Post-exertion Hormone Concentrations During Simulated Military Operational Stress

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(No relevant relationships reported)

Military operational stress has been shown to impair performance and cause changes in corresponding blood biomarkers. Anabolic and stress hormones are common biomarkers used as surrogate endpoints to monitor physiological status during military training. **PURPOSE:** To determine patterns of resting and exercise-induced anabolic and stress hormones across 5 days of simulated military operational stress (SMOS). **METHODS:** 51 service members (25.8 \pm 5.1 yrs, 174.5 \pm 9.4 cm, 80.1 \pm 15.9 kg, 21.4 \pm 7.0 BF%; 11 women) completed a 5-day/night SMOS protocol. During days 3 (D3) and 4 (D4), subjects were given 50% of caloric demands. On nights 1, 2, and 5 subjects slept from 2300-0700. During nights 3 and 4, subjects slept from 0100-0300 and 0500-0700. Participants underwent a Tactical Mobility Test (TMT) familiarization on D1 followed by testing on D2-5: 2-min water can carry (40 kg), fire and movement course, 20-meter casualty drag (91 kg), 300-meter unloaded and loaded (16 kg) shuttle runs, and 2-mile paced then 2-mile best effort timed ruck march (15 kg). Blood was drawn before (PRE) and immediately after (POST) the TMT. A two-way repeated measures ANOVA was run to determine the effect of exercise over time on growth hormone (GH), insulin-like growth factor-I (IGF-I), adrenocorticotrophic hormone (ACTH), and cortisol concentrations. **RESULTS:** There were no significant interactions between exercise and time on hormone concentrations. However, there was a significant main effect of time on IGF-I (D2: 40.2 \pm 2.0 to D4: 37.3 \pm 2.0 to D5: 35.2 \pm 1.9 ng/mL, $p < 0.001$) and cortisol (D2: 22.3 \pm 1.0 and D5: 19.6 \pm 1.2 μ g/dL, $p = 0.02$). Exercise caused a significant increase in IGF-I (PRE: 37.1 \pm 2.0 vs. POST: 38.2 \pm 1.9 ng/mL, $p = 0.02$), GH (PRE: 1.2 \pm 0.3 vs. POST: 3.9 \pm 0.6 ng/mL, $p = 0.001$), ACTH (PRE: 49.8 \pm 11.1 vs. 61.8 \pm 11.5 pg/mL, $p = 0.001$), and cortisol (PRE: 15.8 \pm 0.8 vs. POST: 25.8 \pm 1.5 μ g/dL, $p < 0.001$). **CONCLUSION:** Despite significant declines in circulating hormone concentrations over time during SMOS, hormonal response amplitude was maintained. Hormonal response to exertion may provide important insights to physiological status that would otherwise be missed if measuring circulating concentrations alone.

3981 Board #298 May 30 9:00 AM - 10:30 AM
Rapid Gut Microbiome Changes In A World-Class Ultramarathon Runner: A Case Study

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The human gut microbiome is a dynamic ecosystem with prolific health connotations. Physical activity is emerging as a potent regulator of human microbiome composition. **PURPOSE:** This study examined changes in the gut microbiome of a world-class ultramarathon runner before and after competing in the Western States Endurance Run (WSER), a 163 km mountain footrace. **METHODS:** Anthropometrics and body composition were assessed and the ultramarathoner's submaximal and maximal performance profiles were evaluated. Gut microbiome analyses were performed at four time-points: 21 wk and 2 wk before and 2 h and 10 d after WSER. **RESULTS:** Aerobic power ($\dot{V}O_{2max}$) was 4.24 L/min (66.7 ml/kg/min), and running economy (51.1 ml/kg/min at 268 m/min) and lactate threshold (~83% $\dot{V}O_{2max}$) values were comparable to that of highly trained distance runners. Two hours post-race, considerable changes in the ultrarunners gut microbiome were observed. Alpha diversity (Shannon Diversity Index) increased from 2.73 to 2.80 and phylum-level bacterial composition

(Firmicutes/Bacteroidetes ratio) rose from 4.4 to 14.2. Underlying these macro-level microbial alterations were demonstrable increases in select bacterial genera such as *Veillonella* (+14,229%) and *Streptococcus* (+438%) concomitant with reductions in *Alloprevotella* (-79%) and *Subdoligranulum* (-50%). **CONCLUSIONS:** To our knowledge, this case study shows the most rapid and pronounced shifts in human gut microbiome composition after acute exercise in the human literature. These findings provide yet another example of how exercise can be a powerful modulator of human health.

3982 Board #299 May 30 9:00 AM - 10:30 AM
The Effect Of Probiotic Supplementation In Phagocytic Function Of Neutrophils In Amateur Marathon Runners

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The use of probiotics is recommended for maintaining the immunological health of endurance athletes, however the effects of probiotics on athletes immune cells function is still unclear **PURPOSE:** Investigate the effect of probiotics utilization in phagocytic function of neutrophils from marathon runners

METHODS: Twenty seven male marathoners were double-blind randomly assigned to either a probiotic group (PR) (PR=14; 35.96 \pm 5.81 years, 79.30 \pm 10.99 Kg; time of trial, 4:04 hours \pm 22.55 minutes) or placebo (PL) (PL=13 40.46 \pm 7.79 years, 72.67 \pm 10.20 Kg, time of trial, 4:53 hours \pm 1h:15 minutes). PR consumed during 30 days a sachet containing Lactobacillus Acidophilus and Bifidobacterium Lactis (10x10⁹UFC + maltodextrin 5g/day) while PL received a sachet with maltodextrin (5g/day). Phagocytic function of neutrophils were assessed by specific phagocytosis kit (Vybrant /Thermo Fisher®) after blood cell neutrophil isolation. The measures were evaluated before the supplementation period (B), one day before the race (1D), and one hour after race (1H). Data were analyzed in SPSS version 25® using ANOVA two way with repeated measures, "group" and "time" as factors, and Tukey's post-hoc test ($p < 0.05$). **RESULTS:** The statistical analyses showed significant differences among the times. The PL group showed significant decrease of phagocytic function when compared basal with other times (B: 32.46 \pm 14.47; 1D: 10.14 \pm 3.08; 1H: 8.15 \pm 4.65) and the same behavior was seen in the probiotic group with a significant decrease of phagocytic function when compared the basal with others times (B: 25.96 \pm 10.21; 1D: 8.59 \pm 4.33; 1H: 8.07 \pm 2.29). Between groups no differences was observed. **CONCLUSIONS:** Thirty days of probiotic (Lactobacillus Acidophilus and Bifidobacterium Lactis (10x10⁹UFC/day) supplementation was not able to cause alterations in neutrophil phagocytic function. These results may change regarding other immune cells population and with prolonged use or higher dosages of probiotic. Financial Support: CNPq, CAPES/PROEX

G-45 Free Communication/Poster - Clinical
Exercise Physiology - Other

Saturday, May 30, 2020, 8:00 AM - 10:30 AM
 Room: CC-Exhibit Hall

3983 Board #300 May 30 8:00 AM - 9:30 AM
Evaluating The Validity Of Heart Rate Measured By The Rhythm During Mountain Biking

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The Rhythm armband is a wearable device that measures heart rate, and it is unknown whether it is valid throughout rough terrain, such as mountain biking. **PURPOSE:** The purpose of this study was to investigate the validity of heart rate (HR) measurement by the Rhythm armband against the criterion, the Polar H7 chest strap while mountain biking.

METHODS: A total of sixteen healthy adults (males = 8, females = 8, 24.69 \pm 4.44 yrs, 171.45 \pm 8.9 cm, 74.23 \pm 21.07 kg) were recruited to ride mountain bikes on a 3.22km, beginner-level mountain biking trail at the McCullough Hills Trailhead in Henderson, NV. Participants were fitted with both a Polar H7 HR monitor and the Rhythm HR monitor and rode 1.61km away from the trailhead and 1.61km back to the start of the trailhead.

RESULTS: The lower and upper limit of agreement (LoA) range was -412.25 and 451.59, respectively, and the mean absolute percent error (MAPE) was 59.82%. The Rhythm armband also demonstrated an ICC = 0.008 (95% CI = -0.006, 0.022, p-value < 0.140).

CONCLUSIONS: The Rhythm armband demonstrated low correlation and a low level of agreement against the Polar H7 chest strap, suggesting that The Rhythm is not a valid measurement of HR during mountain biking.

3984 Board #301 May 30 8:00 AM - 9:30 AM
Large Vs Small Skeletal Muscle Mass Training: A Study On Solid Organ Transplanted Recipients

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Heart, kidney and liver transplanted patients (HTR, KTR and LTR) suffer from a reduced exercise capacity. Several studies pointed out the impairments of both central and peripheral factors as responsible for the decreased peak oxygen consumption ($\dot{V}O_{2peak}$) and diminished peak work rate (WR_{peak}); however, if the main limitation comes from central or peripheral origin is still unclear (Williams and McKenna, 2012). In healthy humans, $\dot{V}O_{2peak}$ is mainly constrained by central factors with peripheral factors playing a minor role, indeed endurance training (ET) involving small muscle mass fails to increase whole-body $\dot{V}O_{2peak}$ (Rud et al, 2012). Given the skeletal muscle abnormalities reported in HTR, KTR and LTR the limitation conferred by peripheral factors might be important as the central one. **PURPOSE:** The study investigated if ET of small muscle mass, e.g. single leg cycling (SL), induces higher increase in $\dot{V}O_{2peak}$ and WR_{peak} than ET with large muscle masses, e.g. double leg cycling (DL), in HTR, KTR and LTR.

METHODS: 33 sedentary patients were enrolled and divided into SL group (SLG) (n= 17; HTR=6, KTR=6 and LTR=5) and DL (DLG) (n= 16; HTR=7, KTR=5 and LTR=4). Subjects completed DL incremental tests to determine $\dot{V}O_{2peak}$ and WR_{peak} ; peak cardiac output (Q_{peak}) was assessed by cardio-impedance and peak systemic arterio-venous O_2 difference ($C_{a-v}O_{2peak}$) was calculated as: $\dot{V}O_{2peak}/Q_{peak}$. All subjects were asked to attend 24 ET sessions: the DLG performed traditional cycling and the SLG the first half of the session with the one leg and the second half with the other limb.

RESULTS: SLG and DLG increased $\dot{V}O_{2peak}$ by $19.7 \pm 2.7\%$ (mean \pm SE) and $23.2 \pm 3.1\%$ (Time effect: $P < 0.001$), respectively; WR_{peak} became $15.3 \pm 2.2\%$ and $18.2 \pm 3.2\%$ larger in SLG and DLG (Time effect: $P < 0.001$), respectively. Q_{peak} changed by $-1.5 \pm 5.5\%$ in SLG (n=11) and by $6.7 \pm 5.3\%$ in DLG (n=10), however no effect of ET was found Q_{peak} . $C_{a-v}O_{2peak}$ improved by $17.6 \pm 6.5\%$ and $12.7 \pm 6.2\%$ in SLG (n=11) and DLG (n=10) (Time effect: $P: 0.003$), respectively.

CONCLUSIONS: Given the absence of improvement in Q_{peak} after ET, the accretion of $\dot{V}O_{2peak}$ and WR_{peak} seems to be induced by a greater $C_{a-v}O_{2peak}$, suggesting a key role of peripheral factors in impairing exercise capacity in HTR, KTR and LTR.

3985 Board #302 May 30 8:00 AM - 9:30 AM
Functional Capacity, Physical Activity And Body Composition In Type 2 Diabetes Chronic Kidney Disease Patients

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Type 2 Diabetes Mellitus is one of the major public health problems in Puerto Rico. It is the principal cause for Chronic Kidney Disease. There is evidence that suggests that engaging in physical activity (PA) improves glomerular filtration rate (GFR), body composition, cardiorespiratory fitness, psychological state, and quality of life. Thus, it is important to assess functional capacity (FC), PA, and body composition (BC) in patients diagnosed with Type 2 DM and CKD.

PURPOSE: To describe: 1) the level of PA, FC and BC in patients diagnosed with type 2 DM and CKD; and to assess 2) the relationship between Type 2 DM, CKD, the level of PA, FC and BC. **METHODS:** 15 participants diagnosed with Type 2 DM and CKD were evaluated (IRB: # 1516-0884). 1) PA was assessed using the International Physical Activity Questionnaire—Long Version (IPAQ-L); 2) FC was assessed using 2-minutes step test; 3) BC was assessed using anthropometry. **RESULTS:** The

participants average height 64.2 ± 0.53 inches, weight 190.9 ± 8.78 pounds, Body Mass Index 32.4 ± 1.27 , GFR 41.4 ± 2.23 mL/min/1.73 m², CKD Stage 3.13 ± 0.91 , ratio waist/height 0.9200 ± 0.77 , body fat percentage $34.300 \pm 3.37\%$, 2-minutes step test 13.87 ± 2.36 steps. The average scores of the IPAQ-L were: 1536 ± 345.05 METs/week, Sitting time 2760 ± 402.7 minutes. A Spearman Correlation analysis did show significant inverse relationship between BC (body fat percentage) and FC ($p < .05$). Also showed significant inverse relationship between GFR and CKD Stage ($p < .05$).

CONCLUSIONS: This study gave descriptive data of the Puerto Rican population with Type 2 DM and CKD, referring to their level of physical activity, functional capacity and body composition. The results from the IPAQ-L showed that the participants engaged in moderate physical activity and remain sitting for long periods of time, obese and with lower functional capacity.

3986 Board #303 May 30 8:00 AM - 9:30 AM
ELITE ATHLETE WITH RHABDOMYOLYSIS AFTER A WORLD EXTREME CONDITIONING COMPETITION.

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 (No relevant relationships reported)

PURPOSE: Understand the conditions surrounding rhabdomyolysis in extreme conditioning programs such as CrossFit to prevent new cases.

METHODS: Blood tests, abdominal ultrasound and urine summary of a 36-year-old Crossfit athlete (5'9" and 154 pounds) were analyzed after suffering an injury during the world competition of Crossfit (Reebok CrossFit Games, 2018).

RESULTS: On the same day of the injury it was already possible to notice great abdominal distension and the creatine kinase (CK) values were 42,040 U/L, and after 72h it reached 82,443 U/L. After 6 days, abdominal ultrasound was performed, identifying areas of hemorrhage and rupture in the rectus abdominis, bilaterally and throughout. After 8 days, blood tests showed elevated values of enzymes other than CK, such as oxalacetic glutamic transaminase (TGO) and pyruvic glutamic transaminase (TGP): 456 U/L (reference value 5 to 40 U/L) and 513 U/L (reference value 10 to 49 U/L) respectively. In addition, elevations in lactate dehydrogenase (555 U/L; reference value: 120 to 246 U/L), and again CK (18,962 U/L) levels were also seen. The urine summary showed an increase in red blood cell levels and the presence of hemoglobin. After 15 days the examinations were repeated and TGO levels decreased by 92.6% (29 U/L; reference value 5 to 40 U/L) and 72.7% TGP (140 U/L; reference values 10 to 49 U/L). Lactate dehydrogenase decreased to 157 U/L and CK to 284 U/L (99.6% reduction). **CONCLUSIONS:** Thus, it is possible to conclude that an athlete's susceptibility to rhabdomyolysis is real, especially when in conditions that are determinant for it, such as sports competitions, heat, dehydration and other factors. Early diagnosis that requires clinical suspicion associated with laboratory confirmation is important in order to avoid further damage to the athlete, as well as to prevent future cases.

3987 Board #304 May 30 8:00 AM - 9:30 AM
Effects Of Transcutaneous Vacuum Treatment On Joint Mobilization On Leg

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 (No relevant relationships reported)

BACK GROUND: Last year, we reported that transcutaneous vacuum treatment improved gliding function, flexibility of muscle and fascia in vastus lateralis. However, the effect of transcutaneous vacuum treatment on joint mobility has not been investigated to date. **PURPOSE:** The purpose of this study was to investigate the effects of transcutaneous vacuum treatment on posterior thigh with straight leg raising angle, compared with passive static stretching of hamstrings. **METHODS:** Seven volunteers who had not undergone any prior orthopedic treatment for the lower legs participated in this study. The left and right legs were used for the experiment. Transcutaneous vacuum treatment (CVT) (vacuum and rolling [approximately 0.5Hz]) was applied to posterior thigh (ischial tuberosity to upper area of popliteal region) for 30 seconds 3 times with 15 second intervals between sets (n=7). Passive static stretching of hamstrings (PSS) was applied by pushing the heel using a hand held goniometer to the final angle of movement for 30 seconds 3 times with 15 second intervals between sets at supine position with knee extended (n=7). We measured straight leg raising (SLR) angle with active and passive hip flexion before and immediately after CVT or PSS. **RESULTS:** After PSS, the SLR angle statistically increased at active (89.9 ± 9.2 to 97.1 ± 12.4 degree) and passive (92.2 ± 11.5 to 99.0

± 13.8 degree) hip flexion. After CVT, there was no change in SLR angle at active hip flexion (92.0 ± 9.8 to 92.9 ± 8.3 degree). However, it statistically increased at passive hip flexion (92.0 ± 11.5 to 99.1 ± 13.8 degree). There were no differences of SLR angle for passive hip flexion between PSS and CVT after treatment. **CONCLUSIONS:** In this study, there was significant increase of SLR angle in passive hip flexion after CVT, and these changes were almost equivalent to the angle after PSS. However, despite the increase after PSS, the angle in active hip flexion after CVT did not change. These results suggest that the mechanism of change in active range of motion after transcuteaneous vacuum treatment may be different from that of static stretching.

3988 Board #305 May 30 8:00 AM - 9:30 AM
Aerobic Exercise Training, Fatigue And Fatigability In Women With Systemic Lupus

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 (No relevant relationships reported)

Introduction: Persistent and excessive fatigue is the most common and debilitating symptom of systemic lupus erythematosus (SLE), potentially impacting quality of life and ability to sustain employment. While aerobic exercise training may improve cardiorespiratory limitations in women with SLE, its influence on fatigue and fatigability is not well understood in this population. **Purpose:** To evaluate changes in measures of performance fatigability and perceived fatigue in women with SLE after 12 weeks of aerobic exercise training. **Methods:** Subjects were 13 women (age 44±9 years, BMI 29.8±5.7 kg/m²) enrolled in the NIH Aerobic Exercise in Women with Systemic Lupus Erythematosus Trial (NCT03186794). All subjects had mild or no SLE activity, as measured by Safety of Estrogens in Lupus National Assessment-Systemic Lupus Erythematosus index (SELENA-SLEDAI, score <4), and self-reported the presence of fatigue on the Fatigue Severity Scale (FSS, score ≥3). Each subject participated in vigorous (70-80% heart rate reserve) supervised treadmill walking, 30 minutes per session, 3 times/week. Subjects also completed treadmill cardiopulmonary exercise tests (CPET) to volitional exhaustion, 10-minute walk tests (10MWT), and the Patient-Reported Outcomes Measurement Information System (PROMIS) and Fatigue Severity Scale (FSS) questionnaires, before and after the 12 weeks of training.

	CPET Time to Fatigue (s)	10MWT Distance	FSS	PROMIS (Fatigue domain)
Before Training	814 (226)	921 (136)	4.5 (1.2)	51.2 (5.1)
After Training	913 (163)	1012 (135)	3.0 (1.4)	45.8 (7.5)
p-value	0.0011	0.0003	<0.0001	0.0005

Results: Subjects attended an average of 34 (±2) supervised training sessions. Improvements in measures of performance fatigability (10MWT distance and time to volitional exhaustion on CPET) were observed. Additionally, perceived fatigue scores diminished, as indicated by improved scores on the FSS and PROMIS Fatigue Domain. **Conclusion:** These findings suggest that aerobic exercise training improved both performance fatigability and perceived fatigue in these women with SLE.

3989 Board #306 May 30 8:00 AM - 9:30 AM
Reliability Of Muscle Power And Functional Performance In Healthy, Older Women

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 (No relevant relationships reported)

Functional performance measures in older adults are commonly used in studies investigating age-related declines in mobility. Surprisingly, there is a lack of literature on the clinimetric properties associated with these tests, especially in healthy, older adults. In addition, reliability of tests is commonly measured over 1-2 weeks, and does not address the question of longer-term reliability that might be more relevant for a typical training study. **PURPOSE:** The purpose of this study was to assess the longer-term reliability (over 9 weeks and 15 weeks) of an isotonic muscle power test (using an isokinetic dynamometer) and commonly-used functional measures (Short Physical Performance Battery, maximal gait, 30s chair stand test, stair climbing, and the 400-meter walk) in healthy, older women. **METHODS:** Participants were older women (n = 18) who were healthy and untrained (Age = 73.3 ± 3.4 years, Height = 159.6 ± 7.7 cm, Weight = 69.5 ± 12.7 kg, BMI = 27.3 ± 4.8). Test-retest measures (muscle power and function) took place at baseline, week 9, and week 15. Intraclass

correlation coefficients (ICC) and the coefficient of variation of the typical error (CV) are reported for all time point comparisons. **RESULTS:** ICCs ranged from 0.83-0.97 for muscle power, and 0.64-0.93 for functional performance, indicating moderate to excellent reliability. CVs for upper-leg muscle power ranged from 5.7 - 10.5%, and lower-leg muscle power ranged from 9.9 - 20.0%, while CVs for functional tests ranged from 1.9 - 14.9%. For function, the stair-climb power test demonstrated the greatest reliability from baseline to week 15, with the CV = 8.94% and ICC = 0.94 (CI = 0.82-0.98). There were no changes in mean values for tests over time, with the exception of the chair stands which improved significantly from baseline to week 15 (p < 0.05). Although the chair stands were significantly different, these changes were smaller than what has previously been identified as clinically meaningful (eg. < 3.3 chair stands for the 30s chair stand test). **CONCLUSIONS:** Muscle power and functional tests demonstrated consistency over durations typically used in exercise studies. Conducting these tests under standardized conditions should enable researchers to confidently describe the impact of exercise interventions on muscle power and function in this population.

3990 Board #307 May 30 8:00 AM - 9:30 AM
Validity Of Body Composition Measures By Inbody 770 Bioelectrical Impedance Analyzer

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 (No relevant relationships reported)

PURPOSE: To test the validity of InBody 770 bioimpedance analyzer (IB770) against isotope dilution (D2O) for total body water (TBW) and against DXA for percent body fat (PBF). **METHODS:** Fifty-eight apparently healthy women (mean age 21.2 ± 2.6 years, BMI 26.7 ± 6.3) visited the Exercise Science Physiology Laboratory at KSU after an overnight fast. Subjects were given a 10g deuterium oxide solution (Cambridge Laboratories) to drink within 5 minutes and were asked to remain still in a reclining chair for 4 hours before providing a urine sample. Subjects were assessed via DXA for PBF and IB770 for both TBW and PBF. Frozen urine samples were shipped to an external laboratory for TBW assessment by mass spectroscopy. One extreme outlier was excluded from analysis due to probable D2O measurement error. Correlation analyses were used to assess the validity of TBW and PBF measures from IB770 compared to those from D2O and DXA.

RESULTS: TBW estimates from IB770 were similar to those from D2O (32.6 ± 5.9 vs. 32.3 ± 6.0, respectively). PBF estimates from IB770 were also consistent with those from DXA (35.1 ± 9.1 vs. 35.8 ± 8.5, respectively). T-tests indicated that there were no significant differences among these measures (p > 0.05 for both). IB770 measures for TBW and PBF were strongly correlated with D2O (r = .976, p < 0.001) and DXA (r = .961, p < 0.001), respectively. **CONCLUSIONS:** These data suggest that IB770 is a valid method for estimating TBW and PBF and may be appropriate for use as an alternative to D2O and DXA in a young female population.

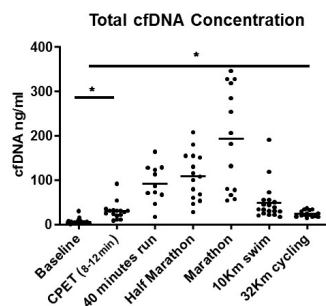
3991 Board #308 May 30 8:00 AM - 9:30 AM
The Effect Of Various Types Of Exercise On Cell-free Circulating DNA

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Elevated levels of cell-free circulating DNA fragments (cfDNA) released from dying cells into the blood stream have been established as a reliable biomarker in multiple pathologies such as trauma, heart attack, cancer and inflammation. Acute exercise also causes an immediate increase in the concentration of cfDNA in the blood. The cellular origins and the physiological significance of this phenomenon are not understood, but it has been speculated that cfDNA in exercise may reflect the intensity of the effort and potentially indicate overtraining. **Purpose:** The aim of the study was to compare the level of cfDNA after different types of exercise, and to identify their source.

Methods: We have used a methylation-based approach to assess the tissue sources of blood cfDNA of 75 subjects, men and women, ages 17-46 years, before and after the following exercise activities: Graded maximal exercise test (8-12 min; n=16), 40 minutes moderate-intensity run (n=12) half marathon (21.1km; n=15), marathon (42.2 km; n=14), cycling time trial (32 km; n=15) and open water swimming (10 km; n=19). **Results:** Our analysis revealed a significant (P < 0.0005) elevation of cfDNA after strenuous exercise which varied between sport modalities (Figure). CfDNA levels returned to near-baseline within 60 minutes post exercise, and derived exclusively from neutrophils and not from myocytes or other tissues. **Conclusions:** The origin of

the blood cfDNA in response to physical activity stems exclusively from neutrophils, with a large difference in its amount following various types of exercise. We are currently attempting to understand the physiological mechanisms of this exercise induced elevated cfDNA, including heart rate, blood pressure, type of muscle activity, blood oxygen levels, body temperature etc. Our findings open an exciting window into inflammatory and other physiologic processes taking place during exercise, and shed light on new aspects of cfDNA biology.



Plasma cfDNA concentration is dramatically increased after various types of exercise. *, p value < 0.0001

3992 Board #309 May 30 8:00 AM - 9:30 AM
Effects Of High-intensity Interval Training On The Expression Of Circulating Micro-RNAs In Women With Polycystic Ovary Syndrome

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 (No relevant relationships reported)

Purpose: 1) To compare the expression of circulating miRNAs (c-miRNAs) in women with and without Polycystic Ovary Syndrome (PCOS), and 2) to determine the effects of two different high intensity training (HIT) protocols in women with PCOS on c-miRNA expression. **Methods:** Women with PCOS were randomised to one of three conditions: 1) 10×1 min "all-out" work bouts (HIT1, n=13); 2) 4×4 min work bouts at 90-95% of HR_{max} (HIT4, n=14); 3) Control (Non-Ex, n=15). Both HIT groups exercise trained 3 x per week for 16 weeks. c-miRNAs were quantified before and after 16 weeks. c-miRNAs were extracted from plasma and quantified via a customised plate array with real-time PCR in women with (n=42; 29 ± 5 years; BMI, 31.2 ± 7.0 kg/m²; VO_{2peak} 32.7 ± 7.3 mL/kg/min) and without PCOS (Non-PCOS, n=12; 30 ± 6 years; BMI, 29.3 ± 5.5 kg/m²; VO_{2peak} 34.9 ± 6.7 mL/kg/min). Women without PCOS were age- and BMI-matched to 12 women with PCOS. The array contained 8 c-miRNAs previously reported to associate with PCOS and/or training response. **Results:** Women with PCOS had a higher basal expression of c-miRNA-27b compared to Non-PCOS ($P=0.006$, 269 \pm 184% difference). Non-Ex had a higher basal expression of c-miRNA-27b compared to both HIT1 ($P=0.003$, 30 \pm 52%) and HIT4 ($P=0.003$, 45 \pm 52%). miRNA-27b is associated with hormone metabolism, inflammation, adipogenesis and is positively correlated with testosterone. No observed basal differences in c-miRNA-146a and c-miRNA-223. Following the training intervention, HIT4 increased VO_{2peak} with 2.0 ± 3.4 mL/kg/min ($P=0.020$). Non-Ex had a higher expression of c-miRNA-27b compared to HIT1 ($P<0.001$, 96 \pm 126%) and HIT4 ($P=0.005$, 95 \pm 126%). No changes in the expression of c-miRNA-27b occurred within groups after training. The expression of c-miRNA-146a and -223 were lower in HIT4 compared to Non-Ex after the training ($P=0.043$, 156 \pm 105% and $P=0.040$, 184 \pm 106%, respectively). miRNA-223 is linked to hypertension, apoptosis of endothelial cells and type 2 diabetes, whereas miRNA-146a is linked to reducing progesterone, estradiol and testosterone release. **Conclusion:** c-miRNA-27b might have a role as biomarker for women with PCOS and high intensity interval training has the potential to decrease the expression of c-miRNA-146a and -223 in women with PCOS compared to non-exercising women with PCOS.

3993 Board #310 May 30 8:00 AM - 9:30 AM
Exercise Snacking And Detraining Effects On Postprandial Glucose Responses - A Randomized Crossover Trial In Trained Older Adults

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 (No relevant relationships reported)

Purpose: Experimental data suggest that frequent interruptions in sedentary behavior (SB) promote improvements in postprandial glucose (PPG) responses. However, little is known about the impact of these interruptions before and after a detraining period in active older adults. The main purpose of this investigation was to examine the acute effects of interrupting prolonged SB in a sample of trained older adults, before and after 2-weeks of detraining, on PPG.

Methods: Older active adults performing structured exercise at least 2/week for the past 6 months (n=14; aged between 65 and 90 years-old), were enrolled in a randomized crossover trial. Participants performed two conditions before and after 2-weeks of detraining (i.e. refrain from structured exercise): 1) uninterrupted sitting, where participants remained seated throughout 7 hours (SIT); 2) Sitting + moderate intensity breaks (INT), where participants were instructed to sit for 7 hours, while interrupting this behavior with 2 minutes of moderate-intensity physical activity (PA) every 30 minutes. The primary outcome was changes in PPG, while body composition and cardiorespiratory fitness (CRF) were considered secondary outcomes. Generalized estimating equations (GEE) were used.

Summary of Results: Both at baseline and after detraining, no differences were observed for 7-h total area under the curve (7h-AUC) for glucose (baseline: Δ -3.1%, $p=0.542$; post-detraining: Δ -8.8%, $p=0.182$) and mean glucose (MG) values (baseline: Δ -3.3%, $p=0.541$; post-detraining: Δ -9.0%, $p=0.188$) between INT and SIT experimental conditions. An unfavorable effect was observed for the SIT condition from baseline to after the detraining period, with higher values for 7h-AUC (Δ 10.6%, $p=0.014$) and MG (Δ 11.7%, $p=0.015$). No changes were observed in the response to INT condition between baseline and after detraining in PPG values (7h-AUC: Δ 4.4%, $p=0.535$; MG: Δ 5.2%, $p=0.523$).

Conclusion: Frequent interruptions in SB had no effect on PPG, prior to or after a 2-week detraining period, when compared to prolonged SB in active older adults. On the contrary, older adults experiencing a short-term detraining period can use strategies, such as breaking up SB, in order to potentially improve glycemic control during these intermissions.

3994 Board #311 May 30 8:00 AM - 9:30 AM
Step Count Error Of Activity Monitors For Patients In Phase II Cardiac Rehabilitation

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 (No relevant relationships reported)

The use of wearable activity monitors in patient populations is gaining popularity with researchers and clinicians. Because much of the research describing their accuracy has been completed with healthy participants, investigating the error in daily steps in patient populations, the most intuitive physical activity metric, is necessary. **Purpose:** To investigate the step count error of four wearable activity monitors compared to StepWatch (SW) steps across the day for days when patients attended phase II cardiac rehabilitation (CR) and days when they did not attend. **Methods:** Nineteen phase II CR patients (mean \pm SD; age, 68 ± 7 yr; BMI, 31.7 ± 14.7 kg/m²) wore an SW (criterion step method) on the ankle for four days. For comparison, one wrist-worn monitor (Fitbit Charge 2 [Charge] or Apple Watch series 2 [Apple]) and one waist-worn monitor (Fitbit Zip or ActiGraph GT9X [AG]) were randomly assigned, per participant, for wear during the first two days and the other wrist and waist monitors were worn during the second two days. Each monitor was worn for one day where participants attended CR (ACR) and for one day they did not attend (NCR). AG steps were processed with and without the low-frequency extension (AG_{LFE} and AG, respectively) and with the moving average vector magnitude algorithm. Daily steps for each monitor were summed across self-reported wear time and converted to percent of SW steps. One sample t-tests were used to determine if the percent of SW steps from each monitor, for each condition, was significantly different from 100% of SW steps and paired samples t-tests were used to compare the ACR and NCR conditions, per monitor. **Results:** Summary statistics showing the degree of error for each monitor are available in Table 1.

Conclusion: For those in phase II CR, steps are underestimated during ACR and NCR days, except when the LFE is applied.

Table 1. Summary statistics and comparisons of steps per day for each monitor and condition when participants attended cardiac rehabilitation (ACR) and a day when they did not attend (NCR).

Monitor	Condition	N	Steps per day Mean (SD)	% of SW steps Mean (SD)	MAPE (%)	95% CI	
						LL	UL
SW	ACR	37	5204 (2496)	-	-	-	-
	NCR	35	8418 (4225)	-	-	-	-
AG ^a	ACR*	17	3514 (1155)	62.7 (14.0)	38.2	-46.6	-31.1
	NCR*	16	4348 (2658)	50.2 (13.2)	49.8	-56.8	-42.7
AGLFE	ACR*	17	7473 (2596)	145.0 (28.8)	34.0	25.1	57.7
	NCR*	16	10614 (4286)	134.9 (29.8)	34.9	19.0	50.7
AGMAVM	ACR*	16	2666 (1116)	44.9 (15.6)	55.2	-63.9	-47.6
	NCR*	15	3128 (2214)	36.4 (14.6)	63.4	-71.7	-55.5
Apple	ACR*	18	4293 (1212)	85.2 (26.8)	31.7	-37.4	-5.8
	NCR*	16	5594 (2602)	71.6 (17.3)	27.9	-37.8	-7.6
Charge	ACR*	18	4562 (2655)	80.4 (26.5)	33.1	-31.4	-3.4
	NCR*	17	6180 (3501)	73.3 (19.9)	27.7	-35.5	-11.6
Zip	ACR*	18	3202 (1955)	65.3 (7.8)	34.4	-39.9	-30.3
	NCR*	16	5329 (3387)	58.8 (15.3)	42.2	-50.0	-21.0

*Significantly different from 100% of SW steps (p<0.05). ^aSignificantly different between ACR and NCR condition (p<0.05).

3995 Board #312 May 30 8:00 AM - 9:30 AM
Gait Improvements With BWSTT For Incomplete SCI One Year Post-injury
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(No relevant relationships reported)

PURPOSE: The purpose of this case study is to highlight the use of Body Weight Support Treadmill Training (BWSTT) to improve gait deficits in an incomplete spinal cord injury (SCI) patient one year post-injury.

METHODS: RC is a 60 y/o female who sustained a cervical SCI. Initial diagnosis was C4, ASIA C incomplete injury, which was later changed to ASIA D due to improvements. One year and four months after the initial injury, RC received BWSTT to improve gait. BWSTT was implemented 2x/week for 8 weeks. Initial treatments involved 8 minutes at 0.8 mph based on the patients endurance with offloading to normalized gait pattern with tactile facilitation of the lower extremities. The gait speed was gradually increased and offloading gradually decreased as RC improved throughout the sessions.

RESULTS: At baseline, RC demonstrated decreased arm swing, decrease left step length with left foot not advancing past the right foot, and a gait speed of 0.17 m/s. Within a 50 foot walking distance, RC lost her balance three times, two of which she was able to independently recover and one of which required minimal assistance to regain her balance. After 8 weeks, RC's gait speed improved to 0.6 m/s. Within a 50 foot walking distance, RC demonstrated improved arm swing, and increased left step length with the left foot advanced beyond the right foot. Her gait speed improved from a household ambulator to a limited community ambulator. At an 18 week follow up, the patient's gait speed was 0.42 m/s. Although the patient did regress in her gait speed, she still maintained a speed more than twice as fast as her baseline speed and remained a limited community ambulator.

CONCLUSIONS: BWSTT has the potential to improve the speed and quality of gait in an incomplete spinal cord injury even after a year post-injury. RC's ability to receive continued physical therapy services was limited by insurance and cost, but she was able to receive ongoing BWSTT through the university pro bono services. Future studies can include BWSTT beyond 8 weeks to investigate whether or not further improvements can be gained. Even with a discontinuation of BWSTT, the patient was able to maintain a higher walking speed compared to baseline at 4 months after treatments.

3996 Board #313 May 30 8:00 AM - 9:30 AM
Metabolic And Motor Proficiency Profiles Of Youth With Down Syndrome
 Vincenzo G. Nocera, Aaron P. Wood, Tyler J. Kybartas, Angela J. Wozencroft, Dawn P. Coe, FACSM. *University of Tennessee Knoxville, Knoxville, TN.*
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(No relevant relationships reported)

Two factors that have a significant impact on obesity levels are low resting metabolic rate (RMR) and insufficient physical activity (PA) levels. Impaired RMR and neuromuscular coordination are common in youth with Down syndrome (DS) and may contribute to high rates of obesity. **PURPOSE:** To determine the metabolic and motor proficiency profiles of a sample of youth with DS. **METHODS:** Participants were youth with DS (n=11; 7 females; 16.8±3.9 y) attending a weeklong therapeutic recreation camp. Height and weight were measured, body mass index (BMI) was calculated, and BMI percentiles were used to determine weight status. The participants' RMR was evaluated in a supine position in a quiet, dark room for 15 minutes, using a portable metabolic system (Oxycon Mobile, Vyaire). One-minute averages were collected, and the first five minutes were excluded from the analysis. A rolling average technique was used to determine the average for each 5-min interval. The lowest rolling average was considered the RMR. The Bruininks-Oseretsky Test of

Motor Proficiency Ed. 2 (BOT-2) Short Form was used to test motor proficiency. The BOT standard scores (range from 20 - 80) and age- and sex-specific percentiles were calculated for each participant using conversion tables in the BOT-2 administration manual. Spearman correlations were run to determine associations among BMI, RMR, and BOT-2 scores.

RESULTS: The average BMI of the participants was 29.7±7.6 kg·m⁻² (91% obese). Average RMR was 4.1±1.8 ml/kg/min. The average standard BOT-2 score was 26.8±3.8, average percentile was 1.4±0.7. All youth were classified as *Well-Below Average*. There were no significant correlations among the variables (p>0.05).

CONCLUSIONS: RMR does not appear to be impaired in this sample. However, in this sample, the extremely low motor proficiency scores may contribute to limited PA participation and obesity levels. PA programs and interventions should consider addressing strategies to improve motor proficiency in youth with DS.

3997 Board #314 May 30 8:00 AM - 9:30 AM
The Effects Of Exercise Timing On Sleep
 Travis Emerson, Jay Porter, Ryan Petit-Mee, Guido Lastra, Anand Chockalingam, Jill Kanaley, FACSM. *University of Missouri, Columbia, MO.*
(No relevant relationships reported)

Epidemiological research has linked sleep quality with exercise, but few prospective studies have examined if exercise improves sleep quality and if the timing of the exercise impacts sleep.

PURPOSE: To determine if exercise timing differentially affects sleep quality in men and women.

METHODS: Thirty subjects wore an Actiwatch (Actiwatch 2, Phillips Respironics), which measured sleep duration, sleep efficiency and wake after sleep onset (WASO) for three consecutive nights at home, followed by a testing day of either no exercise (NOEx), morning exercise (AMEx), or nighttime exercise (PMEx). Morning exercise occurred at 0700 h and the nighttime exercise occurred at 2000 h on the respective study night. For each exercise bout, the subject exercised on a treadmill at 55% of their VO₂max for 45 minutes. The order in which they completed each condition was randomized, and study nights were separated by about one month. For the study nights, subjects arrived at the hospital at 1700 h and were given a standard meal at 1800 h. Lights were turned off by 2230 h and turned back on at 0700 h.

RESULTS: Sleep duration significantly increased on the study nights (7.9±0.16 h) compared to the nights of sleep at home (7.4±0.13 h, p=0.02), but was not affected by exercise. There were no differences in the sleep efficiency between study nights (84.8±1.6%) and non-study nights (83.4±1.1%, p=0.33) or between exercise conditions; NOEx (82.0±2.2%), AMEx (85.7±1.1%), and PMEx (84.5±1.5%, p=0.14). WASO was not different by study nights (0.8±0.13 h) and non-study nights (0.7±0.09 h, p=0.15), or between exercise conditions; NOEx (0.87±0.21 h), AMEx (0.55±0.5 h), and PMEx (0.78±0.22 h, p=0.14).

CONCLUSIONS: Sleep quality was maintained from the home setting to the research setting. Exercise did not improve sleep duration, efficiency or WASO in our subjects between the exercise and no exercise day and exercise timing had no effect on these variables.

G-46 Free Communication/Poster - Pilot and Feasibility Research in Exercise Oncology
 Saturday, May 30, 2020, 8:00 AM - 10:30 AM
 Room: CC-Exhibit Hall

3998 Board #315 May 30 9:00 AM - 10:30 AM
Impact Of A Home-based Exercise Program In Men With Prostate Cancer
 Darpan I. Patel, Amber Gallegos, Bilal Sheikh, Sarah Vardeman, Michael Liss. *University of Texas Health Science Center at San Antonio, San Antonio, TX.*
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(No relevant relationships reported)

PURPOSE: Physical activity after cancer diagnosis is associated with better cancer-specific and overall survival in individuals diagnosed with prostate cancer (PCa). The purpose of this study is to test the hypothesis that a home-based exercise program improves quality of life (QoL), physical fitness, and functional capacity in men with PCa under active surveillance.

METHODS: A single-group, self-controlled study design was used to test the hypothesis. A total of 30 men are planned to complete the 6-month home-based exercise study. The 24-week home-based exercise program consisted of weekly light calisthenic exercise (i.e., incline pushups, body weight squats, and hip thrusts) and 150 minutes of light-to-moderate walking (monitored via FitBit). Participants completed the Short Form (SF-36) and Functional Assessment of Chronic Illness Therapy-Fatigue

(FACIT-F) surveys. Anthropometric measurements (i.e., height, weight, and body mass index; BMI) were measured and functional exercise capacity was assessed using the 6-minute walk test (6MWT). **RESULTS:** At this time, five men with PCa (age: 69 ± 3; BMI: 27.4 ± 3.2) under active surveillance have completed the 24-week home-based exercise program with 100% adherence rates for weekly activity. As a result, we have observed substantial improvements in BMI (Pre: 27.4 ± 3.2; Post: 25.4 ± 2.0; -7.6%), 6MWT distance (Pre: 494.0 ± 38.3 meters; Post: 565.4 ± 8.3 meters; 14.5%) and SF-36 subscale of social functioning (Pre: 81 ± 21.3; Post: 72.5 ± 39.1; 17.2%). Modest improvements were reported for the SF-36 subscale of emotional well-being (Pre: 75.2 ± 23.7; Post: 78 ± 34.1; 3.7%) and FACIT-F subscales of functional well-being (Pre: 22.8 ± 1.3; Post: 23.5 ± 6.4; 5.9%). No other changes greater than 5% have been reported. **CONCLUSIONS:** This home-based exercise program was shown to be feasible with promising outcomes in body mass, physical performance and indicators of quality of life. Though it is too early to determine statistically, the results are trending towards supporting the hypothesis that a structured home-based exercise program can lower BMI and improve both QoL and functional exercise capacity.

3999 Board #316 May 30 9:00 AM - 10:30 AM

A Feasibility Study: Self-efficacy Amongst Cancer Survivors In A 12-week Individualized Exercise Intervention

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Cancer survivors have unique physical and psychological challenges that can affect exercise adherence. While many factors play a role in regular exercise for cancer survivors, adherence may be improved by increased exercise self-efficacy (ESE), exercise support (ES), and exercise outcomes (EO). **PURPOSE:** To determine the impact a community-based, individualized exercise intervention on exercise adherence, ESE, ES, and EO following the completion of a tailored exercise intervention. **METHODS:** Six cancer survivors (mean age 60.2±11.5) were enrolled in a 12-week feasibility study. Baseline measures included the following tests: 1-rep max, treadmill, sit-and-reach and the ESE survey. Participants attended three, weekly, one-hour session led by a Cancer Exercise Specialist (CES). Training included cardiovascular, strength, and flexibility exercises tailored to the participant's fitness and physical needs. Measures were repeated immediately post-intervention (week 6) and at week 12. Exercise adherence was determined by the percentage of the 36 sessions completed. Paired t-tests were used to compare baseline and follow-up assessments. **RESULTS:** Exercise adherence was 87.9%. Total ESE was not significantly higher at week 6 (15.4 ± 2.1, vs. 17±1.2, p<0.09) or week 12 (15.4 ± 2.07 vs. 16.6 ± 0.5, p<0.06). ES was not significantly higher at week 6 (18. 8±8.2 vs. 26.3±7.5, p<0.35) but demonstrated a statistically significant increase at week 12 (18.8 ± 8.2 vs. 23.2 ± 12.3, p< 0.03). EO was not significantly higher at week 6 (41.8 ± 3.9 vs. 46 ± 5.4, p<0.09) or week 12 (41.8 ± 3.9 vs. 43.8 ± 3.7, p<0.16). **CONCLUSION:** This study demonstrated feasibility of a community-based, CES-led 12-week exercise intervention. Improved ES and adherence were demonstrated among participants. Study outcomes are being used to guide an exercise intervention focused on adolescent and young adult survivors of cancer, a traditionally understudied group.

4000 Board #317 May 30 9:00 AM - 10:30 AM

Exercise And Compression Therapy To Improve Lymphedema In Breast Cancer: A Pilot Randomized Controlled Trial

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Breast cancer related lymphedema (BCRL) is a chronic swelling that may develop in breast, trunk and arm on the side of the surgery. More than one in five women with breast cancer develop BCRL. Recent studies in BCRL have demonstrated that resistance exercise can improve symptoms and quality of life without worsening the lymphedema. Few studies, however, have controlled for the use of a compression garment during or following exercise. Moreover, no studies have explored the potential of combining resistance exercise with therapeutic strategies to help reduce arm lymphedema volume. We hypothesize that a progressive resistance exercise program that incorporates compression therapy and follows the decongestive exercise sequence

(DPRE) has the potential to reduce arm lymphedema volume. **Purpose:** To investigate the feasibility of a 12-week DPRE with compression therapy among women with BCRL. **Methods:** A randomized controlled pilot trial was conducted involving 20 women with stable BCRL, recruited through the Cross Cancer Institute in Edmonton, Canada. As per standard of care, all women were required to wear their day-time compression sleeve daily for 12 hours. Women were randomly assigned to one of three groups: (i) Standard care: home decongestive exercise regimen (n=6), (ii) DPRE plus use of a daytime compression sleeve during exercise (n=7), and (iii) DPRE plus use of an adjustable compression wrap (AC) garment during exercise (n=7). Approval was obtained from the Health Research Ethics Board. Feasibility outcomes were analyzed descriptively. Due to the pilot nature of the study and the small sample size, no inferential analyses were performed. **Results:** Feasibility data demonstrate high study completion (95%), attendance (94%) and adherence to prescribed protocol of DPRE program (97%). A mean reduction in arm lymphedema volume of 35 ml (-5.1%) was observed in the DPRE with day-time sleeve group and a 45 ml (-6.7%) in the DPRE with AC group. In contrast, a mean increase of 68 ml (+14.6%) was observed in the standard care group. **Conclusion:** DPRE with use of compression is feasible and shows promise in reducing arm lymphedema volume. A large-scale RCT is being conducted to examine the efficacy of this program on arm lymphedema volume, with the addition of imaging techniques to further inform changes to tissue composition.

4001 Board #318 May 30 9:00 AM - 10:30 AM

Feasibility And Preliminary Efficacy Of High-intensity Interval Training During Neoadjuvant Chemoradiotherapy For Rectal Cancer

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PURPOSE: To assess the feasibility, safety, and preliminary efficacy of a supervised high-intensity interval training (HIIT) program in rectal cancer patients undergoing 5-6 weeks of neoadjuvant chemoradiotherapy (NACRT).

METHODS: Thirty-six rectal cancer patients scheduled to receive NACRT followed by surgery were randomized to either exercise training (n=18) or usual care (n=18) in the Exercise During and After Rectal Cancer Treatment (EXERT) Trial in Edmonton, Alberta. Patients in the exercise group were asked to complete 3 supervised HIIT sessions/week for the duration of NACRT. Feasibility was determined by eligibility rate, recruitment rate, follow-up rate and exercise adherence. Safety was assessed by tracking serious adverse events related to exercise. The primary efficacy outcome was cardiorespiratory fitness (VO₂ peak) assessed immediately post-NACRT by a graded exercise test. Secondary efficacy outcomes included functional fitness assessed by the Senior's Fitness Test.

RESULTS: From June 2017 to August 2019, 205 rectal cancer patients were screened, 131 (64%) were eligible, and 36 (27%) were recruited. Follow-up fitness testing post-NACRT was completed in 75% (exercise n=14; control n=13). Reasons for missed fitness testing were medical issues. Median attendance for the supervised HIIT sessions during NACRT was 82%. No serious adverse events were observed, however, 2 patients in the exercise group experienced musculoskeletal events which resulted in 4 missed exercise sessions. Analyses of covariance showed no statistically significant or clinically meaningful difference between groups for the primary outcome of VO₂ peak (adjusted between-group mean difference, 0.9 ml/kg/min; 95% CI, -1.6, 3.3; p = 0.47). The 8-foot up-and-go was significantly better in the exercise group post-NACRT (adjusted between group mean difference, -0.4 seconds; 95% CI, -0.7, 0.0, p = 0.031). No other significant group differences in functional fitness were observed. **CONCLUSIONS:** Supervised HIIT during NACRT for rectal cancer was feasible and safe. Further research is needed, however, to better understand the feasibility of completing fitness testing immediately following NACRT and whether HIIT can produce meaningful improvements in fitness in this challenging clinical setting.

4002 Board #319 May 30 9:00 AM - 10:30 AM

Cardiorespiratory Fitness In Men With Prostate Cancer Following 8 Weeks Of Vigorous Continuous Or Interval Exercise Training Performed During Radiation Therapy

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(No relevant relationships reported)

Persons with cancer have been reported to experience significant fatigue due to marked reductions in cardiorespiratory fitness as a result of anticancer therapy. Moderate exercise programs during and after completion of cancer treatment have been suggested to mitigate cancer-related fatigue **Purpose:** This study aimed to

characterize cardiorespiratory fitness and physiological changes in fatigue in men with prostate cancer who participated in an exercise training program during External Beam Radiation Therapy (EBRT). **Methods:** Subjects were eight men with prostate cancer (age 65.75±8.84 years; BMI 25.31±2.62 kg/m²) scheduled to receive EBRT. Subjects completed eight weeks of vigorous supervised exercise [either continuous training (30 minutes at 70-80% of peak heart rate) or high intensity interval training (eight one-minute intervals of 95% peak heart rate)] three times a week during EBRT. Subjects also completed a treadmill cardiopulmonary exercise test (CPET) to exhaustion before and after eight weeks of EBRT. CPET results were compared before versus after completing the training regimen and EBRT. **Results:** Pre (28.2±5.07 ml/kg/min) and post (28.7±6.08 ml/kg/min) peak oxygen consumption (VO₂) were not significantly different. Conversely, a significant increase in time to anaerobic threshold (AT) before (409.5±66.97 sec) and after (448.16±72.70 sec) exercise training was observed (p = 0.049). There were no significant changes in VO₂ at AT or time to exhaustion after exercise training. **Conclusion:** While the construct of fatigue is complex and multidimensional, AT provides an objective measure of endurance that is not influenced by perception or motivation. The National Comprehensive Cancer Network (NCCN) recommends moderate exercise programs during and after completion of cancer treatment to reduce cancer-related fatigue. In this study, vigorous exercise training performed during EBRT, maintained cardiorespiratory fitness and increased the time to AT in these men undergoing prostate cancer therapy. **Funding:** This study is fully supported by the Division of Intramural Research of the National Institute of Nursing Research and the Clinical Center, Rehabilitation Medicine Department of the National Institutes of Health, Bethesda, Maryland.

4003 Board #320 May 30 9:00 AM - 10:30 AM
Exercise Triage And Program Adaptations For Cancer Survivors With Multiple Myeloma: A Case Series.

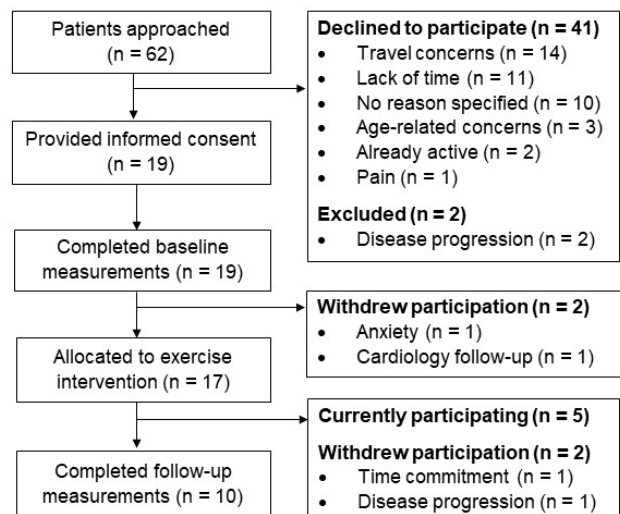
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Multiple myeloma (MM) is associated with fracture risk and deconditioning. Exercise training can attenuate functional declines, but the safety of exercise in this population remains unclear. **PURPOSE:** This case series explores the clinical history, considerations for triage, program adaptations, and functional changes in patients with MM taking part in the Alberta Cancer Exercise (ACE) study. **METHODS:** An exercise physiologist screened cases using a cancer-specific intake and the PAR-Q+. Due to MM diagnosis, physician approval was required for entry into the ACE study. ACE involved 60 mins of community or clinic-based exercise 2x/wk for 12 weeks. Pre/post measures included the 6-Minute Walk Test (6MWT), 30s sit-to-stand, sit and reach, and optional max bench press (1RM) and plank tests. **RESULTS:** CASE 1: 54-year old male on chemotherapy with a history of lytic lesions throughout the thoracic cage and pelvis, and radiation therapy (RT) to large lytic lesions in the pelvis and left clavicle. Goal: improve fitness for upcoming stem cell transplantation (SCT). Physician recommendation: controlled low loading due to fracture risk. Approved for community (1x/wk) and clinic-based (1x/wk) exercise. CASE 2: 37-year old female diagnosed with MM without bone involvement, receiving chemo and targeted therapy. She had undergone surgery and was recovering from a SCT. Goal: reduce fatigue and improve fitness. Approved for clinic-based exercise with transition to community after 12 wks. CASE 3: 54-year old female on maintenance chemo with multiple lytic lesions, history of cervicothoracic decompression, reduction and instrumentation C5-T3, and prior RT to spine and pelvis. Goal: improve fitness, strength and health. Approved for clinic-based exercise. Physician recommendation: low intensity exercise due to fracture risk and pain. No adverse events occurred and increases were seen across cases in 6MWT (8.2%, 5.6%, 9.5%), sit-to-stand (0%, 18.8%, 5.9%), sit and reach (18.6%, 56.7%, 42.2%), 1RM (4.1%, 21.4%, N/A), and plank (36.8%, 50%, N/A). **CONCLUSIONS:** The cases presented with unique complications and apprehension towards exercise. Presence and location of lytic lesions, fracture history and risk, surgical history, and treatment stage were key considerations for exercise triage and adaptations within the ACE program.

4004 Board #321 May 30 9:00 AM - 10:30 AM
Feasibility Of A Progressive Walking-based Exercise Programme In Clonal Plasma Cell Disorders

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Epidemiological data shows that regular physical activity is associated with reduced risk of developing the blood cancer Myeloma. Myeloma is preceded by the asymptomatic stages Monoclonal Gammopathy of Undetermined Significance (MGUS) and Smouldering Myeloma (SM). International guidelines do not advocate treatment for MGUS and SM, instead disease biomarkers are routinely monitored. The effect of exercise training on MGUS and SM disease activity has not yet been investigated despite evidence that an active lifestyle may reduce Myeloma risk. **PURPOSE:** Determine the feasibility of a progressive exercise programme for MGUS and SM patients, for subsequent investigation of its effect on disease activity. **METHODS:** 62 patients (21 MGUS, 41 SM) were invited to participate in a single-arm trial. The exercise programme comprised 2 supervised and 1 home-based session per week for 16 weeks. Supervised exercise involved treadmill walking (30 mins progressing from 40% to 80% VO_{2MAX}). At home participants completed a moderate intensity walk for ≥40 mins. Results are mean ± SD. **RESULTS:** Uptake was 31% and retention was 79%. Ten participants (2 MGUS, 8 SM, 50% male, 60 ± 11 years) have completed the trial to date. Adherence was higher for supervised (91 ± 7%) than home-based (74 ± 26%) sessions. In supervised sessions, compliance to duration was high (98 ± 3%) but compliance to intensity was low (61 ± 20%) due to a drop-off at intensities >70% VO_{2MAX} (<70% = 70 ± 30%; >70% = 52 ± 28%). The 40-min home-based walk target was exceeded (47 ± 11 mins). No severe adverse events occurred. **CONCLUSION:** Exercise is safe for patients with MGUS and SM. Adherence to supervised exercise was high, as was compliance to 30 mins of walking at 40-70% VO_{2MAX}. Walking exercise >70% VO_{2MAX} was not feasible. Future studies could evaluate interval training to maximise exercise intensity with the aim of delaying disease progression from MGUS and SM to Myeloma. Grants: Physiological Society & University of Bath Alumni Fund



4005 Board #322 May 30 9:00 AM - 10:30 AM
Aerobic Recovery Of A 65-year Old Following Radical Prostatectomy

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 (No relevant relationships reported)

Following radical prostatectomy, patients are generally advised to engage in no strenuous exercise for 4-6 weeks. Beyond that time range, the rapidity with which a patient may return to high-level aerobic activity is not known.

PURPOSE: To examine the recovery following radical prostatectomy (RP) of an endurance-trained 65-year old man with localized prostate cancer and single-vessel heart disease.

METHODS: A maximal incremental exercise test and a one-hour steady-state test were performed just prior to and three months following robotic RP to determine maximal oxygen consumption (VO_{2max}) and other cardiorespiratory variables. The patient recorded his training as he prepared for an endurance event that was to occur three months after RP, the Norwegian Foot March (NFM), a 30-km road march carrying 11.4 kg.

RESULTS: In the month prior to RP, the patient performed 2-3 hours of vigorous-intensity aerobic exercise per week, fast walking carrying an 11.4-kg pack, with the longest individual session being a 16-km road march. Just prior to surgery, VO_{2max} was 36.7 mL·min⁻¹·kg⁻¹, heart rate during 30 min at 7.2 km·hr⁻¹ and 0% grade was 77% of heart rate reserve (HRR), and during 30 min at 5.3 km·hr⁻¹ and 10% grade was 92% HRR. On post-surgery day 44, he did a 19-km road march carrying 11.4 kg, exceeding the training level of the month pre-surgery. Three months post-surgery, VO_{2max} was 42.7 mL·min⁻¹·kg⁻¹, and heart rates during the flat and uphill 30-min sessions at the same absolute-intensity as pre-surgery were 70% and 83% HRR, respectively. He completed the NFM 93 days post-surgery in 4:24:37, with an average heart rate of 72% HRR.

CONCLUSIONS: This case study demonstrates that an aerobically trained prostate cancer patient can return to high-level aerobic training in as little as seven weeks post-radical prostatectomy, and even exceed pre-surgery fitness. This finding has implications for prognosis given the beneficial effect of vigorous-intensity exercise on prostate cancer progression.

4006 Board #323 May 30 9:00 AM - 10:30 AM
Physical Activity During Pediatric Hematopoietic Stem Cell Transplant And 1yr Follow-up: A Case Study

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PURPOSE: The hematopoietic stem cell transplant (HSCT) is considered for patients who are non-responsive to first intention treatments. This process can last between 4-6 weeks and requires complete isolation of the child. Intensive chemotherapy is given to suppress completely the immune system before transplant. Past studies have reported major motor-developmental and growth deficiencies post-transplant. In this case study we evaluate the feasibility, adherence and effect of physical activity (PA) before, during and after an HSCT process. **METHODS:** Physical capacities, quality of life (QoL) and the daily PA level were evaluated for the 6 yrs. old male subject, 2 months after a diagnosis of a Burkitt Lymphoma stage III. For one-year, PA sessions were offered to the subject twice a week for 5-30 min, at intensities between 4-6 on the Borg Scale. We reassessed the subject after one-year. **RESULTS:** The subject participated 67% of the sessions. Eleven sessions during pre-transplant, 26 during transplant and 4 after treatment completion. The main reason for cancellation was "schedules" (32%). His height did not increase but his body mass increased by 2 kg. The total scoring results from the PedsQL cancer questionnaire increased by 6% for the subject and by 9% for the proxy. The ankle ROM increased by 18°. The vertical jump test increased by 14 cm and the hand grip test increased by 9 kg. Due to the poor physical condition of the child, we were not able to perform the incremental shuttle walk test (ISWT) prior to transplant. Thought, the one-year assessment revealed that the subject was able to reach 90% of his predicted VO_{2max} for this test. The level of daily PA diminished after HSCT (<30min/day), but the active transportation time doubled (90 min-180min/day) and the sedentary activity time was diminished by more than half (172min-65min/day). No major adverse event occurred during this study. **CONCLUSIONS:** Physical activity was safe and feasible before, during and after the HSCT. We could observe positive results on the child's physical capacities, quality of life and daily PA levels. Larger studies evaluating the long-term effect of PA before, during and after HSCT are needed to conclude on the possible late effects it may have on physical and psychological aspects.

4007 Board #324 May 30 9:00 AM - 10:30 AM
Abstract Withdrawn

4008 Board #325 May 30 9:00 AM - 10:30 AM
Physical Activity Measurement Feasibility In Chemotherapy-Receiving Gastrointestinal Cancer Survivors

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Oxaliplatin, a standard chemotherapy for invasive gastrointestinal (GI) cancer, can cause immediate and lasting side effects. Intractable fatigue and neuropathy are common and particularly severe 4-7 days after each oxaliplatin infusion but could be lessened with moderate-vigorous (MV) physical activity (PA). The best MVPA measurement method in PA intervention trials during oxaliplatin treatment is unclear. **PURPOSE:** To describe the feasibility of MVPA measurement in a pilot RCT of home-based brisk walking compared to PA education alone in stage II-IV GI cancer survivors receiving oxaliplatin ($N = 60$). **METHODS:** Patients were recruited at the second oxaliplatin infusion and randomized 1:1 to the 8-week intervention or PA education group. The intervention group received motivational interviewing, a Fitbit Charge 2, and other PA supports. Pearson bivariate correlations were performed among the self-report (PA vital sign [VS] interview) and objective measures (ActiGraph GT9X and Fitbit) of MVPA minutes per week. **RESULTS:** Mean MVPA minutes at 8 weeks were 273.8 (SD 252.34; $n = 24$) by Fitbit, 136.01 (SD 67.28; $n = 11$) by ActiGraph vector magnitude, and 272.52 (SD 666.48; $n = 24$) by self-report in the intervention group; and 107.07 (SD 36.04; $n = 17$) by ActiGraph and 145.02 (SD 154.63; $n = 27$) by self-report in the control group. The intervention group's ActiGraph-PAVS correlation was moderate ($r = 0.714$). Self-report and objective MVPA were not correlated in the control group at 8 weeks and intervention group at baseline. Technical errors ($n = 7$), devices lost while exercising ($n = 2$), and noncompliance ($n = 5$; i.e., not wearing when less active than usual) led to missing ActiGraph data. Patients often struggled to respond to the PAVS, because their MVPA differed 1- and 2-weeks post-infusion. **CONCLUSION:** Self-reported MVPA (the PAVS) may be unreliable in GI cancer survivors during oxaliplatin treatment, due to high response variability, influenced by acutely changing chemotherapy side effects and lack of objective MVPA awareness. For the few compliant participants, ActiGraph measurement the week after infusion may represent true MVPA levels, but re-evaluation of the Fitbit MVPA cut-off points and required duration of ActiGraph measurement is still needed among oxaliplatin-receiving patients.

4009 Board #326 May 30 9:00 AM - 10:30 AM
Abstract Withdrawn

4010 Board #327 May 30 9:00 AM - 10:30 AM
Scientific Abstract

Jani Cléria P. Bezerra¹, Paula Paraguassú Brandão², Evelini Vergas de Jesus³, Fabiana Scartoni⁴, Tomires Campos Lopes⁵, Carlos Jose Nogueira⁶, Estélio Henrique Martin Dantas⁷.
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 (No relevant relationships reported)

INTRODUCTION: Physical activity has been associated as a health protection factor relating its benefits to the reduction of chronic diseases. **PURPOSE:** to present a physical training program, as a proposal of Hospital Physical Education. **METHODS:** ONCOFITNESS method, in patients diagnosed with malignant neoplasms, as part of adjuvant and neoadjuvant treatment, and a non-pharmacological alternative for maintaining quality of life, fitness and health recovery. The eight-week program included 51 patients; 27 women with breast cancer (54.1 ± 6.76 years) and 24 men with prostate cancer (58.4 ± 2.57 years) classified as: Level I - Weak; Level II - Intermediate; and Level III - Advanced. It began with a routine of stretching exercises, moving to neuromuscular exercises. The load determination for effort intensity control was maintained on a light to moderate scale (50% to 75% of the maximum heart rate),

on a subjective exertion perception scale (PSE) of 9-13 and with a consumption of 3 to 6 METs, performing 3 sets of 6 to 10 repetitions, with 2-3 weekly sessions, up to 48h apart. Overload was applied weekly, initially by volume (repetitions); after reaching 10 repetitions the intensity was increased, returning to the six repetitions. Stretching and strength exercises were selected. **RESULTS:** Table 1 presents the results before and after participation in the program. **Table 1.** Results before and after participation in ONCOFITNESS

	Fat percent-age *	Cardiorespiratory Resistance **	Muscular endurance ***	Muscle strength ****	Flexibility *****
Mens (pre)	18,73 (±0,83)	332,92 (±32,66)	11,7 (±3,79)	54,8 (±18,48)	83,3 (±5,69)
Mens (post)	16,39 (±0,81)	471,25 (±24,62)	19 (±3,57)	67,2 (±19,06)	87,9 (±5,97)
Wom-en (pre)	30,13 (±1,16)	280 (±21,76)	12,6 (±3,18)	16,4 (±11,05)	80,7 (±7,12)
Wom-en (post)	26,58 (±0,94)	434,81 (±23,22)	21,3 (±4,18)	24 (±12,55)	91,8 (±6,5)

Units: %; ** Meters in 6 minutes; *** Repeats per minute; **** kg; *****Degrees
CONCLUSION: It is believed that ONCOFITNESS can fill a gap in physical activity issues for cancer patients with a view to health promotion, protection and recovery, and care delivery, ensuring a comprehensive approach to the health-disease process with an emphasis on primary care.

G-47 Free Communication/Poster - Health Equity - Socio-Economic Status

Saturday, May 30, 2020, 8:00 AM - 10:30 AM
 Room: CC-Exhibit Hall

4011 Board #328 May 30 8:00 AM - 9:30 AM
One (1) Month Contextual Comparisons Between Obese Black And White Women To Inform Weight Loss Interventions

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 (No relevant relationships reported)

More than 60% of black women in the U.S. are obese. Evidence suggests black women are exposed to more obesogenic microenvironments. To address this issue, research calls for exploration of bold, new obesity intervention approaches to discover unconventional tactics to address weight loss disparities.

PURPOSE: To compare microenvironments and assessment outcomes across obese black and white women for whom weight loss information and services were made available.

METHODS: A research assistant (RA) entered the participant's home to complete informed consent, baseline assessment, and onboarding. The RA also took note of the home environment without the participants' awareness. Follow-up assessments occurred in the participant's home 28 days after baseline.

RESULTS: Of the 186 black and white women, 62.9% self-reported being African American or Black and the mean age of the group was 52.3 ± 8.4. The mean BMI of all participants at baseline was 44.8 ± 10.1 and 45.4 ± 10.5 at the 30-day follow-up. There were significant group differences in social and physical micro-environments. When compared to white women, more black women had lower incomes ≤ \$20,000 (58.5% vs 29.5%, p<0.03) and lower health literacy (50.4% vs 18.8%, p<0.001). In regard to context, more black women had a television visible from their kitchen (17% vs 3%, p<0.01), when compared to white women, a fry pan visible (61% vs 37%; p<0.01), spent significantly fewer average days with a spouse (4.1 vs 10.0; p<0.01), and more consecutive hours alone (20.9 vs. 15.4; p<0.03). Both groups reported seeing similar numbers of people on a weekly basis (4.2 ± 2.1 and 4.4 ± 2.2), home as their most common location, and the same amount of time at home (39.2 ± 50.1 and 35.5 ± 30.1 hours; p=.422).

CONCLUSIONS: Variables such as lower health literacy and annual income have commonly been associated with the higher incidence of obesity among black women. Intervening on the higher prevalence of micro-level obesogenic cues in the homes of black women is another potential target for weight loss interventions.

4012 Board #329 May 30 8:00 AM - 9:30 AM
Factors Associated With High Response Rates To Improve Ecological Momentary Assessment Research

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 (No relevant relationships reported)

Research indicates black women experience 50% less weight loss through behavioral counseling programs when compared to white women. Examining context may reveal factors associated with weight loss differences. Ecological Momentary Assessment (EMA) via digital devices enables data collection from participants as they move through their daily routine. In this project, we asked participants to respond to prompts about their eating, physical activity and social copresence up to eight times per day over a 30-day period.

PURPOSE: To identify characteristics associated with EMA response rates.
METHODS: Eligible participants were female, aged 35-64 years, self-reported Non-Hispanic black or white race, and were eligible for a Federally Qualified Health Center-based weight loss program based on having a BMI ≥ 30. Survey measures were RA-administered and included household income, work hours, years of education, health literacy and numeracy, food security, depression, anxiety, and social relationships. The RA measured and recorded participant height and weight. The RA then installed and configured the EMA system for data collection on a study-provided smartphone or on the participant's smartphone if it was compatible with the system. The EMA survey asked: "Where are you?" "With anyone?" "Eat or drink in the last 15 minutes?" "Walk or move in the last 15 minutes?" Responses were automatically submitted to the study's secure server.

RESULTS: Of the 259 participants, 136 (52.5%) were classified as responders (>50% response rate). A significantly greater percentage of responders owned a smartphone, 60.3% vs 35.8%, p < 0.001 and lived alone or with one other person 62% vs 49%, p = 0.036. Marginally non-significant positive associations with response included an eating disorder, 21.3% vs 12.2%, p = 0.05; seeing fewer people weekly, 4 vs 5, p = 0.06; not having a TV in the kitchen, 91.8% vs 84.6%, p = 0.07; and food insecurity, 30.9% vs 19.5%, p = 0.09.

CONCLUSIONS: EMA helps examine context if the research participant regularly responds. Identifying factors associated with high response rates is useful in improving EMA research. Future research with EMA in vulnerable populations may require more extensive participant training/practice using study phones or integration of EMA into participants' existing tools.

4013 Board #330 May 30 8:00 AM - 9:30 AM
Influence Of Socioeconomic Status On Cardiometabolic Risk Factor Responses In Active Older Adults

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Socioeconomic status (SES) has been reported to influence cardiovascular disease (CVD) and health in adult populations. **PURPOSE:** This study was designed to determine if older adults from communities with different SES would differ on cardiometabolic risks (CMO) initially and following a three-month period where they were encouraged to be physically active.

METHODS: The study is part of a larger project as older participants volunteered to take part in the study and they signed an institutional approved informed consent form prior to participation. The mean age of the participants ranged from 72.0 to 74.3 years. The average community income of the participants were \$50,537 (site 2), \$68,673 (site 1) and \$78,894 (site 3). Some of the participants were involved in structured, some in unstructured and some in little or no physical activity. CMO risks measured included cholesterol, HDL, LDL, Triglyceride, blood glucose, SBP and DBP on the initial assessment and three months later. Additionally, they were measured for BMI, BF% and timed up and go.

RESULTS: SBP was a risk factor (>135 mmHg) for every assessment, except for test 2 at site 1. Blood glucose suggest on test 2 that participants at site 2 and site 3 were diabetic (GLU ≥ 125 mg/dL). However, the participants had not fast and their HbA1c values were below 6.4 mmol/mol. Cholesterol on test 1 (233 mg/dL) indicate a risk for individuals from site 1. Generally, the blood profiles were not statistically different and most were not risk factors.

CONCLUSIONS: These data indicate that in diverse populations with different SES, CMO risks are essentially the same. This allows for the possibility that healthy lifestyle choices maybe a critical element contributing to the development of CVD.

SATURDAY, MAY 30, 2020