

Sleep Quality, Physical Activity, and Metabolic Health: An assessment of obese adolescents

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Current research states that low sleep quality is associated with decreased physical activity and impaired metabolic health in obese adolescents. **PURPOSE:** The purposes of this study were 1) to describe sleep and physical activity, and 2) to examine the relationship between sleep and physical activity. **METHODS:** Fifty obese adolescents were asked to wear the SenseWear Pro2 armband 24 hours a day for 7 days. Participants with complete sleep data and physical activity data ($n=28$, mean age 15.1 ± 1.9 y) were included in the present analysis. Descriptive statistics and frequencies were calculated for each characteristic. T-tests were used to compare boys and girls and groups divided by sleep quality (low and high sleep efficiency). **RESULTS:** There were no significant differences in subject characteristics or metabolic health between sexes or sleep quality groups. The frequencies for meeting sleep recommendations are as follows: 3.4% averaged more than 8 hours of sleep, 96% averaged less than 8 hours, 68% averaged more than 5 hours, and 31% averaged less than 5 hours (no subjects averaged more than 10 hours). The frequencies for meeting physical activity recommendations are as follows: 28% met moderate to vigorous physical activity recommendations and 14% met steps per day recommendations (females $\geq 11,000$ steps, males $\geq 13,000$ steps per day; only female subjects met step recommendations). No significant differences in subject characteristics or metabolic health were found between those who had high sleep efficiency and those who had low sleep efficiency. However, all participants had poor sleep and physical activity values. **CONCLUSIONS:** Good sleep efficiency does not appear to be beneficial if total sleep duration is low; thus, metabolic health may not benefit from improved sleep efficiency unless sleep duration is sufficient. Further research is warranted regarding the interactive relationship between sleep quality, physical activity, and metabolic health in obese adolescents, primarily focusing on adolescents who have sufficient sleep quality in comparison to those who do not.

Muscle Activation in Seated and Standing Uphill Cycling

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When climbing, cyclists often alternate between seated and standing positions despite a small economy penalty while standing. What prompts a rider's transition between positions is unclear as is any implication for muscle mechanics during cycling. **PURPOSE:** Compare muscle activations for seated and standing cycling positions when riding uphill at constant speed. **METHODS:** Muscle activations of four elite male cyclists (22.5 ± 4.5 yrs, 65.5 ± 5.5 kg) were collected during a single continuous bout of uphill riding using both seated and standing positions. Cycling was at subthreshold intensity with fixed speed (8 mph; 3.58 m/s) and grade (8%) on a large treadmill. Electromyography (EMG) electrodes and wireless transmitters were placed on muscles of the lower body: Rectus Femoris (RF), Biceps Femoris (BF), Vastus Medialis (VM), and Gastrocnemius (GM). 3D position markers were placed on leg landmarks and on the pedal axle from which crank angle was determined. EMG data were sampled at 1000 Hz while position data were sampled at 100 Hz and synchronized to the same start point. After a 10 minute warmup, a 4 minute trial began which alternated 1 minute stages of either seated or standing cycling. Specific gears generating cadences of about 66 and 60 rpm (seated and standing respectively) were required during each stage. EMG data were collected for the last 30 seconds of each stage from which 10 cycles were extracted and used for seated vs. standing comparisons. Raw EMG data were rectified, smoothed (RMS, 100 ms window), and normalized across crank angle (0 to 360 degrees). Each muscle amplitude was normalized to the maximum observed during seated cycling. **RESULTS:** Muscle activations for RF and VM were greater for the standing compared to seated position ($p < .05$). Mean EMG amplitudes (normalized to peak during seated cycling) for RF were $34 \pm 3\%$ seated vs. $47 \pm 5\%$ standing while for VM they were $36 \pm 8\%$ seated and $57 \pm 15\%$ standing. Peak amplitudes when standing were 59 and 34% greater than when seated (RF and VM). Mean activations for BF and GM were not different for seated and standing positions. However, considerable variability of activation was observed across riders when standing, particularly for BF. **CONCLUSION:** Standing while pedaling uphill elicits considerably greater activation of quadriceps muscles compared to a seated position.

Assessment of skeletal muscle protein content between mouse, rat, dog, human and cultured cell models.

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The knowledge of human skeletal muscle health and function has been advanced largely in part by the observations within animal and cultured cell models. Many laboratories, including our own, utilize a variety of such model systems to study the decline of health and function in aging skeletal muscle. Although variations between model systems are expected, our understanding to the extent of variation is limited. The purpose of this study is to compare skeletal muscle protein content from mouse, rat, dog, and human as well as cultured myoblasts and myotubes. All tissues were separated into three sub-cellular protein pools (myofibrillar, cytosolic, and mitochondrial) using differential centrifugation. Protein content within each pool was quantified by bicinchoninic acid (BCA) assay. Protein content in the mitochondrial and cytosolic fractions differed greatly between model systems. For example, dog mitochondrial protein content ($4.68 \pm 0.92 \mu\text{g}/\text{mg}$ tissue) was approximately twice that of mouse ($2.59 \pm 0.52 \mu\text{g}/\text{mg}$), rat ($2.08 \pm 0.49 \mu\text{g}/\text{mg}$) and human ($2.38 \pm 0.61 \mu\text{g}/\text{mg}$). However, myofibrillar protein content was similar for all animal model systems. C2C12 myotubes had greater myofibrillar protein content ($4.69 \pm 0.02 \mu\text{g}/\mu\text{l}$) than C2C12 myoblasts ($2.54 \pm 0.02 \mu\text{g}/\mu\text{l}$), Myotubes also had greater protein content in the mitochondrial and cytosolic fractions compared to myoblasts. Here we show subcellular protein content greatly differs between model systems. The data provided reiterate the need for careful consideration when selecting a model system for study. To ensure beneficial translation from animal and cultured cell models to human physiology, model systems of comparable protein content should be used.

Title: Kefir Does Not Alter Short Term Food Consumption in Sprague Dawley Rats

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PURPOSE: Kefir is a naturally fermented milk beverage containing a mixed microbial culture of lactic acid bacteria and yeast. Although this beverage has been used extensively in the Middle East, Russia and Eastern Europe for thousands of years, an exploration of the health benefits of kefir in society today is in its infancy. The purpose of this pilot study is to determine whether the addition of kefir to a liquid diet would alter short term food consumption in rats.

METHODS: Male, Sprague Dawley rats were placed on one of two liquid diets at 10 weeks of age (Control diet (CON), n=12; kefir diet (KEF), n=12). Both diets were equal in caloric density and macro and micro nutrient content. Animals were singly housed and on a 12:12 light cycle in a temperature controlled room. Food consumption was measured every 12 hours for 13 days. A Student's t test was used to compare the groups. Data are presented as mean \pm SD.

RESULTS: Over the course of the 13 day dietary intervention period, there were no significant differences in control or kefir diet consumption. CON and KEF food consumption averaged 39.51 ± 19.67 g and 45.52 ± 16.60 g per 12 hour period over the course of 13 days respectively (p=0.42).

CONCLUSION: The addition of kefir to a liquid control diet does not significantly influence food consumption over the course of a 13 day dietary adaptation period. This information is useful for individuals who are interested in exploring the health benefits of kefir and might want to ensure that any changes in rat physiology are not attributed to significant changes in dietary habits.

Physical Activity and Dietary Behaviors of Active Cancer Survivors

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PURPOSE: Individuals who are mostly sedentary throughout the day and are engaged in unhealthy eating may not receive the full health-related benefits of a structured exercise program. These behaviors may be exacerbated in cancer survivors because of fatigue and other symptoms associated with cancer treatments as well as the cancer itself. The purpose of this study was to document the daily physical activity levels and dietary habits of cancer survivors.

METHODS: Subjects were recruited from the Rocky Mountain Cancer Rehabilitation Institute and visited with administrators on two separate occasions before the irregularly scheduled exercise sessions. During the first visit, basic descriptive measures including age, weight and body composition (InBody770) were obtained. Each participant was provided with an accelerometer (Actigraph) affixed to a belt and wore it just above the hip during waking hours for the next 7 days. Participants were also asked to record all food and beverages consumed for 3 days (2 weekdays and 1 weekend day) during the time they were wearing the accelerometers to allow for the assessment of caloric intake (Nutritionist Pro). During the second visit, participants returned the accelerometer and diet log. Data for all variables are presented as mean \pm SD.

RESULTS: A total of 14 subjects (10 females, 4 males) participated in this study. Participants were 64 ± 15 years of age, 76.7 ± 18.6 kg with an average of $36\% \pm 8\%$ body fat. Average participant accelerometer wear time during the 7-day period was 10.9 ± 2.7 hours/day which included the time spent in their structured exercise program. Participants spent $78\% \pm 7\%$ of their total wear time in sedentary behavior, $19.5 \pm 5.7\%$ of wear time in light intensity physical activity, and $2.2\% \pm 1.6\%$ of wear time in moderate to vigorous physical activity. Average caloric expenditure was 232 ± 139 kcals/day and caloric consumption was $1,711 \pm 243$ kcals/day.

CONCLUSION: This study found that cancer survivors participating in a structured exercise program spend a large percentage of their time awake engaged in sedentary behavior. Professionals working with cancer survivors may need to consider activity throughout the day along with appropriate caloric intake in order to help properly define healthy lifestyle parameters post-cancer diagnosis.

Effect of Acute Exercise on Nucleosome Positioning and Mitochondrial Adaptations in Lean and Obese/Overweight Men

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Abstract:

Purpose: DNA methylation plays a role in acute exercise-induced gene expression. A single bout of acute exercise hypomethylates the promoter region of genes related to lipid metabolism and mitochondrial biogenesis. We hypothesize that nucleosome repositioning also plays a role in regulating the expression of these genes in response to an acute exercise bout.

Methods: 30 men, aged 19-30 were divided into lean group (BMI<25, n=15) and overweight/obese group (BMI≥25, n=15). We determined body composition and maximal oxygen consumption using a DXA scan and a Vo₂ max test respectively. On the test day, we took a blood draw and a muscle biopsy from the vastus lateralis muscle. The subjects were given a high carbohydrate breakfast, four hours after which they performed cycling exercise on a stationary ergometer until they expended 650 kcal at 50% of their Vo₂ max. A second blood draw and a biopsy were taken immediately after the completion of the exercise bout.

Results: The lean group had lower percent whole body fat as compared to the overweight/obese group (19.11% ± 4.86 vs. 27.52% ± 8.6). The lean group had a higher Vo₂ max compared to the overweight/obese group (39.73 ml/kg/min ± 6.71 vs. 33.66 ml/kg/min ± 8.95).

Conclusion: We are currently in the process of determining skeletal muscle gene expression across the transcriptome using RNA sequencing. We plan to determine nucleosome positioning via MNase sequencing in the skeletal muscle and perform metabolomic analysis of acylcarnitines in the skeletal muscle. These data will help us determine if nucleosome positioning of nuclear-encoded mitochondrial genes is affected by acute exercise and if this is accompanied by change in the gene expression of these genes. Acylcarnitine profiling will help us determine the effect of acute exercise on mitochondrial beta oxidation in both groups. Our primary goal is to determine if exercise would help reduce the risk of CVD in obese individuals by epigenetically upregulating nuclear-encoded mitochondrial genes such as peroxisome proliferator-activated receptor gamma coactivator 1 alpha (PGC1α) and bringing about complete beta oxidation thereby reducing intramyocellular lipid load.

Vertical Jump Ground Reaction Forces Change with Load

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Dominant versus non-dominant tendencies have been shown to affect performance and increase the risk for injury. Bilateral discrepancies often exist and are related to jump characteristics.

PURPOSE: To determine if ground reaction forces differ bilaterally during a countermovement jump and the effects of load on these differences. **METHODS:** The participants involved in the study were two male and two female physically active college students. They were asked to perform a series of maximal effort countermovement jumps under various conditions: double-leg and single-leg without load and with additional loads of 10% and 20% of their bodyweight. Five jumps were performed per load for each jump type (45 total). The additional load was applied with equal weight distribution in a weighted vest. The peak ground reaction force prior to takeoff was measured with use of force plates and used to differentiate between dominant and non-dominant jump characteristics. Results were analyzed using T-Tests with a single-subject design. **RESULTS:** The dominant leg supplied the greater ground reaction force than the non-dominant leg regardless of load or jump type. However, our findings indicated no relationship between load and bilateral asymmetry. The variability of force characteristics was dependent on the type of jump performed: in comparison to double-leg jumps, single-leg jumps provided a greater combined force. **CONCLUSIONS:** Ground reaction forces are highly variable and bilateral differences are dependent upon individual characteristics—they may not accurately assess risk of injury or significantly affect performance.

Keywords: Bilateral Asymmetries, Countermovement, Single-Leg, Double-Leg, Force Plate

Upregulation of Endogenous Antioxidants but not Exogenous Antioxidant Treatment Promotes Proteostatic Maintenance

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PURPOSE: Maintaining proteostasis may slow the aging process, and it is likely that the increased protein turnover with exercise training contributes to this process. Exogenous antioxidant treatments such as vitamin C (Vit C) target the detrimental effects of reactive oxygen species (ROS), but may simultaneously prevent the beneficial redox signaling associated with exercise. A possible alternative strategy to prevent oxidative damage while permitting redox-sensitive signaling is to increase endogenous antioxidants. The transcription factor nuclear factor (erythroid-derived 2)-like 2 (Nrf2) increases the transcription of endogenous antioxidants by binding to the antioxidant response element in the promoter region of target genes. Protandim (Pro, LifeVantage), a combination of five phytochemicals, activates Nrf2 by increasing its translocation to the nucleus. We hypothesized that, compared to Vit C, treatment with the Nrf2 activator Pro would not blunt ROS signaling.

METHODS: To mimic ROS signaling, C₂C₁₂ myoblasts were treated with H₂O₂. Treatment occurred alone or in combination with either Vit C or Pro. Deuterium oxide labeling was used to measure protein synthesis in the mitochondrial and cytosolic cell fractions after 2, 4, 8, and 12 hours of treatment. Simultaneously cell proliferation was measured by deuterium incorporation into DNA.

RESULTS: Compared to the untreated control, H₂O₂ alone had no effect on protein or DNA synthesis. Compared to H₂O₂ alone, Pro decreased protein synthesis in both cytosolic and mitochondrial fractions. However, Pro also decreased DNA synthesis. This resulted in a greater protein to DNA ratio suggesting maintenance of proteostasis. Vit C had no effect on protein or DNA synthesis and therefore no effect on proteostasis.

CONCLUSION: From these data, it appears that although treatment with exogenous antioxidants has no effect on proteostatic maintenance, activation of Nrf2 upregulates the endogenous antioxidant system and reduces the rate of proliferation in favor of allocating resources to maintaining the existing proteome.

Relationship between two jumping tests to speed, agility, and throwing speed among Division II softball players.

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PURPOSE: The purpose of this research was to determine the relationship between the broad jump and vertical jump to speed, agility, and throwing speed of NCAA Division II softball players. **METHODS:** 21 NCAA Division II softball players (age =, height= 164.85 ± 6.01 cm, weight= 67.4 ± 9.3 kg) were studied to determine if there was a relationship between two different jumps and speed, agility, , and throwing speed. Vertical Jump height (VJ)(15.6 ± 1.8 in.) was measured using a switch mat (Just Jump™) and broad jump (BJ)distance(60.1 ± 6.1 in.) using a standard tape line. Running speed (RS) (3.4 ± 0.1 sec.) was measured via a 60 foot sprint. Agility (2.4 ± 0.1 sec.) was measured using the 505 agility test. Throwing speed (TS)(56.6 ± 4.3 mph) was measured using a speed gun (Pocket Coach Ball Coach PR1000-BC radar gun). SPSS 23.0 software package was used for descriptive data analysis and correlation tests on each variable. **RESULTS:** Statistical analyses indicated strong negative relationships between VJ and RS ($r = -0.67$) and BJ and RS ($r = -0.61$). Moderate negative relationships were found between VJ and agility ($r = -0.57$) and BJ and agility ($r = -0.42$). Weak to moderate positive relationships were discovered between VJ and TS ($r = 0.36$) and BJ and TS ($r = 0.48$). **CONCLUSIONS:** These relationships suggest that VJ may be a better indicator of running speed whereas horizontal power production may be a better indicator of sport specific skills related to throwing.

Postural effects on cerebral blood flow and autoregulation

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Introduction: Cerebral autoregulation (CA) acts to maintain constant cerebral blood flow (CBF), yet CBF decreases when moving from a supine to a seated posture. We sought to determine why CBF decreases when one sits up and if this reflects imperfect CA. **Methods:** Bilateral cerebral blood velocity (CBV) in the middle cerebral arteries, arterial blood pressure (MABP) at the level of the heart, cardiac output (Q), and end-tidal carbon dioxide (PETCO₂) were measured in 18 (11 female and 7 male) healthy 26±9 year-olds during periods of supine and seated rest. Subjects lay, or sat, quietly with their eyes open for 10 minutes in each position twice (randomized order). Multiple regression was used to evaluate the influence of PETCO₂, MABP, Q, and hydrostatic pressure on CBV. Static CA was assessed by evaluating absolute changes in steady-state CBV. Dynamic CA was assessed by transfer function analysis of the CBV response to spontaneous oscillations in MABP. **Results:** Sitting up reduced CBV (55.2±9.1 cm/sec vs. 63.6±10.6 cm/sec supine; P<.001) and PETCO₂ (29.1±2.6 mmHg vs. 30.9±2.3 mmHg supine; P<.001), but increased MABP (92.1±8.4 mmHg vs. 84.2±12.1 mmHg supine; P<.001). The reduction in CBV was suggestive of imperfect static CA and could not be explained by changes in PETCO₂, MABP, Q, or hydrostatic pressure. Dynamic CA was not affected by changes in posture (P>.05). **Discussion:** These results suggest that postural changes in CBV and static CA do not impair the ability of the cerebral vasculature to adjust to spontaneous oscillations in blood pressure. This may indicate that the cerebral vasculature is preferentially protected against spontaneous oscillations in MABP.

ARTERIAL OXYHEMOGLOBIN SATURATION AS A DETERMINANT OF THE HEMOGLOBIN MASS-VO₂MAX RELATIONSHIP IN ENDURANCE ATHLETES

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Total hemoglobin mass (tHb) is a well-established, key predictor of maximal oxygen uptake (VO₂max) across aerobic fitness levels. Arterial oxyhemoglobin saturation (S_aO₂) has the potential to modify this relationship, especially in populations that experience exercise-induced arterial desaturation.

PURPOSE: To examine whether variability in S_aO₂ at VO₂max affects the relationship between tHb and VO₂max at moderate altitude (1625m) in highly trained athletes.

METHODS: 13 males and 8 females each completed four visits. Subjects were competitive highly trained (>10 hr training per week) cyclists/triathletes. On visits one and four tHb was assessed via the optimized carbon monoxide rebreathing method. Visits two and three were identical graded exercise tests on a cycle ergometer to determine VO₂max and S_aO₂ at VO₂max; the workload began at ~4 W kg⁻¹ and power increased 20 W every minute until volitional exhaustion. VO₂ was measured using indirect calorimetry and VO₂max was calculated as the highest average 30 sec VO₂. S_aO₂ was measured at rest and during exercise using forehead pulse oximetry; S_aO₂ at VO₂max was calculated as the average S_aO₂ during the same 30 sec used to determine VO₂max. Duplicate measures were averaged in order to reduce measurement error for key parameters. In order to control for the effect of body mass on VO₂max and tHb, both variables were normalized by body mass prior to analysis.

RESULTS: VO₂max ranged from 64.5 – 80.7 ml kg⁻¹ min⁻¹ in men and 50.4 – 65.4 ml kg⁻¹ min⁻¹ in women; tHb ranged from 12.2 – 17.4 g kg⁻¹ in men and 9.7 – 13.0 g kg⁻¹ in women; S_aO₂ at VO₂max ranged from 81.9 – 94.6% in men and 86.0 – 93.6% in women. In men, tHb explained 30% of the variability in VO₂max (r = 0.55, p = 0.05). When tHb was corrected by S_aO₂ at VO₂max, it explained 33% of the variability in VO₂max (r = 0.58, p = 0.04) but this was not significantly better than tHb alone (p = 0.6). In women neither tHb nor tHb corrected by S_aO₂ at VO₂max explained a significant amount of variability in VO₂max.

CONCLUSION: In highly trained male athletes at moderate altitude, correcting tHb by S_aO₂ at VO₂max does not appear to explain more variability in VO₂max; in a similar group of female athletes, no variability in VO₂max could be explained by either variable. However, data collection is ongoing and larger sample sizes are needed to confirm these results.

Evaluation of Concussion Sustained by Rodeo Athletes
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Purpose: To assess the prevalence and mechanism of injury (MOI) of concussion in professional rodeo. **Methods:** The study design was a retrospective descriptive analysis of data collected by the Justin Boots Sports Medicine Team (JSMT) between the years 2011-2014. Only injuries that occurred at Professional Rodeo Cowboys Association rodeo events where the JSMT was present were included. Concussion incidents in the events of bull riding, bareback riding, saddle bronc riding, steer wrestling, team roping, tie-down roping, and barrel racing were eligible for inclusion in the study. Cases relating to bull fighters and other rodeo personnel were also included. Variables analyzed included rodeo event, MOI, phase of activity when injury occurred, surface condition when MOI was hitting the ground, and equipment worn at injury site. **Results:** A total of 288 injury reports were analyzed. The majority (91.9%) of concussions were sustained by rough stock riders, with bull riders accounting for 60.1% (n=161) of all injury incidents. Most athletes suffered concussions during the dismount stage of competition (n=248; 64.9%). The most common MOI was an individual hitting his/her head on the ground (n=138; 47.9%). Fifteen of the injury cases were incurred by rodeo personnel. The majority of these incidents happened outside of a competition (n=8; 53.3%) and were usually caused by equipment (n=6; 40%). Sixty bullriders reported wearing a helmet at the time of their injury. **Conclusions:** Rough stock riders, especially bull riders, are most likely to sustain concussions during rodeo competition compared to other rodeo athletes or personnel. However, anyone involved in rodeo events, including the personnel, are at risk for head injuries. Continued education on the importance of protective helmets, is warranted, as is determining how to prevent the rodeo athlete from hitting his/her head on the ground.

The Benefits of Cooling during Constant Power Non-Steady State Cycling in Endurance Trained Athletes

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PURPOSE: The aim of this study was to compare the effects of different cooling methods on thermoregulatory and energetic responses during constant power, non-steady state cycling in thermoneutral conditions. **METHODS:** Endurance trained males ($n = 12$) performed a graded exercise test to determine lactate threshold power (1 mM above baseline). On three separate days, subjects cycled at their lactate threshold power for 60 min or until volitional exhaustion under three conditions: wearing a water perfused vest and sleeves circulating ice-cooled water (COOL), a synthetic shirt embedded with an active particle technology claimed to facilitate evaporative heat loss (EVAP), and a standard synthetic shirt (CON). Metabolic variables, core temperature (T_C), sweat rate, thermal sensation, and rating of perceived exertion (RPE) were measured during testing. **RESULTS:** A greater percent of subjects completed 60 min of cycling during COOL (82%) and EVAP (75%) compared to CON (64%). The increase in T_C from baseline at isotime (same time point across conditions based on the shortest duration completed in all three experimental conditions specific to each subject) was reduced during COOL and EVAP compared to CON (1.44 ± 0.45 and 1.52 ± 0.43 vs. 1.66 ± 0.45 °C, $p < 0.05$). Sweat rate was reduced during COOL compared to EVAP and CON ($1,312 \pm 331$ vs. $1,525 \pm 393$ and $1,550 \pm 548$ mL·hr⁻¹, $p < 0.01$). Gross efficiency decreased over time from baseline in all conditions ($p < 0.01$), but COOL attenuated this decrease by 22% compared to CON ($p < 0.05$). No differences

in the change in gross efficiency over time were found between COOL and EVAP or between EVAP and CON. Over time, thermal sensation was reduced by 23% during COOL compared to EVAP and CON ($p < 0.01$), whereas RPE was reduced by 3% and 2% during COOL and EVAP compared to CON ($p < 0.01$). **CONCLUSION:** During constant power, non-steady state cycling, cooling using the vest and sleeves or the synthetic shirt embedded with an active particle technology blunted the rise in core temperature and RPE over time compared to the standard synthetic shirt. Cooling using the vest and sleeves also reduced the decrease in gross efficiency over time as well as reduced sweat rate and thermal sensation compared to wearing the standard synthetic shirt.

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Predictors of Physical Activity Levels in Patients with Multiple Sclerosis

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Multiple Sclerosis (MS) is the leading cause of non-traumatic neurological disability in young adults and affects 1 in 420 Colorado residents. Patients with MS (PwMS) often have reduced physical activity (PA) levels compared to their healthy counterparts.

PURPOSE: The purpose of this study was to identify the strongest predictors of time in moderate-vigorous PA / day (MVPA) in PwMS to provide targets for rehabilitation.

METHODS: Thirty-four PwMS (26 women; age: 53.8 ± 12.4 years; Patient Determined Disease Steps: 2 (range: 0-6)) participated in the study. A total of 16 tests were completed to assess behavioral and functional outcomes of MS. Nine variables that were correlated with MVPA were entered into a stepwise multiple regression analysis to predict MVPA. The 9 independent variables for MVPA were: Modified Fatigue Impact Scale and Falls Efficacy Scale-International questionnaire scores, walking speed, 9-Hole Peg Test performance on the less-affected side and average performance of both sides, sit-to-stand and Timed Up and Go performance, and body weight normalized total leg strength (knee extensor + flexor force) on the more- and less-affected sides. More- and less-affected sides were determined from a combination of leg strength and self-report. PA levels were measured with Actigraph GT3X⁺ accelerometers on the hip of the more-affected leg for one week.

RESULTS: The patients averaged 29 min of MVPA (range: 4-76 min). The stepwise procedure converged on a model for MVPA ($R^2 = 0.35$, $P = 0.001$) that included perceived fall risk (partial $r = -0.46$, $P = 0.007$) and total leg strength of the less-affected side (partial $r = 0.44$, $P = 0.009$). The other variables did not contribute significantly to the model ($P > 0.465$).

CONCLUSION: PwMS with a lower perceived risk of falling and greater leg strength on the less-affected side engage in more MVPA. A greater perceived risk of falling may deter PwMS from engaging in PA, especially at a moderate-vigorous intensity. The strength of the less-affected leg is a predictor of PA levels because it may represent the ability to overcome the impairment of the other leg. Rehabilitation for PwMS should target leg strength with an emphasis on maintaining or improving the capacity of the less-affected leg, while also treating the factors of increased fall risk.

LIMIT 2000 CHARACTERS

Title: Effect of Pole Length on Economy and Kinematics During Double Poling on a Treadmill

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INTRODUCTION: Double poling is a cross-country skiing technique in which all the propulsive force is transmitted through poles. It has been noted that longer than self-selected poles result in higher horizontal impulse of force, faster 80-m sprint trials and better submaximal skiing economy on treadmill. The underlying biomechanical factors have received much less attention. **PURPOSE:** To study the effects of pole length on skiing economy and kinematics during double poling on a treadmill. **METHODS:** Four cross-country skiers completed a protocol consisting three 4-minute stages at 6, 7 and 8 mph using poles of both self-selected (“normal”) length, and 5 cm longer (“long”). Respiratory gases and heart rate were measured during the protocol and fingertip blood samples taken between the stages to determine blood lactate concentration. In addition, kinematic recordings were collected during the second to last 30-s period of each stage to determine joint and pole angles at the pole plant. Statistical significances were analyzed using single-subject comparisons. **RESULTS:** Statistically significant difference in oxygen consumption between “normal” and “long” poles was observed for only one subject at 8 mph stage. Two out of three subject’s demonstrated larger hip angle and more vertical pole angle at the pole plant with “long” compared “normal” poles. **DISCUSSION:** This study failed to demonstrate consistently significant difference in economy between self-selected and 5 cm longer poles. Skiers used somewhat different strategies when adapting to longer poles, but most notably they seemed to assume more a more upright body posture and the poles were positioned at a more vertical angle when compared to the “normal” pole body positions and pole angle.

Effects of Beetroot Juice on Cerebral Blood Flow and Autoregulation

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Purpose: Stroke is among the leading causes of death in the United States. Dietary nitrate, in the form of beetroot juice (BRJ), is a potent vasodilator in the peripheral circulation; however, little is known about its effect on cerebral hemodynamics. We hypothesized that acute BRJ supplementation would increase cerebral blood flow (CBF) and improve autoregulatory function in humans. **Methods:** To test this hypothesis, we measured middle cerebral artery blood velocity (MCA_v – transcranial Doppler) and arterial blood pressure (ABP – finger photoplethysmography) responses of 11 healthy individuals (5 females, 7 males, 27 ± 7 yrs, 67.6 ± 3 kg) 2.5 hours after ingestion of either concentrated BRJ (12.9 mmol nitrate in 140 ml) or nitrate-depleted placebo (double blind, crossover design). Cerebral autoregulation (CA) was evaluated using a bilateral thigh cuff test to provoke a rapid change in ABP necessary to calculate the rate of regulation (RoR) and autoregulation index (ARI) of the MCA_v response. All measurements were repeated twice. Averages were compared using paired t-tests ($\alpha=0.05$). **Results:** Acute ingestion of nitrate rich BRJ increased mean MCA_v (55 ± 12 vs. 50 ± 9 cm/s; $P=0.03$), but did not affect mean ABP, RoR, or ARI (all $P>0.05$). **Conclusion:** Acute dietary nitrate supplementation in the form of BRJ increases CBF at rest, but does not affect dynamic CA in healthy individuals. Future studies should evaluate whether BRJ is a viable and economical dietary strategy to reduce risk of stroke.

Understanding Competitive Female Bodybuilding Retirement

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Background: Female bodybuilders are an invisible and often marginalized community. Given the extreme physical, mental, and social commitment to the sport, retirement from bodybuilding may be a challenging process. The purpose of this study was to examine the retirement experiences of female bodybuilders based on Taylor and Ogilvie's conceptual model: 1) causal factors that initiate retirement; 2) factors related to adaptation to retirement; 3) available resources for retirement; 4) quality of adaptation to retirement; and 5) treatment issues related to distressful reactions to retirement.

Methods: Participants were 19 retired female bodybuilders aged 24-55 who had competed in at least one national or international competition within the US and had no intention of competing in the future. Participants completed a 20-minute online survey to assess demographics and retirement (12 open-ended questions). Data analyses included a constant comparative method to analyze the open-ended questions. All key themes and phrases were identified by three researchers and categorized into the components of Taylor and Ogilvie's model. **Results:** Lack of sport/life balance and expense related to the sport were identified as reasons for retirement. Difficult adjustments after retirement included a loss of purpose and low self-esteem. Resources needed for retirement included support groups and counseling. **Conclusions:** This was the first study to examine retirement among female bodybuilders. Based on the results, participants identified multiple challenges associated with retirement and resources and support systems needed for successful retirement. Future public health interventions can be designed to address the transition from sport to retirement among female bodybuilders.

Pilot Study: Assessing VO₂max and Forced Expiratory Volumes in Marijuana Users and Non-Users

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PURPOSE: Long term marijuana use has been shown to have adverse effects on the body. However, more recent evidence also suggests that marijuana and its extracts may also be beneficial to individuals with specific health conditions (cancer, Parkinson's etc.). Less is known about the marijuana related health effects on a generally healthy physically active population. Given the recent legalization of marijuana in Colorado and reports of increasing use among college students, this pilot study aimed to assess how marijuana use may be related to respiratory health and cardiorespiratory status.

METHODS: Participants were healthy male and female subjects ages 19-27y. (n=7) were recruited to participate in this study. Participants were recruited based on whether they were users (US; n=3) and non-users (NU; n= 4). Marijuana use was evaluated with the Marijuana Use Measure (MUM) survey and US were defined as using marijuana products at least once a week for the past 6-months while NU were defined as not having used marijuana within the past year. Subject's largest forced expiratory volume in one second (FEV_{1max}) was measured with a spirometer (Spirolab-II). To determine the test subject's VO₂max, the Bruce Protocol was performed on a treadmill and analyzed using a Parvo Medics cart. Data analysis consisted a student's t-test to calculate p-values. Due to the small number of subjects, effect sizes were calculated using Cohen's d equation. Data is presented as mean ± SD.

RESULTS: Average FEV_{1max} values were 3.70 ± 0.6 L/s and 3.91 ± 0.14L/s in the US and NU groups respectively (p=0.52, d=0.62). VO₂max for the US group was 52.35 ± 5.28ml/kg/min and 51.88 ± 3.77ml/kg/min for the NU group (p=0.89, d=0.21).

CONCLUSIONS: P-values of 0.52 and 0.89 for FEV₁ and VO₂max, respectively, indicate no significant difference between the US and NU groups. Effect sizes demonstrated a moderate practical effect for FEV₁max and a low effect for VO₂max. With further study and by increasing the participant numbers in each group, a more definitive relationship can be established between US and NU with respect to FEV₁max and VO₂max.

Neuromuscular electrical stimulation can improve walking endurance in old adults

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Keywords: neuromuscular electrical stimulation, aging, motor function

Author Disclosure Information: None.

Abstract:

Aging causes declines in motor function, which may be attenuated by interventions such as neuromuscular electrical stimulation (NMES). NMES pulse width influences the relative activation of motor and sensory axons. Wide pulses (0.5-1 ms) activate relatively more sensory axons than narrow pulses (0.2-0.4 ms) due to the longer strength-duration time constant and lower rheobase of sensory axons. Wide-pulse stimulation, therefore, can augment the central contribution to evoked contractions.

PURPOSE: To compare the influence of pulse width on the changes in motor function elicited in old adults by a 6-wk NMES intervention. We hypothesized that the improvement in walking endurance would be greater for participants who received wide-pulse NMES.

METHODS: 13 healthy old adults (75.6 ± 5 yrs) free of neurological disease were recruited to participate in a 6-week intervention comprising 3 weekly sessions of NMES provided over the proximal gastrocnemius and distal soleus muscles. Participants were randomized to receive either narrow- or wide-pulse stimulation. The stimulation applied in each session comprised a cycle of 4-s on, 12-s off for 20 minutes per leg at the maximal intensity tolerable. Evaluation sessions were performed at weeks 0, 4, 7, and 10 to measure walking endurance (400-m walk test), walking speed, maximum voluntary contractions with leg muscles, time to complete a chair-rise test, and balance (maximal length and rapid step tests).

RESULTS: While not yet sufficiently powered to compare the narrow- and wide-pulse groups, pairwise comparisons performed on data collapsed across groups demonstrated that the time to walk 400 m was significantly reduced (250 ± 61 s to 234 ± 54 s, $P = 0.02$). Preferred walking speed did not change, but maximal walking speed increased between weeks 0 and 4 (0.55 ± 0.08 m/s to 0.51 ± 0.08 m/s, $P = 0.02$). Plantarflexor strength increased between weeks 0 and 7 ($P = 0.001$), but no significant changes were observed for the dorsiflexors, hip flexors, knee extensors, and knee flexors. Chair rise test time was reduced between weeks 0 and 4 ($P < 0.05$), weeks 0 and 7 ($P = 0.005$), and weeks 0 and 10 ($P = 0.002$). No significant differences were detected in the balance tests.

CONCLUSION: NMES can improve walking endurance, maximal walking speed, strength of the muscles stimulated, and chair rise performance in old adults.

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Self-Reported Fatigue Does Not Highly Correlate with Objectively Measured Fatigue in Cancer Survivors

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Despite its prevalence, cancer-related fatigue (CRF) is seldom assessed and treated in clinical practice. Due to the subjective and multifactorial causes of CRF, accurately assessing CRF is challenging. Self-reported measures are widely used and accepted for CRF assessment, however, these are not objective measures of fatigue. Direct assessment of fatigue through muscle function testing could provide further insight into how cancer survivors experience fatigue, which could lead to improved exercise-based interventions that target fatigue.

PURPOSE:To evaluate the relationship between subjective self-reported psychometric fatigue measures and objectively-measured muscular fatigue in cancer survivors. **METHODS:**Cancer survivors ($N = 117$; ages 60 ± 13 years) were asked to complete the Revised Piper Fatigue Scale (PFS) which produces a total score and four subscale scores: behavioral/severity, affective, sensory, and cognitive/mood. A handgrip fatigue index (HFI) was determined for each participant by repetitively squeezing a handgrip dynamometer 15 times with maximal force each repetition. Participants also completed 15 maximal force knee extensions at a joint velocity of $60 \text{ deg}\cdot\text{s}^{-1}$ and a quadriceps fatigue index (QFI) was computed. Each fatigue index was computed as the difference between the average of the first two cycles and the average of the last two cycles divided by the average of the first two cycles and expressed as a percentage. **RESULTS:**Cancer survivors exhibited similar fatigue indices during hand grip ($34 \pm 15\%$) and knee extension tests ($35 \pm 11\%$) when compared with non-cancer populations from the literature. Significant relationships between the PFS total score and HFI ($r^2 = .120$; $p = .001$) and the PFS sensory subscale and HFI ($r^2 = .143$; $p < .001$) were observed, but less than 15% of the variance was explained in either relationship. No significant relationships were observed between PFS and QFI ($p = .309$). **CONCLUSION:**These results suggest that cancer survivors display similar rates of muscular fatigue compared with non-cancer populations and that self-reported fatigue measures are not good measures of local muscular fatigue rates in cancer survivors. As a result, subjective measures of fatigue should not be a primary determinant of the exercise dose in cancer survivors.

EFFECT OF AN 8-WEEK STRENGTH & POWER TRAINING PROGRAM ON CLUB HEAD SPEED IN COLLEGIATE GOLFERS

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ABSTRACT

Traditionally, golfers have either abstained from resistance training for fear of becoming stiff or changing their technique, or employed resistance training consisting of primarily light weights and rotational movements. Many sports have discovered the benefits of simply getting stronger and more powerful in the compound movements of the squat, deadlift and the Olympic lifts such as the power clean, and although slow growing, golf is to beginning to adopt heavy resistance training as a means to improve club-head speed (CHS) and therefore driving distance and performance. **PURPOSE:** The aim of this study was to compare a traditional golf training program consisting primarily of flexibility, rotational movement and lighter loads, with a strength and power training program focusing on improving performance through heavy resistance training in the squat, deadlift and power clean on CHS.

METHODS: Twelve male and female NCAA division II collegiate golfers participated in the study and were randomized into either an 8-week off-season strength/power intervention (N=6), or a control group, consisting of the golfers' normal off-season strength program (N=6). Both groups trained three times/week for the duration of the intervention. Pre and post-test measures recorded were CHS, vertical jump, squat, deadlift and power clean 1-

RM. **RESULTS:** All 12 participants completed all sessions throughout the 8 weeks of training. The intervention group significantly increased peak CHS (5.23 ± 3.98 km/h, $p < 0.05$), VJ (5.59 ± 3.56 cm, $p < 0.05$), and 1-RM power clean (6.44 ± 3.02 kg, $p < 0.05$), compared to the control group after the 8 weeks. No difference was found between the control and intervention group when comparing 1-RM deadlift and 1-RM back squat before and after the 8 weeks ($p > 0.05$). **CONCLUSION:** The golfers in the intervention group improved their CHS, power clean and vertical jump by a significant ($p < 0.05$) margin compared to the control group. These findings suggest that becoming better in the compound movements of the power clean and vertical jump can significantly improve CHS, which may improve driving distance and therefore golf performance. Future studies may wish to directly measure drive distance and accuracy.

Relationship Between Selected Measures of Physical Fitness and Performance on an Occupational Specific Physical Agility Test Among Law Enforcement Officers

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Purpose: The purpose of this investigation was to determine if significant relationships exist between selected physical fitness assessments and the time required to complete an occupational specific physical ability test (PAT) amongst law enforcement officers (LEOs). **METHODS:** The following metrics for 257 male law enforcement officers were selected for descriptive and comparative purposes: anthropometric measures (body weight, height, Body mass index), muscular endurance (1 minute push-up and sit-up scores), muscular strength (Isometric leg/back dynamometer scores); aerobic fitness (Multi-Stage Fitness Test), power (vertical jump height scores) and completion times for the specific PAT. **Statistical Analysis:** The provided data was entered into a computer file suitable for statistical analysis using the SPSS 22.0 software package. A descriptive statistical analysis was conducted to determine mean scores for each skinfold site and each measure of performance. A Pearson's correlation was utilized to determine significant relationships between selected measures of fitness and PAT performance amongst law enforcement officers. **RESULTS:** Pearson's Correlation indicated moderate to strong relationships between PAT times and Beep Test performance ($r = -.684, p < .001$), 1 minute push-up ($r = -.530, p < .001$), sit-up ($r = -.554, p < .001$) and vertical jump height ($r = -.527, p < .001$). **CONCLUSION:** Results of this study suggest that aerobic/anaerobic endurance, lower-body muscular power and upper body/trunk muscular endurance are significantly related to performance on a PAT designed to replicate essential job tasks for LEOs.

The Effect of Various Heating Modalities on Ankle Flexibility

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Thermal therapeutic modalities have been shown to aide in increasing range of motion. Previous studies have shown that ultrasound, heat packs, and stationary cycling in combination with stretching have improved range of motion in various joints. **PURPOSE:** To investigate the independent effects of ultrasound, heat packs, combination of ultrasound and heat packs, and stationary cycling on ankle dorsiflexion passive range of motion. **METHODS:** Four subjects were randomized into specific orders of treatment with one treatment being administered per day, allowing a minimum of 48 hours in between each treatment session. Before beginning treatment protocols, five baseline measurements were recorded. After each treatment, five measurements of the ankle dorsiflexion passive range of motion were taken using a goniometer by the same clinician pushing the ankle into dorsiflexion. Ultrasound treatment was applied to the Achilles tendon for seven minutes at a frequency of 3MHz and intensity of 1 W/cm². Heat pack treatment was applied to the calf muscles for seven minutes. The combination treatment included the same parameters simultaneously. Stationary cycling was conducted for 10 minutes with the subject's heart rate at 130-140 BPM. **RESULTS:** Each modality yielded a significant improvement ($p < 0.05$) for at least one of the participants. For female 1 and male 2, ultrasound proved to be the most effective modality. For male 1, heat pack was the most effective modality, and interestingly ultrasound decreased range of motion for this subject. Lastly, female 2 showed greatest improvements after the combination treatment of ultrasound and heat packs. **CONCLUSIONS:** Some modalities worked best for different subjects, though the data indicates that ultrasound by itself or in combination with heat packs is most effective.

Title: The Sensory Analysis of a Kefir Product Designed for Active Cancer Survivors

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PURPOSE: Kefir is a fermented milk product that provides a good source of protein and healthy bacteria and has the potential to improve the overall health and well-being of cancer survivors participating in a structured exercise program. The purpose of this study was to explore cancer survivor attitude and acceptance of a kefir recovery beverage made from cultured milk, whole fruits and natural sweeteners.

METHODS: Kefir was made by inoculation and fermentation of milk (4% fat) with kefir grains. The kefir was then mixed with a whole fruit base into a smoothie consistency. Cancer survivors (N=39, males (n=18) and females (n=21)) over the age of 18 years and currently involved in a structured exercise program at the Rocky Mountain Cancer Rehabilitation Institute were involved in this study. Participants were then seated and provided with a 1-ounce sample within 30 minutes after a structured exercise session. They evaluated, with paper and pencil surveys, the acceptability of the sample (overall appearance, aroma, taste, mouthfeel/smoothness and overall liking using a 9-point hedonic scale or the just-about-right scale (JAR) with 3 categories (not enough, just about right, and too much). They expressed their feelings and emotions associated with the beverage using a 5-point scale and indicated their purchase intent using a binomial (yes/no) scale. Data are presented as mean ± SD.

RESULTS: Overall liking of the beverage scored 7.0 ± 1.46 out of 9. There was a high intent to purchase with 35 participants out of 39 showing a desire to use this product for use after exercise. Of the questions related to emotion and feelings associated with consumption following exercise, Healthy and Refreshed received the highest scores of 3.8 ± 0.93 and 3.7 ± 0.89 out of 5, respectively.

CONCLUSION: The kefir beverage was found to be acceptable by cancer survivors and the majority of participants showed an interest in purchasing this product for use following exercise. These results suggest that this kefir-based recovery beverage has the potential to be a healthful addition to a post exercise recovery plan for cancer survivors.

EFFECT OF VARYING POST-ACTIVATION POTENTIATION INTENSITIES ON VERTICAL JUMP
PERFORMANCE IN FOOTBALL AND VOLLEYBALL PLAYERS

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ABSTRACT

PURPOSE: The aim of the study was to determine whether a sub-maximal or supra-maximal protocol is a more effective post-activation potentiation (PAP) method for improving vertical jump (VJ) performance in Division II football (FB) and female volleyball (VB) players. **METHODS:** The participants (8 football and 11 volleyball players) had baseline maximal back-squat and VJ height determined before completing a crossover design which included VJs after sub-maximal jump-squat and supra-maximal rack-squat loading protocols. **RESULTS:** FB showed an insignificant ($p>0.05$) increase in jump performance following the jump-squat (JS) intervention (70.38 ± 13.61 cm) and rack-squat (RS) intervention (70.16 ± 13.41 cm) in comparison to the baseline performance (69.37 ± 11.32 cm). VB had insignificant decreases ($p>0.05$) in VJ performance following the RS intervention (46.69 ± 9.53 cm) and the JS intervention (46.86 ± 10.21 cm) compared to the pre-test performance (47.14 ± 9.07 cm). There was no significant difference within either group between the VJ after the RS and JS interventions ($p>0.05$). Sport played however, had a significant ($p<0.05$) effect on the change in jump performance via PAP as the stronger, more seasoned football players experienced greater VJ improvements compared to the volleyball athletes. No significant differences ($p>0.05$) in VJ performance were identified between the two loading protocols (RS vs. JS) in either group. **CONCLUSION:** Although not statistically significant, PAP interventions seem to have some practical benefits on subsequent power training performance, as demonstrated by VJ, in athletes with greater pre-existing strength, such as the football players. Further research is necessary to confirm these results.

Table 1.

Vertical Jump Results Pre/Post Intervention

Group	Sport	Mean Height (cm)	SD
Baseline	Volleyball (n=11)	47.14	9.07
	Football (n=8)	69.37	11.32
	Total (n=19)	59.37	10.20
Post Rack-Squat	Volleyball (n=11)	46.69	9.53
	Football (n=8)	70.16	13.41
	Total (n=19)	58.64	11.47
Post Jump-Squat	Volleyball (n=11)	46.89	10.21
	Football (n=8)	70.38	13.61
	Total (n=19)	58.64	11.91

Commuting with Electric Assist Bicycles as a Means to Improve Cardiometabolic Risk Factors

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This study used a type of electric assist bicycle known as a pedelec. A pedelec is a bicycle equipped with a modest electric motor that provides assistance only when the rider is actively pedaling thus helping to overcome the common hurdles associated with active transportation (e.g. difficult hills and longer distances).

PURPOSE: Our primary purpose was to quantify improvements in cardiometabolic risk factors associated with pedelec commuting for 4 weeks. Our secondary purpose was to quantify pedelec usage patterns (duration and intensity). **METHODS:** Twenty physically inactive participants (6 males, 14 females) visited the lab three times for baseline physiological measurements (body composition, VO_2 max test, mean arterial pressure (MAP) blood pressure, lipid profile, and 2-hour oral glucose tolerance test (OGTT)). During the following 4 weeks, participants commuted using a pedelec a minimum of 3 day/week for 40 min/day. While riding the pedelec, participants wore a heart rate monitor and used a GPS device. Heart rate data was used in conjunction with regression equations developed from the VO_2 max test to estimate METS. After 4 weeks, participants repeated the physiological measurements. **RESULTS:** Commuting with a pedelec significantly improved 2-hr post OGTT glucose (5.45 ± 1.18 to 5.02 ± 0.91 mmol/L, $p < 0.05$), VO_2 max (2.19 ± 0.48 to 2.37 ± 0.52 L/min, $p < 0.05$), and power output at the end of the VO_2 max test (165.6 ± 39.4 to 185.6 ± 38.2 Watts, $p < 0.05$). There was a trend

for improvements in MAP (84.1 ± 10.5 to 82.7 ± 9.4 mmHg, $p=0.15$) and fat mass (28.3 ± 11.3 to 27.8 ± 11.4 kg, $p=0.07$). The average ride distance was 11.2 ± 6.8 km with ride time averaging $0:32:56 \pm 0:14:41$ (hr:min:sec). Average 4 week total distance and time were 317.9 ± 113.7 km and $16:16:41 \pm 3:19:05$, respectively. Estimated METS while riding were in the moderate intensity range (4.6 ± 1.2 METS).

CONCLUSION: Commuting with a pedelec for 4 weeks resulted in significant improvements in 2-hr post OGTT glucose, VO_2 max, and peak power output. Despite the electric assistance, riders self-selected an intensity that helped them meet the ACSM guidelines for physical activity. Pedelecs are an effective form of active transportation that can improve some cardiometabolic risk factors.

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Marijuana Use and Muscular Strength and Power in College Aged Students: An Exploratory Study.

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PURPOSE: Marijuana use is associated with a number of negative health outcomes; however, in some cases, its use is associated with various health benefits. Less is known about the potential for marijuana to influence the well-being of a healthy, physically active population and there are now individuals in the community suggesting that marijuana use may potentially improve athletic performance. Given the legalization of marijuana products in Colorado, and the recent claims of marijuana's health benefits, the purpose of this study is to explore the relationships between marijuana use, muscular strength and power in marijuana users (MU) and non-users (NU).

METHODS: Marijuana use was evaluated with the Marijuana Use Measure (MUM) survey. NU had not used marijuana within the past year (n=3) and MU had used marijuana products at least once a week for the past 6-months (n=3). All participants visited the lab once and completed handgrip strength assessments (Grip-D T.K.K. 5101) and a Wingate test (Monark-Ergomedic 828E cycle ergometer). A student's t test was used to compare groups. Because sample sizes were limited in this pilot study, effect sizes were calculated using Cohen's d equation. Data are presented as mean \pm SD.

RESULTS: The mean age of study participants (N=6) was 22.33 ± 2.81 yrs of age. Muscular strength, as measured by dominant handgrip strength, was not different between the groups (NU 33.7 ± 4.86 ; MU 34.73 ± 6.14 ; $p = 0.83$, $d = 0.18$). There were no differences in relative peak power between the groups during the Wingate test ($p = 1.0$, $d = 0.17$). Anaerobic fatigue and anaerobic capacity measured during the Wingate test were also not different between the groups ($p = 0.99$, $d = 0.10$ and $p = 0.56$, $d = 0.52$) respectively.

CONCLUSION: The preliminary results of this pilot project suggest that muscular strength and power may not be different when comparing individuals with respect to marijuana use status. Small effect sizes for the handgrip strength, relative peak power and anaerobic fatigue suggest that there is no meaningful variability between NU and MU groups. However, the medium effect size of 0.52 for anaerobic capacity suggests that there is moderate variability between the means of NU and MU.

Differences in linear speed between higher and lower power producers among NCAA Division II soccer players.

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Purpose: Acceleration and maximal velocity represent two crucial skills for success in elite soccer. Current research holds that power production provides a foundation for both. This study aimed to determine the relationship of power production to these skills, and the possible differences in linear speed between high power producing athletes, and low power producing athletes. **Methods:** Thirty-six NCAA Division II soccer players (20 males, 16 females) were tested for speed over 10 and 30 meters and power (CMJ). Groups were created by gender, and separated according to power output. Group 1: females with power production below the mean, Group 2: females with power production above the mean, Group 3: Males with power production below the mean, Group 4: Males with power production above the mean. CMJ height, peak power (PAPw) produced through CMJ, and power to weight ratio (P:W) were analyzed for their impact on linear speed. One-way analysis of variance (ANOVA) with pairwise comparisons were used to compare differences between gender groups (SPSS ver.23). **Results:** Females with CMJ scores above the mean were significantly faster in acceleration ($p=.047$) and maximal velocity ($p=.001$). Females with PAPw above the mean were significantly in acceleration ($p=.013$), and maximal velocity ($p=.011$). Females with P: W above the mean saw significantly greater maximal velocity ($p=.001$). Males with P: W above the mean had significantly higher maximal velocity ($p=.032$). **Conclusion:** Significant relationship exists between high power output measured using CMJ and linear speed performance in collegiate soccer players. Improving power production, and power to weight ratio, may contribute to improved linear speed in these athletes.

Differences in change of direction speed performance between higher and lower power producers among NCAA Division II soccer players.

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Purpose: Change of direction speed (CODS), is one of the most pertinent skills for elite soccer athletes. Power production is believed to have strong implications in the development of a foundation for CODS. This study aimed to determine the relationship power production has to CODS, and to analyze the difference in this relationship between high and low power producing athletes. **Methods:** Thirty-six NCAA Division II soccer players (20 males, 16 females) were tested for CODS (pro agility, t test) and power (CMJ). Groups divided by gender, and then by those above and below mean. Group 1: Females below the mean, Group 2: Females above the mean, Group 3: Males below the mean, Group 4: Males above them mean. Groups were compared across three categories, CMJ height, Peak Power from CMJ (PAPw), and Power to Weight ratio (P: W). One-way analysis of variance (ANOVA) with pairwise comparisons were used to compare differences between gender groups. **Results:** Females with PAPw above the mean saw significantly faster performance on the T Test than females below the mean ($p=.005$). Females with P: W above the mean had significantly greater performance on the T Test than those below the mean ($p=.004$). Males above the mean in P: W saw significantly greater performance in pro agility ($p=.027$). **Conclusion:** Findings suggest significant relationship between PAPw and P:W and change of direction speed in collegiate soccer players. Improving athlete power production and power to weight ratio, may improve change of direction speed in these athletes.

Four-day Head-down Tilt Bed Rest as a Model for Studying Rapid Alterations in Hemoglobin Mass

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Rapid decreases in hemoglobin mass (Hbmass) have been reported in healthy humans with spaceflight and following descent from high altitude. It has been proposed that a selective increase in the destruction of young red blood cells (RBCs) mediates these decreases but conclusive evidence demonstrating neocytolysis is lacking. Based on the proposed triggers and time course of adaptation during spaceflight, we hypothesized that 4 days of -6° head-down tilt bed rest (HDTBR) would cause a rapid decrease in Hbmass that would be associated with evidence of increased RBC destruction. **PURPOSE:** To examine changes in Hbmass before (PRE), 5 hours after (POST), and 5 days after (POST5) 4 days of HDTBR. **METHODS:** Seven healthy, recreationally active men (age: 21 ± 3 years, peak oxygen uptake: 50 ± 6 mL kg⁻¹ min⁻¹) completed 4 days of HDTBR. Hbmass was assessed using the optimized carbon monoxide rebreathing method. Markers of RBC production and destruction assessed included [erythropoietin] ([EPO]), [soluble transferrin receptor] ([sTfr]), reticulocyte count, [ferritin], [haptoglobin], and [bilirubin]. **RESULTS:** [EPO] decreased by $30 \pm 33\%$ from PRE to POST ($p = 0.028$). Contrary to our hypothesis, Hbmass was increased by $4.0 \pm 4.3\%$ from PRE to POST ($p = 0.014$) before decreasing to a level $3.6 \pm 2.4\%$ below PRE at POST5 ($p = 0.027$). From PRE to POST, haptoglobin increased $66 \pm 73\%$ ($p = 0.013$), [bilirubin] decreased $26 \pm 34\%$ ($p = 0.054$), ferritin increased $17 \pm 17\%$ ($p = 0.012$), and reticulocyte count remained stable. From PRE to POST5, sTfr decreased $17 \pm 5\%$ ($p = 0.018$) but there were no significant alterations in [ferritin], [haptoglobin], [bilirubin] or reticulocyte count. **CONCLUSION:** Our findings suggest that 4-day HDTBR results in a transient increase in Hbmass that may be influenced by decreased RBC destruction. However, since the POST measurement occurred following re-ambulation, a potential role for other factors (i.e., spleen contraction) on the increase in Hbmass cannot be excluded. The decrease in Hbmass at POST5 appears to be mediated by decreased RBC production rather than increased RBC destruction. These findings highlight the need to re-examine the time course and mechanisms of Hbmass alterations with short-term spaceflight and simulated microgravity.

Incidence and Long-Term Follow Up of Isolated Posterior Cruciate Ligament Tears

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ABSTRACT

Purpose: Isolated posterior cruciate ligament (PCL) tears are an uncommon injury. The goals of this study are to 1) determine the population-based incidence of isolated PCL tears, 2) compare the occurrence of secondary meniscal tears or arthritis in patients with PCL deficiency to patients without PCL tears, and 3) evaluate factors associated with long-term sequelae among patients with PCL deficiency.

Methods: This retrospective study included a population-based incidence cohort of 48 patients with new-onset, isolated PCL tears between 1990 and 2010, as well as an age and sex-matched cohort of individuals without PCL tears. A chart review was performed to collect information related to the initial injury, treatment, and outcomes. Subjects were retrospectively followed to determine the development of subsequent meniscal tears, arthritis, or total knee arthroplasty (TKA).

Results: The age- and sex-adjusted annual incidence of isolated, complete PCL tears was 1.8 (95% CI: 1.3, 2.3) per 100,000. During a mean 12.2 year follow-up, patients with isolated PCL tears had a significantly higher likelihood (HR 6.2, 95% CI: 1.8, 21.2) of symptomatic arthritis compared to individuals without PCL tears. The likelihood of subsequent meniscal tears (HR 2.1, 95% CI: 0.4, 10.7) and TKA (HR 3.2, 95% CI: 0.5, 19.6) was more frequent among patients with PCL tears compared to subjects without PCL tears. Older age at injury was significantly associated with future arthritis ($p = 0.003$) and TKA ($p = 0.02$).

Conclusion: Isolated PCL tears remain a rare injury with an estimated annual incidence of 2 per 100,000 persons. Patients with isolated PCL tears have a significantly higher risk of symptomatic arthritis than patients without PCL tears. Older age at injury is associated with a higher risk of arthritis and the need for TKA. The results of this study can be used to educate patients about the natural history of isolated PCL tears and provide a baseline of expectations for the future development of arthritis and subsequent meniscal injury following PCL injury.

THE EFFECT OF PROLONGED STANDING ON GROUND REACTION FORCE CONTROL

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Prolonged standing (PS) substantially increases the risk of experiencing low back pain. However, the specific factors involved, and sex related differences are not fully understood. One factor may be bilateral asymmetries in posture. **PURPOSE:** The goal of this study was to examine the effect of prolonged standing on weight-bearing and ground reaction force control within healthy young adults during quiet stance. **METHODS:** Twenty-four subjects (12 male, 12 female) voluntarily participated in the study (age = 22.3 ± 2.4 years, height = 1.70 ± 0.09 m, mass = 69.89 ± 11.31 kg, BMI = 24.1 ± 2.5 kg/m² [mean \pm SD]). Subjects performed two 60 sec. quiet standing trials separated by one 30 min. free standing trial while ground reaction forces under each foot were measured. Forces were normalized to percent body weight (%BW). Sway, maximum velocity (maxV), and path length (PL) were calculated from the center of pressure (CoP) for both the dominant (D) and non-dominant (ND) foot, as well as net combined values. All CoPs were calculated in both the anterior-posterior (AP) and medial-lateral (ML) directions, and were normalized to standing height (%height). Weight-bearing (WBAs) and CoP asymmetries (CoPAs) were calculated by subtracting the ND limb from their D limb. **RESULTS:** There were no differences in WBA or CoPA between the pre- and post-PS trials, nor between the men and the women ($p > 0.05$). In both of the quiet stance trials, there were no significant differences between the D and ND limbs for WBAs, but the ND limb generally had a greater contribution to CoP movements than the D limb. There was an increase in four of the net CoP variables after PS exposure ($p \leq 0.003$). Significant negative correlations were found between WBAs and some CoPAs during the pre-PS trial ($p \leq 0.018$, $r \leq -0.660$) and the level of these significant correlations changed during the post-PS trial ($p \leq 0.024$, $r \leq -0.628$). Men and women exhibited different significant correlations for both trials. **CONCLUSION:** While these results suggest that 30 min of PS does not have an effect on WBA or CoPA during quiet stance, there appears to be an effect on net CoP movements, as well as sex related differences in the correlations between WBAs and CoPAs. These findings suggest that fatigue is potentially occurring.

Category: C

EXERCISE IN ROUTINE CANCER CARE

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Exercise reduces cancer-related side effects and improves quality of life. Exercise may enhance cancer prevention, treatment, and survivorship. The role of exercise as part of routine cancer care is unclear. **PURPOSE:** The purpose of this study is to determine exercise recommendation, prescription, and/or referral among healthcare professionals treating patients with cancer. **METHODS:** One hundred and fifty clinicians from Oklahoma will complete a survey indicating cancer treatment protocols and the role of exercise as part of care. Responses between oncologists, primary care physicians, and specialists will be compared. **RESULTS:** ANOVA will determine group differences at $p < .05$. Study results will be reported after completion of data collection and analysis. **CONCLUSION:** Previous study suggests that exercise has a minimal role in routine cancer care. Further study and effort in establishing exercise as an effective component of cancer care is proposed.

Mentor: Darling, TV

VALIDITY OF BAR SENSEI™ IN DETERMINING BARBELL VELOCITY AND A NOVEL MEASUREMENT
OF STARTING STRENGTH.

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ABSTRACT

Velocity based training (VBT) can be used to determine loading, track progress and monitor fatigue in the weight-room. Traditionally, technologies such as force plate systems or linear position transducers (LPTs) were needed to implement VBT. Force plates and LPTs are often outside the budget of many programs. Accelerometer systems have become popular for implementing VBT as they are significantly more affordable. The Bar Sensei™ accelerometer by Assess2Perform™ (Boulder, CO), claims to accurately measure traditional VBT metrics such as peak velocity, as well as a novel measurement called POP-100, which measures the bar velocity during the first 100ms of the concentric lift, often referred to as “starting strength”.

PURPOSE: The aim of the study was to determine the validity and reliability of the Bar Sensei™ for determining bar velocity and POP-100 during the squat compared to a standard force plate system.

METHODS: The 7 volunteers had 6.57 ± 2.23 years of squatting experience and had a mean 1RM squat of 130.7 ± 59 kilograms. After completing a warm-up, each participant performed three squats at 20, 40, 60 and 80% of their 1RM. All squats were performed on a force plate system (Pasco Scientific, Roseville CA), sampling at 500 Hz, with the Bar Sensei™ attached to the barbell. Force plate data was collected using Pasco Capstone™ software and was analysed in a custom Microsoft Excel spreadsheet.

RESULTS: Paired t-test's showed a significant difference ($p < 0.05$) between measurement devices. When all 84 lifts were analyzed, the Bar Sensei™ measured 0.12 m/s and 0.15 m/s higher than the force plates for peak velocity and POP-100, respectively. However, at 80% of participants' 1RM, paired t-test's showed that peak velocity was not significantly different based upon measurement device, $p = 0.419$. Across all loads, there is a significant linear relationship between both peak velocity ($r = 0.44$) and POP-100 ($r = 0.92$) measured by the Bar Sensei and force plates, $p < 0.001$.

CONCLUSION: While found to measure both peak velocity and POP-100 significantly higher than a force plate, the Bar Sensei™ appears to be a reliable measurement tool, especially at higher workloads, for tracking data over time. Future analysis should focus on additional metrics such as mean velocity and a variety of exercises to prove the worth of this promising device.

Title: Short Term Kefir Administration Does Not Alter Body Weight in Sprague Dawley Rats

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PURPOSE: Kefir is a fermented milk beverage containing lactic acid bacteria and yeast. Although this beverage has been used extensively for thousands of years, an exploration of the health benefits of kefir in society today is lacking. The purpose of this pilot study is to determine whether the addition of kefir to a liquid diet would alter short-term body weight changes in rats.

METHODS: Singly housed, male, Sprague Dawley rats (10 wks of age) were placed on one of two liquid diets (Control diet (CON), n=12; kefir diet (KEF), n=12). Diets (CON and KEF) were equal in calories, and macro and micronutrients. Animals were on a 12:12 light cycle in a temperature controlled room. Body weight was measured every 24 hours for 13 days. A Student's t test was used to compare the groups. Data is presented as mean \pm SD.

RESULTS: CON and KEF gained an average of 32.00 ± 26.70 g and 26.40 ± 45.19 g ($p=0.72$) over the course of the 13 day intervention dietary intervention period.

CONCLUSION: The addition of kefir to a liquid control diet does not significantly influence body weights over the course of a 13 day dietary adaptation period. This information is useful for individuals who are interested in exploring the health benefits of kefir.