Thematic Poster Session Format:
First 30 minutes of session – View posters
Remaining 90 minutes of session – Chair leads discussion

A-21 Thematic Poster – Inspiratory Muscle Training

MAY 30, 2007 9:30 AM - 11:30 AM
ROOM: 334

1174 **Chair: Craig Harms, FACSM.** *Kansas State University, Manhattan, KS.*

1175 ***Board #1*** **May 30** **9:30 AM - 11:30 AM**
Repeatability of the DeVilbiss Respiratory Muscle Trainer (RT2)

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PURPOSE: To present test-retest 'repeatability' of the DeVilbiss Respiratory Trainer (RT2) for maximal inspiratory pressure (MIP) and time of contraction (Tcont) of the inspiratory muscles (Tcon).

METHODS: Forty male subjects (20.8 ±1.3yrs) participated in the study. An inspiratory maneuver was completed to familiarize the subjects to the equipment. Each subject then performing one set of 3 sustained MIP maneuvers on study day 1, followed by a repetition of the 3 sustained MIP maneuvers 24 hours later (study day 2). For each subject was instructed to exhale to residual volume (RV), and then inhale maximally until total lung capacity (TLC) was reached, creating a single sustained maximum inspiratory effort from RV to TLC. Statistical analysis was performed using t-tests, correlation (r), coefficient of variation (CV), intraclass correlations (ICC) and 95% limits of agreement (95%LOA).

RESULTS: Table 1: Statistical Analysis of the Test-Retest Data

	Study Day 1 mean±SD	Study Day 2 mean±SD	Diff mean±SD	T-test (p)	r	CV	ICC	95%LOA	
									0.05±3.12
MIP (cmH_2O)	122.53±28.37	125.20±25.25	-2.68±9.38	0.657	0.945	3.99	1	-2.68±18.38	

A paired t-test demonstrated no significant difference (p>0.05) between study day 1 and 2 for MIP or Tcont. The test-retest data was highly correlated for MIP (r=0.949, ICC=0.99), and Tcont (r=0.855, ICC=1.19). The mean CV was low (<10%) indicating high reliability. The LOA demonstrate the bias of the data (t-test) and also the random measurement error. For both Tcont and MIP, the difference is low (0.05 and -2.68 respectively) but the random measurement error is large (3 sec and 18 cmH_2O respectively).

CONCLUSION: The data indicate that there is a small bias and a low CV. However, LOA suggests large random measurement error for Tcont and MIP (greater than 10%), suggesting that the RT2 is not repeatable.

1176 ***Board #2*** **May 30** **9:30 AM - 11:30 AM**
Inspiratory Muscle Training Does Not Alter Respiratory Functioning During Submaximal Exercise

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PURPOSE: Although past studies have examined the effects of respiratory training in athletes or subjects with pulmonary disorders, the current study determined if this training alters pulmonary functioning during submaximal exercise in subjects with no respiratory dysfunction.

METHODS: Subjects (age=21±0.9 yrs) were randomly assigned to control (C, n=11) or experimental group (E, n=10). Pre-testing included forced expiratory volume in 1.0 s (FEV1.0), forced vital capacity (FVC), and maximal voluntary ventilation (MVV). Minute ventilation (VE), rating of dyspnea (RD), and rating of perceived exertion (RPE) were collected at a specified submaximal stage (3.13 m/s) of a graded treadmill test. E completed six weeks of interval-based respiratory muscle training using an instrument designed to provide inspiratory resistance. Training regimen consisted of two sets of 25-30 breaths (3 X wk). C completed no respiratory training. Post-testing methodology was identical to pre-testing. Pre-test and post-test data for the E and C groups were analyzed via ANOVA for repeated measures (α=0.05).

RESULTS: There were no differences between C and E groups in FEV1.0, FVC, FEV1.0/FVC, or MVV (p=0.589, 0.937, 0.886, 0.981). Additionally, during submaximal exercise, there were no differences between C and E groups in RD, RPE, or VE (p=0.980, 0.821, 0.974).

	Control	Experimental
	Pre-test, Post-test	Pre-test, Post-test
RPE	4.55±1.81, 4.91±2.97	5.2±1.93, 5.7±1.95
Dyspnea	4.09±1.38, 4.91±2.30	4.7±2.21, 5.50±2.27
VE (L/min)	52.83±14.74,59.48±12.94	58.28±10.82, 65.13±13.01
MVV (L/min)	140.8±39.5, 136.6±35.5	156.5±43.8, 150.1±37.4
FVC (L)	4.83±1.33, 4.31±1.29	5.18±1.29, 4.89±1.33
$FEV_{1.0}$ (L)	3.91±1.15, 3.55±0.87	4.37±1.09, 4.21±1.06
$FEV_{1.0}$/FVC	81.6±11.9, 84.3±10.9	84.5±4.06, 86.7±4.57

CONCLUSION: A six-week targeted inspiratory muscle training program does not enhance maximal respiratory function or respiratory functioning during moderate intensity exercise in healthy, active individuals. It is possible the training regimen was insufficient to elicit an adaptation, the time frame was too short (six weeks) for adaptations to be measurable, or both.

1177 ***Board #3*** **May 30** **9:30 AM - 11:30 AM**
Efficacy of Three Weeks of Inspiratory Muscle Training on Pulmonary and Inspiratory Muscle Function

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PURPOSE: To examine the effect of 3 weeks of inspiratory muscle training (IMT) on pulmonary function, residual lung volume, and inspiratory muscle strength and endurance in well-trained endurance runners.

METHODS: A total of 14 [Eight male (20 ± 1 yr, 65.5 ± 4.8 kg, 67.4 ± 6.1 ml·kg-1·min-1) and six female (20 ± 2 yr, 55.3 ± 7.7 kg, 56.5 ± 4.1 ml·kg-1·min-1)] well-trained runners participated in this study. Participants were randomly assigned to either an experimental (N=7) or control group (N=7). Subsequent to 3 familiarization sessions, baseline measures for pulmonary function, residual lung volume, and inspiratory muscle strength and endurance were assessed. Participants visited the laboratory 3 times per week to perform IMT under supervision. The experimental and control group trained at 80% PI max and 20% PI max, respectively. Following 3 weeks of IMT, baseline (pre-IMT) measures were repeated in the experimental and control group.

RESULTS: No significant differences (p>0.05) were observed in pulmonary function, residual lung volume or inspiratory muscle endurance. However, there was a significant increase (p<0.05) in inspiratory muscle strength (PI max) post-IMT (176 ± 31.8 cmH2O) compared to pre-IMT (112 ± 22.4 cm H2O) in the experimental group, but no significant difference (p>0.05) in the control group.

CONCLUSION: Although, 3 weeks of IMT was of sufficient duration to induce an increase in inspiratory muscle strength, this was too short a duration to elicit changes in inspiratory muscle endurance, residual lung volume, and pulmonary function.

1178 ***Board #4*** **May 30** **9:30 AM - 11:30 AM**
Does Inspiratory Muscle Training Reduce Exercise-Induced Arterial Hypoxemia in Female Rowers?

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During heavy exercise, women demonstrate greater expiratory flow limitation, an increased work of breathing and perhaps greater exercise induced arterial hypoxemia (EIAH) compared to men.

PURPOSE: To examine the effects of inspiratory muscle training (IMT) on end-exercise arterial O2 saturation (Sa,O2), lung function at rest and rowing performance in highly-trained female rowers that exhibit severe EIAH.

METHODS: Sixteen highly-trained female rowers that exhibited severe (Sa,O2: ≤ 89%) EIAH, were divided into two groups: IMT (T; n=8 age: 19.3 yrs, weight: 65.4 kg, height: 173.1 cm) and control (C; n=8 age: 19.6 yrs, weight: 62.4 kg, height: 167.6 cm). T group, in addition to their daily rowing practice, performed IMT by means of a threshold inspiratory muscle trainer (POWER breathe®, IMT Technologies Ltd., Birmingham, UK) for ~0.5h·d-1, 5 times a week for six weeks. C group participated only in their regular daily rowing training. Prior to the initiation and at the completion of the 6 week IMT program, on three separate occasions both groups underwent: a) an incremental rowing ergometer test (Concept IIc, Nottingham, UK) b) a rowing ergometer 2000m all-out effort and c) a rowing ergometer 5 minute all-out effort without prior warm-up. Lung function was measured at rest.

RESULTS: Six weeks of IMT significantly (p<0.05) increased PImax from (Mean ± SEM) 93.1±7.3 to 143.2±6.9 (cmH20), FEF25 from 5.54±0.8 to 7.1±1.5 (L.sec-1), MVV from 146.5±17.5 to 164.0±16.0 (L.min-1), FEV1 from 4.06±0.4 to 4.92±0.41 (L), FVC from 4.53±0.2 to 5.0±0.2 (L), VCin from 4.32±0.5 to 4.61±0.3 (L), VEmax from 124.5±2.5 to 134.0±6.0 (L.min-1) and decreased Dimax from 0.89±0.1 to

0.84±0.1. IMT also increased Sa,O2 from 87.0±2.6 to 91.0±1.5 (%) and Powerav from 218.3±13.1 to 231.0±17.9 (W), and reduced Di from 1.08±0.1 to 1.03±0.1, rowing time from 487.4±11.5 to 461.4±22.87 (sec) during the 2000m all-out effort in the T group. Moreover, IMT significantly ($p<0.05$) increased rowing distance from 1285.3±17.1 to 1319.6±21.2 (m) during the 5 minute all-out effort without prior warm-up in the T group. In contrast, no changes in PImax or any other parameter were observed in the C group during the six week period.

CONCLUSIONS: We conclude that six weeks of IMT increases Sa,O2 and rowing performance in highly trained female rowers that exhibit severe EIAH.

1179 ***Board #5*** **May 30** **9:30 AM - 11:30 AM**

Effects of Inspiratory Muscle Training on Whole Body Exercise Performance in Males

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It has been shown in humans that following a bout of whole body endurance exercise at intensity level greater than 85% VO_2max the diaphragm response to supramaximal electrical stimulation was substantially lower compared to the pre-exercise response. This fatigue of the major inspiratory muscle could potentially be limiting to intense whole body exercise performance.

PURPOSE: To examine the effects of inspiratory muscle training (IMT) on whole body exercise performance time.

METHODS: Forty male subjects Gave informed consent and were randomly placed in four groups; a control group (N=10, CON), an inspiratory muscle training group (N=10, IMT), a whole body exercise group (N=10, WB), and a group doing whole body training followed by inspiratory muscle training (N=10, WB+IMT). WB training consisted of 10-20 minute on a cycle ergometer working at 90% VO2max. IMT required the subject to inspire against a resistive load set at 50% of the subjects measured maximal inspiratory pressure (MIP). The subject performed 30 maximal efforts at this load followed by a 10 minute break and then performed 30 more maximal efforts. The training sessions were done three times per week for six weeks. Pre and post training testing consisted of an incremental cycle ergometer test to determine VO2max and two 10 kilometer time trials (10 KmTT) on a cycle ergometer. The time to complete the 10 Km TT was used as the indication of performance. Comparisons of performance time were made between pre vs. post -training within a group and between groups.

RESULTS: The post-training performance times were significantly reduced for the IMT(97% of pre-training time), WB (96% of pre-training time) and WB+IMT(92% of pre-training time) groups versus pre-training times ($p<0.05$). The largest decrease in performance time was found in the WB+IMT group (8% lower vs. pre-training) and was substantially different vs. WB (4% lower) and IMT groups (3% lower) ($p<0.05$).

CONCLUSION: Improvements in whole body exercise performance due to IMT program may be enhanced by preceding the IMT training session with a short bout of intense whole body exercise.

B-18 Thematic Poster – Locomotion Mechanics

MAY 30, 2007 1:00 PM - 3:00 PM
ROOM: 334

1180 **Chair: Todd D. Royer.** *University of Delaware, Newark, DE.*

1181 ***Board #1*** **May 30** **1:00 PM - 3:00 PM**

Interlimb Asymmetry During Walking Following Unilateral Total Knee Replacement

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Walking abnormalities that remain following unilateral total knee replacement (TKR) may predispose the individual to a pattern of further joint deterioration in the contralateral limb. Stiff knee gait may reduce force attenuation in the limbs. Habitual reliance on the contralateral limb, reflected in asymmetrical mechanics, may result in deterioration of its joints.

PURPOSE: To determine whether interlimb differences in peak vertical force during loading (GRFPK), average and instantaneous loading rates (ALR, ILR), knee flexion excursion (KEXC) and knee joint stiffness (KSTIF) exist following TKR.

METHODS: Healthy older adults with previous TKR (n = 12) provided informed consent and participated. Gait data were collected at 120Hz (1080Hz analog) as subjects walked at their typical speed across two force platforms. Data from five trials were averaged for analysis. Effect size (ES) was used to investigate the hypothesized differences between limbs.

RESULTS: The uninvolved limb bears a larger peak force during the loading phase of gait than the involved limb, although loading rates are similar. The uninvolved limb is also stiffer and goes through greater knee flexion excursion during loading, indicating a greater knee extension moment in the uninvolved limb.

Table 1: Variables of interest in involved and uninvolved limb, mean (standard deviation)

	GRFPK	ALR	ILR	KSTIF	KEXC
Involved	1.03 (0.06)	5.70 (1.61)	10.96 (3.27)	0.024 (0.012)	9.8 (4.4)
Uninvolved	1.08 (0.05)	5.71 (1.31)	11.78 (3.60)	0.034 (0.019)	12.1 (5.7)
ES	0.89	0.01	0.24	0.63	0.46

GRFPK in BW; ALR, ILR in BW/s; KEXC in degrees; KSTIF is change in normalized joint moment (Nm/(mass, kg x height, m) divided by change in joint angle (degrees).

CONCLUSION: Greater loading of the uninvolved limb may be related to further joint degeneration in this limb.

1182 ***Board #2*** **May 30** **1:00 PM - 3:00 PM**

Relationship Between Speed and Peak Ground Reaction Force During Locomotion in Lunar Gravity

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The relationship between ground reaction force and locomotion speed in normal gravity is well established. Although there have been attempts to examine the effect of reduced gravity on ground reaction forces, there are no data that relate the magnitude of ground reaction force to speed during locomotion in lunar gravity.

PURPOSE: To determine the relationship between speed and peak vertical ground reaction force (pGRF) during locomotion in lunar gravity.

METHODS: Seven subjects (5 male/2 female) walked and ran on an instrumented treadmill during parabolic flight onboard a C-9 aircraft. Subjects completed multiple trials over a range of locomotion speeds between 0.45 and 2.52 m/s in lunar gravity (1/6th earth gravity). The instrumented treadmill collected vertical ground reaction forces at 480 Hz. The pGRF was found for eight bilateral footfalls and normalized to the subject's lunar bodyweight (LBW). Linear regression was used to examine the relationship between speed and mean pGRF. Separate regression analyses were performed for walking and running.

RESULTS: For both walking (0.45 to 1.65 m/s) and running (0.98 to 2.52 m/s), pGRF was directly related to locomotion speed ($p<0.05$). The pGRF magnitudes ranged from 1.38 to 2.94 LBW during walking, and from 1.93 to 4.81 LBW during running.

CONCLUSION: These results demonstrate that pGRF is affected by speed in a lunar gravity environment. The relationship between speed and pGRF is stronger for walking ($r=0.81$) than for running ($r=0.47$). This discrepancy is likely due to the increased variability in pGRF at higher locomotion speeds. In addition, when normalized to LBW, pGRF magnitudes are larger than comparable earth values. This may be due to the dominant role that inertial forces exert over gravitational forces during lunar gravity locomotion.

1183 ***Board #3*** **May 30** **1:00 PM - 3:00 PM**

Changes in Ground Reaction Forces in Modified Short-leg Walkers during Gait

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It has been shown that short-leg walking boots alter kinematics, joint kinetics and ground reaction forces (GRFs) during gait. The altered GRF variables may be associated with the increased heel height on the walker side compared to the shoe side. By modifying the walking boots, it was hypothesized that the diminished heel height difference between the walker side and the shoe side would restore GRF characteristics closer to those in normal walking.

PURPOSE: To examine effects of heel height modifications on the walker and shoe sides on GRF characteristics during level walking.

METHODS: Ten (four males, six females) subjects performed five level walking trials in each of six randomized conditions: lab shoes (Shoe), Gait walker (GW), Gait Walker with heel insert (GWHI), Gait walker modified (GWM), Equalizer walker (EW), and Equalizer walker with heel insert (EWHI). A force platform (1200 Hz) and a seven-camera motion analysis system (120 Hz) were used to collect GRF during the testing session. Visual 3D and customized computer software were used to obtain GRF data. A two-way (2 × 6: side × condition) mixed design ANOVA was used to examine selected peak GRF related variables and post hoc comparisons with an alpha level ($p < 0.05$) adjusted for multiple comparisons through a Bonferroni procedure.

RESULTS: The application of a walker created a peak GRF prior to the normal peaks associated with the loading response in both vertical and anteroposterior GRFs. Wearing a walker introduced an elevated minimum vertical GRF in GW (0.88 BW), GWHI (0.89 BW), GWM (0.89 BW) and EWHI (0.88 BW) compared to Shoe (0.82 BW) on the shoe (left) side. Peak propulsive GRFs were smaller in all five walker conditions (0.13 - 0.15 BW) compared to Shoe (0.20 BW) on the walker side. The

same peak was smaller in GWHI, EW and EWHI on the walker side compared to the shoe side whereas it was greater on the right side than the left side in Shoe.

CONCLUSION: The application of heel insert in GWHI and GWM (on shoe side) does not diminish the minimum vertical GRF as hypothesized. Wearing a walker decreases the peak propulsive ground reaction force on the walker side and induces asymmetrical loading.

1184 *Board #4* **May 30 1:00 PM - 3:00 PM**

Footstrike Patterns During Barefoot Running

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PURPOSE: The purpose of this study was to determine if runners changed how their foot struck the ground when running barefoot versus running shod.

METHODS: Subjects (n = 10; 23.7 ± 2.9yrs, 170.7 ± 9.4cm, 70.1 ± 14.2kg) ran at preferred speeds across a 10m indoor runway over a force platform while shod and in a barefoot condition. Subjects were instrumented with 7-25mm reflective markers placed medially (head and base of the first metatarsal, medial malleolus, and shared heel marker) and laterally (head and base of the fifth metatarsal, lateral malleolus, and shared heel marker) on the right foot and ankle. Seven to ten trials were completed for each subject condition, with motion capture (120Hz) and ground reaction force (GRF, 1080Hz) data simultaneously recorded. For each trial, vertical and horizontal position data at ground contact were extracted to calculate Ground Contact Index (GCI), a measure of foot contact. Ground contact was identified as the point where the vertical GRF reached 20 N. Zero vertical position for each marker was the height of the marker while standing with weight evenly distributed between the feet. Vertical versus horizontal position scatter plots were created for the medial and lateral marker sets. Each scatter plot was fit with a first order polynomial with the slope recorded to represent GCI. A greater GCI is representative of a heel-toe contact; GCI close to zero is representative of a mid-foot contact and GCI less than zero is representative of a forefoot contact. Medial and lateral GCI were each statistically analyzed between running conditions using paired t-tests.

RESULTS: GCI was significantly different ($p<0.001$) between shod and barefoot conditions for both the medial (med) and lateral (lat) sides of the foot. GCI in barefoot running (med: 0.276 ± 0.181 lat: 0.207 ± 0.178) was less than GCI in shod running (med: 0.558 ± 0.147 lat: 0.478 ± 0.137).

CONCLUSION: There was a difference in the footstrike of runners from shod to barefoot as indicated by the change in GCI. However, it is interesting to note that in barefoot running GCI is still indicative of some degree of a heel-toe footstrike pattern though observed to be less in barefoot versus shod running. It is conjectured that the difference in GCI occurred in order to modulate impact magnitude when running barefoot.

1185 *Board #5* **May 30 1:00 PM - 3:00 PM**

A Gait Analysis of a Patient with Peroneal Nerve Injury

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Injury to the peroneal nerve will result in dysfunction of the dorsiflexors and evertors. This dysfunction may cause acute changes in gait pattern. However, long term accommodations may lead to some degree of compensation. These compensations may cause further complications due to modified force on a specific joint or muscle**.**

PURPOSE: The purpose of this study was to quantitatively compare gait parameters between healthy and affected limb in a patient whose left peroneal nerve was injured 5 years ago.

METHODS: A male college student whose left peroneal nerve was severed near the knee joint in an accident 5 years ago participated in this study. Kinematic and kinetic data were recorded by using Vicon 3D (Oxford, UK). The subject performed 7 trials of preferred speed walking. Plug-in-gait model was used to calculate kinematic and kinetic parameters. Differences between left and right limb were tested by using the paired T-test ($\alpha = 0.05$).

RESULTS: No significant difference was observed in several gait characteristics, such as double support duration and step length. However, ankle angle at foot strike and toe off (left: 105°/95° ; right: 99°/108°.$P< 0.01$; Ankle angle is 90° when subject is standing and increase with plantar flexion) and maximum knee flexion angle (left: 69°; right: 63° $P<0.001$) were significant different between left limb and right limb. Significant differences are also observed in maximum vertical component of ground reaction force (left: 816 N; right: 968 N, $P<0.001$), maximum anterior-posterior component of ground reaction force (left: 173 N; right 182 N; $P<0.001$; forward is positive) and maximum ankle joint plantar flexion moment (left: 113 N.M, right: 141 N.M; $P<0.01$).

CONCLUSION: The results of this study show that although some of the temporal characteristics of gait were not affected by peroneal nerve injury during walking at preferred speed, functional loss of dorsiflexors and evertors resulted in less plantar flexion moment and ground reaction force on the affected side. The possible reason for the weakness of planter flexor muscles is due to lack of antagonist contraction load during daily activity. To avoid the degeneration later in life and improve locomotion, specific exercises focusing on dorsal flexor muscles and planter flexor muscle should be recommended.

1186 *Board #6* **May 30 1:00 PM - 3:00 PM**

The Effect of Footwear on Hip and Knee Mechanics in Low Arched Runners

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Runners with low arches (LA) and excessive eversion are suggested to be at a greater risk for patellofemoral pain syndrome (PFPS). As a result, motion control shoes are often recommended for these individuals. However, little is known about how footwear affects hip and knee mechanics that are potentially related to PFPS.

PURPOSE: To examine the effect of motion control shoes on hip and knee mechanics in LA runners.

METHODS: Twenty LA recreational runners (>10 miles per week) were recruited for the study. LA runners were classified as having an arch height index two standard deviations below a previously established normative value (0.340 +/- 0.03). Three-dimensional kinematics and kinetics were collected on the runners as they traversed a 25m runway at 3.7 ms +/- 5% which had a force plate located at its center. Subjects ran in both a cushioning running shoe (C) as well as a motion control running shoe (MC). The footwear order for each subject was randomized. Discrete kinematics and kinetics at the hip and knee were examined between footwear conditions using an Independent samples t-test.

RESULTS: There were no differences between footwear conditions for peak knee internal rotation, peak knee adduction, peak knee abduction moment, peak hip adduction, or peak hip abduction moment. The peak knee external rotation moment was greater for the MC compared to the C ($p<0.01$).

CONCLUSIONS: These results would suggest that, aside from the knee external rotation moment, hip and knee mechanics were similar between footwear conditions. Future studies should focus on the effect of footwear on patients experiencing PFPS, who may gain greater benefits than healthy controls.

Supported by the American College of Sports Medicine Doctoral Research Grant and New Balance Athletic Shoes.

C-21 Thematic Poster – Metabolic Syndrome, Insulin, and Diabetes Risk

MAY 31, 2007 8:00 AM - 10:00 AM
ROOM: 334

1187 **Chair: Shannon J. FitzGerald.** *The Cooper Institute, Dallas, TX.*

1188 *Board #1* **May 31 8:00 AM - 10:00 AM**

Physical Activity, Stress and the Metabolic Syndrome in 8-18 Yr Old Boys

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The origins of obesity and metabolic syndrome occur early in childhood; therefore understanding the impact of lifestyle factors on obesity and related metabolic diseases is an important child health issue.

PURPOSE: The purpose of this study was to examine the moderating effects physical activity may have on the relationship between measures of stress and the components of the metabolic syndrome in 8-18 year old males.

METHODS: Participants were 37 males ages 8 to 18 yrs. Anthropometric variables were determined by standard procedures. Physical activity was assessed using the Actigraph accelerometer. Television viewing (TV) and video game playing times were assessed via questionnaire. Waking salivary cortisol was assayed using a commercially available ELISA kit. Self-report measures of stress were assessed using the Physical Appearance Related Teasing Scale, Perceived Stress Scale, Children's Depression Inventory, State-Trait Anxiety Inventory for Children, and Self-Esteem Questionnaire. Blood pressure was measured according to American Heart Association procedures. Blood cholesterol and HbA1c were collected by finger prick and assessed using a desktop analyzer. A composite score for the metabolic syndrome was generated by summing the age-standardized z-score for HbA1c, MAP, HDL-C, and WC.

RESULTS: Correlations between physical activity and metabolic syndrome were low, but in the expected direction after adjustment for age and maturity ($r<-0.13$). TV and video games playing time were significantly associated with the metabolic syndrome score ($r= 0.39$ and 0.43, respectively). There were significant correlations between school-related self-esteem ($r=-0.46$) and general appearance related teasing ($r=-0.36$) and the metabolic syndrome score. The correlation between anxiety and the metabolic syndrome score was significant in the low physical activity group ($r=0.53$) and null in the high physical activity group ($r=0.07$).

CONCLUSIONS: The results show preliminary but suggestive evidence that physical activity buffers the relationship between aspects of stress and the metabolic syndrome.

1189 *Board #2* **May 31 8:00 AM - 10:00 AM**

Prevalence of the Metabolic Syndrome among Native Japanese and Japanese Immigrants to Brazil

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PURPOSE: This study investigated the prevalence of risk factors associated with metabolic syndrome (MetSyn) among native Japanese and Brazilians of Japanese ancestry residing in Japan and Brazil.

METHODS: A cross-sectional study to assess component risk factors for the diagnosis of the MetSyn was undertaken in urban areas in Japan and Brazil. A total of 773 men and women aged 35 years or over were included in three groups: 249 native Japanese, 269 Brazilians of Japanese ancestry residing in Japan, and 255 Brazilians of Japanese ancestry residing in Brazil.

RESULTS: Higher rates of metabolic abnormalities with respect to central obesity and serum lipid profiles were observed among Brazilians of Japanese ancestry residing in Brazil compared to those residing in Japan and native Japanese. Increased risk for hypertension was observed among Japanese Brazilians residing in Japan. The prevalence of MetSyn in men was significantly higher among Brazilians of Japanese ancestry residing in Brazil (37.5%) compared to those residing in Japan (25.3%) or native Japanese (21.4%), whereas no significant difference was observed among women. In the logistic model, Brazilians of Japanese ancestry residing in Brazil were observed to be twice as likely to develop MetSyn compared to native Japanese.

CONCLUSIONS: These findings underscore the significant heterogeneity in risk factors for developing coronary heart disease among communities of Japanese ancestry residing in Brazil and Japan, and suggest that immigrants exposed to the Brazilian cultural environment are more susceptible to the development of MetSyn than native Japanese.

1190 *Board #3* **May 31 8:00 AM - 10:00 AM**

Fitness and the Predisposition to Metabolic Syndrome in Japanese Men and Women

Kiyoshi Sanada[1], Kenta Yamamoto[1], Motohiko Miyachi[2], Hiroshi Kawano[3], Yuko Gando[3], Michiya Tanimoto[2], Taewoong Oh[2], Yumi Omori[2], Katsuhiko Suzuki[3], Izumi Tabata, FACSM[2], Mitsuru Higuchi, FACSM[3]. *[1]Waseda University, Tokyo, Japan. [2]National Institute of Health and Nutrition, Tokyo, Japan. [3]Waseda University, Saitama, Japan.*
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There is little information on the relationship between cardiorespiratory fitness (VO_2max) and metabolic syndrome (MS).

PURPOSE: To investigate the effect of fitness on the predisposition to MS (MSP) in Japanese men and women.

METHODS: Sedentary and moderately active men (n = 85) and women (n = 271) aged 30-84 yrs participated in this study, and were divided into 4 groups; 48 healthy men, 37 MSP men (up to 2 or more risk factors involved abdominal obese), 237 healthy women, and 34 MSP women. We measured VO2max during an incremental cycle ergometer exercise test. Serum HDL-cholesterol, triglycerides, and plasma glucose were measured in all subjects. Total and regional lean soft tissue and fat mass were also measured using Dual-energy X-ray absorptiometry (DXA).

RESULTS: A total of 24 men (28.2%) and 9 women (3.3%) developed MS. In addition, a total of 37 men (43.5%) and 34 women (12.5%) were involved MSP. VO2max in men and women with MSP (31.5 ± 4.7 and 25.2 ± 5.5 ml/kg/min) were significantly ($P < 0.05$) lower than in healthy men and women (35.9 ± 5.9 and 30.3 ± 5.4 ml/kg/min). Leg extension power in MSP men and women (18.9 ± 5.8 and 12.0 ± 4.3 Watts/kg) were also significantly ($P < 0.05$) lower than in healthy men and women (24.1 ± 6.6 and 13.7 ± 4.0 Watts/kg). VO2max in men with at least three risk factors and women with at least two risk factors were significantly lower than healthy men and women ($P < 0.01$). When all subjects were divided into high and low cardiorespiratory fitness, men (23.5%) and women (5.2%) with high fitness had a lower predisposition to MS rather than men (47.9%) and women (20.0%) with low fitness ($P < 0.01$). The mean number of risk factors in men and women with high fitness (0.9 ± 0.1 and 0.6 ± 0.7, $P < 0.05$) was significantly lower than in men and women with low fitness (1.7 ± 1.2 and 1.0 ± 1.0, $P < 0.05$). Furthermore, the mean number of risk factors in men was significantly higher than in women ($P < 0.05$).

CONCLUSION: The prevalence of MS in Japanese men was higher than that in women. Poor VO2max associated with the prevalence of MSP in men and women. These results suggest that cardiorespiratory fitness is a useful predictor of MSP in both men and women.

1191 *Board #4* **May 31 8:00 AM - 10:00 AM**

Physical Activity and the Incidence of Type 2 Diabetes in Korean Men and Women

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Physical activity is one of the most important modifiable factors in the prevention of type 2 diabetes. However, it is unclear whether physical activity prevents type 2 diabetes in Koreans with impaired fasting glucose.

PURPOSE: The purpose of this study was to determine the relative associations of physical activity with the incidence of type 2 diabetes among Koreans with impaired fasting glucose.

METHODS: This prospective cohort study was conducted in 17,355 men, and 4,118 women, aged 30-69 years, with impaired fasting glucose at baseline who had undergone biennial medical evaluation through the National Health Insurance Corporation between 2000 and 2004. Impaired fasting glucose was defined as fasting glucose 100 to 125 mg/dl, and the subjects were divided into 3 groups depends on physical activity level, regular exercise group ≥3 days per week, irregular exercise group 1-2 days per week, and nonexercise group. During a 5-year follow-up, 1,812 men, and 186 women developed type 2 diabetes in people with impaired fasting glucose. Multivariate logistic regression was used to evaluate the association between the baseline physical activity status and incidence of type 2 diabetes. Analyses were performed separately in men and women and were adjusted for age, body mass index(BMI), blood pressure, cholesterol, smoking status, and a family history of diabetes.

RESULTS: In total impaired fasting glucose group, compared with regular exercise men, adjusted relative risk(RR) of type 2 diabetes among nonexercise men was significantly higher(RR=1.236, 95% CI=1.080-1.415, $p<.05$), and RR for women who had no exercise was higher than regular exercise group(RR=1.131, 95% CI=0.644-1.998, $p<.05$) but it was not statistically significant. In obesity group among total impaired fasting glucose group, RR for men who had no exercise was significantly higher(RR=1.375, 95% CI=1.139-1.660, $p<.05$) than regular exercise men, but RR for women among nonexercise group was not significantly higher than regular exercise group(RR=1.169, 95% CI=0.497-2.745, $p<.05$).

CONCLUSIONS: Physical activity is effective in preventing type 2 diabetes in men with impaired fasting glucose, also obese men with impaired fasting glucose. Men in diabetes high risk group are recommended to participate in regular physical activity to prevent type 2 diabetes.

1192 *Board #5* **May 31 8:00 AM - 10:00 AM**

Association of Resistance Exercise with Impaired Glucose Metabolism in Adults - A Population-based study

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The importance of resistance exercise for the promotion of healthy living, particularly the maintenance of muscle mass and strength, is widely recognized. Maintaining muscle mass may be protective against the development of insulin resistance and type 2 diabetes. However, little is known about the epidemiological relationship between resistance exercise and impaired glucose metabolism, independent of total physical activity (PA) time.

PURPOSE: We examined the association of participation in resistance exercise with impaired glucose metabolism in Australian adults.

METHODS: This population-based cross-sectional study undertaken in 2004/2005 (AusDiab) included 5,775 adults aged ≥ 25 years who were free from diagnosed diabetes mellitus. Impaired glucose metabolism (impaired fasting glycemia, impaired glucose tolerance or undiagnosed diabetes) was based on an oral glucose tolerance test (1999 WHO criteria). Self-reported resistance exercise time (BRFSS) and total PA time (previous week) was assessed using an interviewer-administered questionnaire.

RESULTS: There were 1,036 individuals identified as having impaired glucose metabolism. The percentage of adults who reported participating in some form of resistance exercise was similar in men and women (20.6%) and decreased with advancing age ($p = 0.001$). In those with impaired glucose metabolism, 14.0% reported some resistance exercise in the previous week, compared to 22.0% in those with normal glucose metabolism. In multivariate regression analyses adjusted for age, education, smoking, parental history of diabetes, TV viewing time and total PA time, the odds ratio (OR) of having impaired glucose metabolism were 1.63 (95% CI: 1.2-2.2) in men and 1.32 (1.0-1.7) in women who did not undertake resistance exercise, compared with those who reported some resistance exercise. Further adjustment for waist circumference attenuated the associations; they remained significant in men [OR 1.5 (1.1-2.0)], but not in women [OR 1.2 (0.9-1.6)].

CONCLUSIONS: These findings suggest a protective effect of resistance exercise, independent of total PA time, on impaired glucose metabolism in adults. Resistance exercise should be considered in programs addressing the primary prevention of diabetes in persons with impaired glucose metabolism.

1193 ***Board #6*** **May 31 8:00 AM - 10:00 AM**

Muscle Strengthening Activity And Its Association With Fasting-state Insulin Sensitivity

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Muscle strengthening activity (MSA) may increase insulin sensitivity thereby reducing diabetes risk.

PURPOSE: To demonstrate the relationship among MSA, and insulin sensitivity among American adults.

METHODS: 4,760 individuals without diabetes medication aged 20 to 79 years from the NHANES 1999-2004 had MSA information. Self-reported frequency (times/week) of MSA was used to create 3 groups: low (<1), moderate (1-2.9), and high (≥ 3). Insulin sensitivity was measured via fasting Quantitative Insulin Sensitivity Check Index x 100 (QUICKI).

RESULTS: After adjustment for age, race, other physical activity, BMI, smoking and alcohol consumption, and daily total caloric intake, according to low-, moderate- and high MSA, the means of QUICKI were, respectively, 33.4, 33.7, and 33.9 ($p < 0.05$) for men, and 34.0, 34.5, 34.5 ($p < 0.05$) for women. Means of fasting insulin (U/ml) were 13.1, 12.6, 11.5 ($p < 0.05$) for men, and 11.5, 10.8, 10.4 ($p < 0.05$) for women. There were no statistically significant differences for fasting glucose.

CONCLUSIONS: MSA is independently associated with higher insulin sensitivity among men and women. MSA may be a realistic, feasible and effective modality for the prevention of diabetes among the U.S. adults.

D-18 Thematic Poster – Factors which Influence Health and Performance of Firefighters and Military Personnel

MAY 31, 2007 1:00 PM - 3:00 PM
ROOM: 334

1194 **Chair: James A. Hodgdon, FACSM.** *Naval Health Research Center, San Diego, CA.*

1195 ***Board #1*** **May 31 1:00 PM - 3:00 PM**

Impact of Pre-Participation Hydration Status on Structural Firefighter Cardio-Respiratory Response to Standard Training Activities

Jim Brown[1], Alex Derchak[2], Angela Bennett[3], Martin LePore[3], Steve Edwards[3]. *[1]University of Indianapolis, Indianapolis, IN. [2]VivoMetrics Government Services Inc, Ventura, CA. [3]University of Maryland, College Park, MD.*

PURPOSE: One hundred ninety professional and volunteer firefighters (Age: 31± 9.0 yrs, Height: 70 ± 3.0 in, Weight: 198.6 ± 34.5 lbs) were recruited for a study to examine the physical stress associated with standard firefighter training activities.

METHODS: Prior to participation, hydration status was determined from urine specific gravity (Usg). Subjects executed four work scenarios consisting of a structural maze (MZ) evolution and three live-fire evolutions (B1, B2, &RIT). During work evolutions, subjects wore personal protective equipment (PPE), breathing apparatus (SCBA), a LifeShirtTM ambulatory physiology-monitoring device (LS) and were provided water for hydration ad libitum. During all evolutions, subject heart rate (HR), percent of age-predicted maximum heart rate (%HRmax), and minute ventilation (VE) were monitored by LS. The three-story, near-total-darkness MZ evolution was executed individually while subjects were randomly assigned to teams of four individuals for Burn evolutions. Burn evolutions were executed in a three-story fixed burn structure and were separated by mandatory rest periods. Burn evolution one (B1) was a third-floor fire scenario with high heat exposure. Burn evolution two (B2) was a first-floor fire scenario with a dummy-victim rescue. Subjects executed Burn evolution three as a rapid insertion team (RIT) wearing PPE and SCBA. During RIT, subjects did not enter the burn structure allowing RIT to serve as a physical activity and heat-exposure control device.

RESULTS: Subjects were determined to be in either an adequately hydrated (HYD: Usg < 1.020) or a dehydrated state (DHYD: Usg ≥ 1.020). Compared to DHYD, HYD demonstrated significantly lower HR, and %HRmax during both B1 (HYD-HR: 135.2 ± 9.3 bpm vs. DHYD-HR: 151.1 ± 3.37 bpm, HYD-%HRmax: 69.4 ± 4.78 % vs. DHYD-%HRmax: 80.5 ± 1.73 %) and B2 (HYD-HR: 131.6 ± 13.3 bpm vs. DHYD-HR: 149.1 ± 11.8 bpm, HYD-%HRmax: 67.4 ± 5.80 % vs. DHYD-%HRmax: 78.7 ± 6.10 %). VE did not differ between hydration groups during any evolution

CONCLUSIONS: Subjects beginning the training day in a dehydrated state demonstrated significantly higher cardiovascular stress than their adequately hydrated counterparts. The nature of these firefighter-training scenarios prohibits subjects from being able to recover from a pre-participation dehydrated state.

1196 ***Board #2*** **May 31 1:00 PM - 3:00 PM**

Firefighter Cardio-Respiratory Stress Is Elevated During Post Flashover Simulation Recovery

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PURPOSE: During an annual Flashover training drill, the LifeShirtTM ambulatory physiology monitor was used to assess cardiovascular and respiratory responses of 10 professional firefighters. The average firefighter age was 31.3 ±8.3 years (range: 22-47) with a minimum of 2 years of professional service experience. Flashover is a high heat exposure drill executed within a specialized chamber for the purpose of teaching awareness of factors leading to lethal real-life flashover events.

METHODS: Firefighter heart rate (HR), breathing frequency (Br/M), minute ventilation (VE) and tidal volume (VT) were monitored during a pre-event rest period (PRE), the heat exposure period (HE) and during a post-event recovery period (POST). During HE, firefighters wore full personal protective equipment and breathing apparatus. Using specific heat loads and control of airflow within the chamber, flashover events are initiated in a controlled environment.

RESULTS: Temperatures inside the chamber averaged 900 ± 100 0F, at 8ft above floor level, 600 ± 75 0F at 5ft above floor level, and 300 ± 60 0F at the 2ft above floor level. Firefighter HR was significantly elevated POST compared to all other periods (PRE: 99.5 ± 21.7 beats/minute vs. HE: 110.5 ± 18.9 beats/minute vs. POST: 142.2 ± 26.7 beats/minute). HR did not differ between PRE and HE periods. Br/M was elevated POST compared to all others (PRE: 25.6 ± 7.7 breaths/minute vs. HE: 25.8 ± 6.1 breaths/minute vs. POST: 36.4 ± 5.1 breaths/minute). Br/M did not differ between PRE and HE. VE was higher POST compared to all other periods (PE: VE: 20.0 ± 14.6 vs. HE: VE: 21.7 ± 10.7 L/m). VE did not differ between PRE and HE. VT did not differ among test periods.

CONCLUSIONS: Elevated physiological stress during the passive post-event recovery period may be a core body temperature protective mechanism. If so, the cardiovascular response should be considered a potential contributor to firefighting-related death.

1197 ***Board #3*** **May 31 1:00 PM - 3:00 PM**

The Effect Of Exercise Induced Pre-Warming On Core Temperature During A Live Fire 'Search-and-Rescue' Task

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Professional fire-fighters usually work 24-hour shifts. Although fighting fires is one of their most important tasks, other, non-fire fighting related physically demanding activities such as practicing, workouts and maintenance, form the main part of a shift. These activities may have a warm-up effect on the fire-fighter's body temperature. This rise in core temperature may lead to a faster onset of heat stress symptoms during fire fighting. It may also shorten the maximal acceptable working time of a fire fighting task.

PURPOSE: To explore the effect of exercise-induced pre-warming on the body core temperature during a fire fighting task under realistic conditions.

METHODS: 8 professional fire-fighters of the Amsterdam Fire Brigade performed a standardized live fire 'search-and-rescue' task twice over two days. Standard turn-out gear and SCBA (Self Contained Breathing Apparatus) were used. Prior to one of both 'search-and-rescue' tasks the fire-fighters carried out a 20-min. weight-dependent (1.5 W.kg-1) bicycle ergometer test to provoke an exercise-induced pre-warming effect. During both testing days, core temperature was recorded using an ingestible core body temperature pill (CorTempTM, HQ Inc., USA). Performance time on the 'search-and-rescue' task was also recorded.

RESULTS: Preliminary results show a higher mean core temperature during the combined bicycle ergometer test / 'search-and-rescue' task when compared to the single 'search-and-rescue' task (37.84 (SD=0.30) vs 37.59°C (SD=0.21)). The absolute highest core temperature was also higher during the combined test (38.38 vs 38.02°C). Preliminary results also show that the mean performance time of the 'search-and-rescue' task during the combined bicycle ergometer test / 'search-and-rescue' task was 6.2% higher when compared to the single 'search-and-rescue' task.

CONCLUSIONS: Moderate, non-fire fighting related exercise prior to a fire fighting task may lead to a higher core temperature during fire fighting. Consequently, earlier onset of symptoms of heat stress during a common fire fighting task may occur.

1198 *Board #4* **May 31 1:00 PM - 3:00 PM**

Physiological Consequences of Leather and Rubber Boots in Men and Women Firefighters

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Most firefighters wear heavily insulated rubber boots or lighter leather boots. A five to 12% increase in oxygen consumption per kg of weight added to the foot has been observed; however, the increase may depend on gender, boot material, and whether or not subjects are wearing additional protective clothing or equipment.

PURPOSE: To determine the effects of two leather (L1, L2) and two rubber (R1, R2) boots on firefighters' metabolic and respiratory variables during simulated firefighting tasks.

METHODS: Eighteen women and 21 men, while wearing full turnout gear and one of four randomly assigned pairs of firefighter boots, walked for six minutes at three mph on a treadmill while carrying a 9.5-kg hose and then climbed a stair ergometer for six minutes at 45 steps/min. Minute ventilation (VE), oxygen consumption (VO2 and VO2kg), CO2 production (VCO2), and heart rate (HR) were measured, and an average of breath-by-breath data from minute six was used for analysis of covariance with repeated measures.

RESULTS: During treadmill exercise, boot weight had a significant effect ($p \leq 0.05$) on VO2 and VO2kg for men only (*), whereas boot weight had a significant effect ($p \leq 0.05$) on VE and VCO2 for both men and women (**). There were no significant effects of boot weight during stair climbing. There were no significant effects of boot material on any variables during either mode of exercise.

Boot	Boot Weight (kg)	VE (L/min, BTPS)	VO_2 (L/min, STPD)	VCO_2 (L/min, STPD)	VO_2kg (ml/kg/min, STPD)	HR (bpm)
Treadmill						
L1	2.5	50.6**	1.90*	1.59**	23.1*	149
L2	2.7	52.4**	1.96*	1.64**	23.7*	149
R1	3.2	53.2**	1.96*	1.67**	23.9*	155
R2	3.6	54.2**	2.02*	1.71**	24.6*	156
Stairs						
L1	2.5	54.7	2.02	1.79	24.7	161
L2	2.7	54.2	2.02	1.80	24.7	155
R1	3.2	56.9	2.09	1.87	25.2	165
R2	3.6	56.0	2.06	1.84	25.1	164

CONCLUSION: During treadmill exercise, each additional kg of boot weight was associated with a significant 6.5% increase in VE for both men and women and with a significant 8% increase in VO2 and VO2kg for men only.

Disclaimer: *"The findings and conclusions in this abstract have not been formally disseminated by NIOSH and should not be construed to represent any agency policy."*

1199 *Board #5* **May 31 1:00 PM - 3:00 PM**

Does Loaded Marching Economy Explain Some of the Variance in Loaded Marching Performance?

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Previous attempts have been made to identify physical and physiological variables that predict Loaded Marching Performance (LMP) (Williams and Rayson, 2006, *Mil Med*, 171, 1-7). However, the contribution of specific, sub-maximal measures such as LM Economy (LME) remains unexplored.

PURPOSE: To develop a model to predict 2.4-km LMP from selected physical and physiological variables.

METHODS: Forty-three (n=43) male infantry recruits, age (mean ± SD) 19.1 ± 2.1 years, stature 174.9 ± 5.8 cm, mass 69 ± 8.5 kg were physically assessed during weeks 1 and 2 of a 24-week British Army infantry training course. During week-1 recruits underwent a battery of physical tests that consisted of: anthropometry (height, mass, muscle girths and 8-site skinfolds); strength (dynamic and isometric); treadmill LME (steady state VO2 while carrying 25 kg, at 6.5 km·h-1 for 8-minutes), maximal incremental running (VO2max) and the Personal Fitness Test (PFT: 2.4-km run, 2-min press-ups, 2-min sit-ups). During week-2 a 'best effort' 2.4-km LMP test (with 20 kg) was conducted. Significant relationships ($P<0.05$), between LMP and the independent physical and physiological variables were assessed using Pearson's product moment correlation. A maximum of 3 variables were entered into the multiple regression analysis at any one time.

RESULTS: Data are presented as mean ± SD. LMP ranged from 12:49 to 18:11 min:s (15:29 ± 1:19 min:s). LME (ml·kg-1·min-1) ($R = 0.65$, $P<0.01$), peak static lift strength (kg) ($R = -0.48$, $P<0.05$) and 2.4-km run time (s) ($R = 0.42$, $P<0.05$) individually correlated with the 2.4-km LMP. Collectively they produced the best regression model (Equation 1), which explained 60% of the variance in LMP ($R = 0.78$, $R2 = 0.60$, SEE = 53 s, $P<0.01$). 2.4-km LM time (s) = (12.15 * LME) - (0.97 * Peak SLS) + (0.67 * 2.4-km Run Time) + 212.94 (Eq. 1*)*

CONCLUSION: The task specific measure of LME produced the strongest independent relationship with LMP and, when used in combination with other field performance tests, explained 60% of the variance in LMP. Future studies should determine the extent with which LME improves during recruit training and its subsequent influence on LMP.

This work was supported by the UK Ministry of Defence (Army)

1200 *Board #6* **May 31 1:00 PM - 3:00 PM**

Recovery Duration required prior to Re-Deployment during Firefighting, Search and Rescue.

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Heat strain is the greatest single source of performance limitation and physiological threat to firefighters' when undertaking single exposures of firefighting, search and rescue activities in a built environment (Rayson *et al.,* 2004). In reality firefighter teams may be recommitted rapidly - the effect of previous physical and thermal strain on firefighter performance during a recommitment and recovery required is largely unknown.

PURPOSE: To recommend recovery durations prior to re-deployment in both ambient and live fire scenarios. METHOD: Sixteen firefighters (age 33 ± 6 yrs; height 176 ± 5 cm; mass 81 ± 13 kg) carried out three scenarios in ambient and live fire conditions, each involving two deployments separated by varied recovery periods. There were three conditions for the recovery period: a) 30 min, 15 °C, b) 30 min, 24 °C and c) 120 min, 22 °C. Core temperature (Tcore) was monitored using a telemetric pill (HQInc, Palmetto, Fl). Core temperature data (rate of rise and decline) were used to model the Tcore response using a second order polynomial (quadratic) function to establish the minimum recovery duration to prevent firefighters reaching 39 °C on the re-deployment.

RESULTS: In the ambient scenario, the rate of rise of Tcore was similar between the initial deployment (0.029 ± 0.011 °C.min-1) and re-deployment (0.029 ± 0.013 oC.min-1), with a mean Tcore of 38.4 ± 0.3 °C at the end of the work bouts. The rate of decline of Tcore was also the same for all recovery conditions (-0.017 ± 0.013 oC.min-1). In the live fire scenario, the rate of rise of Tcore was similar between the initial deployment and re-deployment (0.035 ± 0.017 oC.min-1) for all conditions. The rate of decline of Tcore was similar over the three recovery periods when compared after 30 min of recovery (-0.017 ± 0.011 oC.min-1). For scenarios conducted under ambient conditions of 20 min duration, the average firefighter needed 23 min of recovery to prevent them from reaching a Tcore of 39 °C on the re-deployment; this duration is extended to 28 min to protect 95% of firefighters. For live fire conditions, the average firefighter needed 50 minutes of recovery, extended to 65 min to protect 95% of firefighters.

CONCLUSION: For the average firefighter, recovery of 20 min and 50 min is recommended before a re-deployment for ambient and live fire scenarios respectively.

D-52 Thematic Poster – Equipment Mechanics and Design

MAY 31, 2007 3:15 PM - 5:15 PM
ROOM: 334

1201 **Chair: John W. Chow, FACSM.** *University of Florida, Gainesville, FL.*

1202 *Board #1* **May 31 3:15 PM - 5:15 PM**

Proprio 5000: A New Method for Assessing Dynamic Balance

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PURPOSE: This study assesses the accuracy of the ultrasonic sensor in a new proprioceptive training device, the Proprio 5000, by comparing it to the data output from an 8 camera motion analysis system for future use in injury prevention and rehabilitation research.

METHODS: 12 subjects (24.3 ± 5 yrs) were tested. 26 reflective markers were collected using an 8 camera motion analysis system (120Hz) and an ultrasonic sensor (4Hz) attached to the lower back. Subjects completed a 120-second test on the Proprio 5000 in which the platform moved in anterior-posterior (AP), medial-lateral (ML), and diagonal directions at varying angles and speeds. Center of mass

(COM), three dimensional (3-D) position of the sacral marker, and pelvic angles were calculated for 3 trials. Pearson correlation coefficients were used to determine if any association existed between the COM, sacral marker, and the ultrasonic sensor. A 1X3 ANOVA was used to determine if the dynamic motion analysis (DMA) score or 3-D translational movements were significantly different between the 3 measurement techniques. A paired samples t-test was used to determine if significant differences existed between the calculated joint angles and the ultrasonic sensor angles (α=0.05).

RESULTS: No differences existed between the Proprio 5000 angles and pelvic angles. The superior-inferior (SI) and ML translations were correlated between measurement techniques. AP position was poorly correlated between the Proprio 5000 and the COM (r=0.40), however, the Proprio 5000 and the sacral marker were correlated (r=0.957). Average AP positions differed between the 3 measurement techniques ($p<0.001$). SI positions differed between the Proprio 5000 and the sacral maker ($p<0.001$) and between the sacral marker and COM (p=0.001). ML position was not different between the 3 measurement techniques (p=0.665). DMA scores differed between all 3 measurement techniques ($p<0.001$)

CONCLUSIONS: The ultrasonic sensor tracks ML and SI movements of the COM and the sacral marker. However, the AP movements are difficult to assess with this sensor. Significant differences in the DMA scores between the 3 measurement techniques indicate a need for increased sampling rate. Further studies could assess the use of the Proprio 5000 in post-injury rehabilitation and injury prevention.

1203 ***Board #2*** **May 31** **3:15 PM - 5:15 PM**

Repeatability of Dynamic GPS Position Measurements under Varying Conditions

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Research applications using GPS receivers are becoming more common as cost and size has reduced. Earlier studies using differential GPS substantiated the usefulness of such instrumentation, however the emphasis has been on absolute rather than relative errors. Little comparable information about consumer grade devices is available.

PURPOSE: Evaluate GPS position repeatability under varying conditions of time of day and carrying position across changing natural terrain using low-cost, consumer grade GPS units.

METHODS: Variability of position data was evaluated using two dynamic test situations. The first involved constant speed cycling around a 400 m running track at three constant speeds. Five laps at each speed were sampled at 1 Hz. Sixteen fixed positions (waypoints) were determined around the track and mean deviation across laps was calculated. The second test involved walking a 4.5 km forest trail along which 44 waypoints were located at 100 m intervals. Five trials under each collection condition were obtained and mean deviation determined at each waypoint. Six collection conditions were evaluated involving time of day (0700, and 1600 ECT) and 3 GPS carrying positions. Two GPS devices were evaluated (Garmin GPSmap 60csx and GPSport SP110).

RESULTS: First test conditions on a running track were nearly ideal for GPS signal reception and each device repeatably identified positions with mean position deviations of 30 to 40 cm. The GPSport device had systematic position shifts related to speed. The second test on a forest trail had repetitions on separate days but with controlled conditions. Variability was considerably greater than in the first test and exhibited substantial differences from one part of the trail to another depending on terrain. Mean position deviations with the Garmin were 2 to 3 m and about 4 m for GPSport under best conditions. Under poorer reception conditions deviations of 10 m or more were observed at some waypoints.

CONCLUSION: GPS instrumentation has become very useable for field data collections of sport or locomotion. Dynamic position predictions are repeatable to within 2 to 3 meters or better under many conditions. However care should be taken to position the device with as clear a skyward view as possible and collections should be standardized for time of day.

1204 ***Board #3*** **May 31** **3:15 PM - 5:15 PM**

Mechanical and Metabolic Energy Differences When Using a Modified NordicTrack Elliptical Trainer for Gait Training

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The mechanical design of elliptical trainers often creates a foot position that is less than optimal when compared to normal gait.

PURPOSE: To investigate performance differences in subjects using a standard elliptical trainer and a modified version that provided controlled gait-like ankle articulation.

METHODS: Eight healthy adult subjects (4 male, 4 female; mean age 28.6 ± 5.2) participated in this study. Subjects were asked to ambulate on the elliptical trainer with and without the ankle modifications at two metronome paced speeds (1Hz and 1.5Hz). Video based motion analysis techniques were used to collect sagittal plane kinematic data at a rate of 30Hz. Oxygen consumption (VO2) was measured using ventilatory expired gas analysis. Digitized video data were low-pass filtered using a 4th order zero phase lag Butterworth filter with a cutoff frequency of 6Hz. Total mechanical energy was determined via a summed segmental analysis that included translational and rotational kinetic energy and potential energy.

RESULTS: The articulation of the footplate in the sagittal plane on the modified elliptical trainer correlated with normal ambulation ($r2=0.83$, $p<0.001$) while the elliptical trainer without modification had a weaker correlation ($r2=0.62$, $p<0.001$). Lower joint angle correlations were found at the hip and knee ($r2=0.72$ and $r2=0.66$ respectively, $p<0.001$) for the modified elliptical trainer compared to normal gait. These did not differ significantly from the non-modified elliptical trainer. No statistically significant differences were found between the mechanical energy required by the modified and the non-modified elliptical trainer (1Hz, p=0.163, 1.5Hz, p=0.304). VO2 was higher with the modified elliptical trainer (1Hz speed: modified 16.79 +/- 3.18 ml/kg*min, non-modified 12.87 +/- 1.81 ml/kg*min, p=0.001, 1.5Hz speed: modified 19.87 +/- 2.97 ml/kg*min, non-modified 16.38 +/- 2.98 ml/kg*min, $p<0.001$).

CONCLUSIONS: The modified elliptical trainer provided an ambulation pattern more like normal gait at the ankle but was no different from the non-modified elliptical trainer at the hip and the knee. These changes did not effect the mechanical energy required for ambulation, but did require increased VO2.

1205 ***Board #4*** **May 31** **3:15 PM - 5:15 PM**

Knee Joint Loads During Exercise on the Elliptical Trainer

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The elliptical trainer was developed as an exercise machine to maximize the workouts while at the same time reducing joint impact forces. There have been no studies examining the loads on the knee joint during exercise on the elliptical trainer.

PURPOSE: To evaluate the knee joint reaction forces and moments during exercise at three different incline settings on the elliptical trainer exercise machine (Precor EFX).

METHODS: Twenty-six healthy individuals with no history of lower extremity injury and with previous experience exercising on an elliptical trainer volunteered for this study (age: 22.19 ± .85 y, 169.9 ± 9.8 cm, 74.0 ± 19.3kg). Motion was captured with two cameras as subjects performed exercise (120 steps/min) at three workload conditions (13, 25, and 40 degree incline). The pedals of the elliptical were fitted with three orthogonal load cells. Video (60Hz) and force data (600Hz) were synchronized and used to perform an inverse dynamics analysis.

RESULTS: Statistical analyses (repeated measures ANOVA) revealed no significant differences in the mean peak anterior shear force at 13-, 25- and 40-degrees (149 N, 156 N, and 181 N, respectively) nor in the mean peak posterior shear force acting at the knee (110 N, 113 N, and 116 N, respectively). Mean peak compressive force increased significantly (p= .003) with increased ramp inclination. Compressive force values were 796 N, 833 N, and 864 N at 13-, 25-, and 40-degrees, respectively. Knee joint moments also significantly changed with increased ramp inclination. The mean peak extension moment increased with 8 Nm at 13-degrees, 17 Nm at 25-degrees, and 38 Nm at 40-degrees (p=.000). The mean peak flexion moment values decreased across the ramp settings with 174 Nm at 13-degrees, 94 Nm at 25-degrees, and 47 Nm at 40-degrees (p=.000).

CONCLUSIONS: Exercising on an elliptical exercise machine does not generate large forces or moments at the knee joint although compressive forces and moments increase at higher incline workloads. Knee joint loads and moments while exercising on the elliptical were comparable to those previously collected for other exercises including running, walking, stair ascent and descent, and cycling. Pedal load cells provided by Precor, Inc.

1206 ***Board #5*** **May 31** **3:15 PM - 5:15 PM**

Midsole Cushioning during Running on Various Surfaces

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Shoe midsole cushioning is typically assessed over a hard running surface such as a force platform or a treadmill bed. Portable data loggers allow running impacts to be recorded at high rates over extended periods of time. This makes data collection feasible over a variety of running surfaces.

PURPOSE: To determine differences between a soft and hard running shoe midsole on typical running surfaces.

METHODS: Five recreational runners completed two 1.5 mile runs in an Adidas One running shoe. The midsole can be altered to provide soft (10.9 g) or hard (13.7 g) cushioning. Each run contained eight running surfaces assessed for hardness using a Clegg hammer (Table 1). A total of 3489 impacts were analyzed. A GPS watch (Garmin Forerunner) with velocity alarms was used to maintain a constant running velocity. A portable data logger (Crossbow AD2000) attached to an accelerometer (Analog Devices ADXL278) was used to record impacts at 512 Hz. Effect sizes (es) were used to identify differences between shoes for each surface.

RESULTS: On average the soft midsole impacts were 1.0 g less than the hard midsole impacts (es=1.00). These differences ranged from 0.3 g on woodchips up to 1.5 g on sand. Sand produced the highest impacts (7.1-8.6 g) and the wood bridge produced the lowest (5.7-6.3 g).

CONCLUSION: Harder surfaces did not universally produce greater peak g values but the harder midsole did. This might suggest that shoe cushioning is of greater importance

than surface cushioning. Lower extremity geometry may have changed during running on some surfaces. Sand may have caused the subjects to run with greater knee flexion which could increase tibial accelerations due to a decreased effective mass.

Table 1. Soft and hard midsole impacts on various surfaces.

Surface (hardness in g)	Soft (g)	Hard (g)	Effect Size
Woodchips (8.9)	6.4	6.7	0.28
Sand (10.7)	7.1	8.6	0.98
Grass (14.8)	6.8	7.9	0.76
Wood Bridge (24.9)	5.7	6.3	0.71
Gravel (25.5)	6.1	7.1	0.73
Dirt (26.2)	6.2	6.9	0.59
Asphalt (26.9)	6.0	7.1	1.19
Cement (28.6)	6.4	7.5	1.02
Mean	6.3	7.3	1.00

1207 ***Board #6*** **May 31 3:15 PM - 5:15 PM**

Comparison of In-shoe Foot Loading Patterns Between Training And Spike Shoes In Young Athletes During Sprint Running

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PURPOSE: To examine the differences in in-shoe loading patterns between training and spike shoes during sprint running in young athletes.

METHODS: Eleven athletes (15.4 ± 1.7 yrs, 52.7 ± 14.1 kg, 164.2 ± 9.3 cm) performed 60 m maximal sprint on an athletics track with training and spike shoes in a randomized order. Contact area and mean area (CA and Amean, in cm2), maximum and mean force (Fmax and Fmean, in N), peak and mean pressure (PP and Pmean in kPa) and relative load (RL in %) were measured in nine regions of the right foot (medial heel M1, lateral heel M2, medial mid-foot M3, lateral mid-foot M4, medial forefoot M5, central forefoot M6, lateral forefoot M7, hallux M8 and lesser toes M9) and for the whole foot (T). For examining the loading patterns data of 13-14 steps during the last 30 m was averaged from several trials by electronic insoles inserted into the right shoe. The running times for the last 30m were measured by timing gates.

RESULTS: Running times were not significantly different between the training and spike shoes (3.88 ± 0.35 vs. 3.73 ± 0.30 s, respectively). However, CA in T (148.6 ± 26.3 vs. 140.2 ± 26.0 cm2, P = 0.01) and Amean in M8 (9.4 ± 1.3 vs. 8.8 ± 1.5 cm2, P < 0.01) and M9 (16.7 ± 1.9 vs. 16.0 ± 1.9 cm2, P = 0.01) were smaller with spike shoes.

Spike shoes induced also higher loading in midfoot and forefoot area (F_{max}: M4 +34.5%; M5 +35.8%; M6 +36.4% and M7 +13.4%, F_{mean}; M5 +25.9% and M6 +34.4%, P_{mean}; M3 +28.7%, M4 +32.3, M5 +38%, M6 +37.8% and M7 +14.5% and PP in T; 533.9 vs. 421.8 N, P < 0.001) but lower loading under the toes (-14.7%, -9.6% and -15.1% for $F_{max,}$ P_{mean} and F_{mean} in M9, respectively) as compared to the training shoes. Similarly, the RL was higher in forefoot area (M5: +15.5%, P < 0.05 and M6: +19.8%, P < 0.001) but smaller under the toes (-10.3%, P = 0.06 and -21.5% P < 0.001 in M8 and M9, respectively).

CONCLUSIONS: This study demonstrated that wearing spike shoes significantly increases plantar loading under midfoot and forefoot during sprint running, when compared to running shoes. More specifically, due to the decrease in overall CA and the simultaneous increase in force and pressure in M5 and M6, higher loads are applied on central forefoot, mainly under the 1st and the 2nd metatarsal heads.

E-21 Thematic Poster – Exercise Immunology: Special Populations

JUNE 1, 2007 8:00 AM - 10:00 AM
ROOM: 334

1208 **Chair: Ryoichi Nagatomi.** *Tohoku University School of Medicine, Sendai, Japan.*

1209 ***Board #1*** **June 1 8:00 AM - 10:00 AM**

Systemic Cytokine Changes In Children During Prolonged Intense Exercise

Jaime S. Rosa, Stacy R. Oliver, Andria M. Pontello, Rebecca L. Flores, Frank P. Zaldivar, Pietro R. Galassetti. *University of California, Irvine, Irvine, CA.* (Sponsor: Dan Cooper, FACSM)

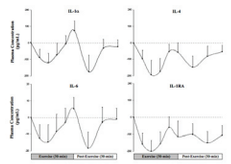
Among the multiple components of the immune response to exercise, a key role is played by systemic changes in pro- and anti-inflammatory cytokines. Despite consensus on their overall importance, however, the kinetics of individual cytokines during and following exercise are still unclear, with some studies reporting exercise-induced systemic elevations while others reporting no change. This conflicting information is particularly scarce in children, who display different metabolic and immunologic responses compared to adults.

PURPOSE: To define the kinetic profiles of key pro- and anti inflammatory cytokines in children during intermittent, intense exercise.

METHODS: 21 healthy children (13.9 ± 0.8 yrs, 8M/13F) performed 10 bouts of 2-min cycling at ~80% VO2max, separated by 1-min intervals. Blood samples from a forearm I.V. line were drawn at baseline, after every other exercise bout, and 10, 20, and 30 min post exercise; plasma was stored at -80°C for later cytokine assays.

RESULTS: Most cytokines initially decreased reaching a nadir ~10-15 min into exercise, then increased to above-baseline by end-exercise (IL-1α, IL-6, IL-8), or remained moderately decreased throughout the study (IL-4, IL-1RA, TNF-α, GM-CSF, Eotaxin, EGF). A second nadir also occurred immediately after exercise for most cytokines, with return to baseline by 30 min post.

CONCLUSION: Key immuno-modulatory cytokines display individual nadirs/peaks at different time points during intense exercise in healthy children, suggesting that detection of absolute changes relative to baseline depends on exercise duration, sampling timing and possibly on exercise type and intensity.



Supported by NIH grants M01-RR00827-28; K-23 RR018661-01; & JDRF #11-2003-332.

1210 ***Board #2*** **June 1 8:00 AM - 10:00 AM**

Plasma Biomarkers of Chronic Inflammation are Elevated in Overweight Mexican-American Children

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Excess body weight is associated with an accumulation of chronic, low-grade inflammation which has been implicated in the pathophysiology of various diseases. The obesity epidemic is more prevalent in certain ethnic groups. Despite this health disparity, few published studies have measured biomarkers of chronic inflammation in Mexican-American children of differing body mass index.

PURPOSE: To determine the effect of body mass index on blood lipid profile, insulin resistance, and inflammatory biomarkers in Mexican-American children.

METHODS: Boys and girls (13.3±0.1 y) were recruited from a local school and assigned to one of three groups as a volunteer sample: healthy weight (HW, 10th - 84th BMI percentile, n=42), at risk of overweight (RO, 85th - 95th, n=25), or overweight (OW, >95th, n=42). All the participants in the present study self-identified their race/ethnic group as Mexican-American. Venous blood samples were collected following an overnight fast (>8h). Plasma concentrations of insulin, hsCRP, sCD14, sIL-6R, sTNF-αR1, sTNF-αR2, IL-6, and TNF-α were determined by ELISA. Plasma glucose was determined using an automated analyzer and insulin resistance scores (HOMA-IR) were calculated.

RESULTS: OW children had significantly greater plasma concentrations of hsCRP (P=0.003), sCD14 (P=0.013), sIL-6R (P=0.010), sTNF-αR1 (P<0.001), sTNF-αR2 (P=0.005), insulin (P=0.001), HOMA-IR (P=0.001), TC: HDL ratio (P<0.001), and triglycerides (P<0.001) than HW children. Also, plasma concentrations of hsCRP, sIL-6R, and sTNF-αR1 were significantly greater in OW compared to RO. When sorted based on HOMA-IR, insulin resistant children had significantly higher TNF-α than non-insulin resistant children (P=0.006).

CONCLUSION: Overweight Mexican-American children had significantly greater plasma hsCRP, sCD14, sIL-6R, sTNF-αR1, and sTNF-αR2 concentrations than healthy weight children. However, we did not find a difference for either IL-6 or TNF-α. Insulin resistant children (HOMA-IR > 5.7) had significantly greater plasma TNF-α concentration than non-insulin resistant children. These findings are consistent with previous reports in obese adults. To our knowledge, this is the first study to report that sCD14 is elevated in overweight compared to healthy weight individuals.

1211 ***Board #3*** **June 1 8:00 AM - 10:00 AM**

The Relationship between BMI and LPS-stimulated TNF-α and IL-6 production in African-American Women

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Obesity is associated with an increase in chronic, low-grade inflammation. Chronic Inflammation has been implicated in the development of Type II Diabetes Mellitus and Cardiovascular Disease.

PURPOSE: The primary purpose of this study was to determine whether obesity status differentially altered whole blood LPS-stimulated IL-6 and TNF-α production in vitro.

METHODS: African-American women (N=24) were recruited for the present investigation from a larger study and distributed to one of five groups based on BMI: normal weight (NW; BMI 20-25), overweight (OV; BMI 25-30), class 1 obese (1OB; BMI 30-35), class 2 obese (2OB; BMI 35-40), or class 3 obese (3OB; BMI >40). Body composition was determined via a whole body DXA scan. Venous blood samples

THEMATIC POSTER SESSIONS

were collected following an overnight fast (>8h), diluted (1:20 in RPMI 1640) and stimulated with five doses of lipopolysaccharide (LPS, from Salmonella Enteritidis): 80, 40, 20, 10, and 5 µg.mL-1 for 24-h in a 37°C, 5% CO2 incubator. Following stimulation, cell-free supernants were analyzed in duplicate for IL-6 and TNF-α using separate enzyme linked immunosorbent assays (ELISAs). Data were analyzed for significance using a one factor ANOVA with SPSS v.14.0.

RESULTS: No significant group differences were found for LPS dose with either TNF-α or IL-6 production. Due to lack of significant LPS dose effects, maximal TNF-α and IL-6 production was compared between groups. 3OB had significantly greater maximal TNF-α production than other groups (P=0.012). No significant group effects were found for maximal IL-6 production. Body weight and BMI were significantly correlated with maximal TNF-α (rs=0.55, 0.53) and IL-6 (is=0.51, 0.51) production.

CONCLUSIONS: Our findings are consistant with previous reports suggesting a relationship between increased obesity and monocyte inflammatory capacity. This is one of the first studies to test this relationship in African-American women, who have higher rates of obesity. We also did not find different LPS dose effects in individuals of differing BMI, which was contrary to our hypothesis. More research is needed to evaluate mechanisms responsible for an obesity induced increase in monocyte inflammatory capacity.

1212 ***Board #4*** **June 1** **8:00 AM - 10:00 AM**

Aerobic Exercise Modulates Resting Plasma Cytokine Concentration in Individuals with Multiple Sclerosis

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Multiple sclerosis (MS) is an autoimmune disease that results in progressive neural degeneration. Cytokines play an important role in the pathogenesis and are a major target for treatment interventions.

PURPOSE: To determine whether a short term exercise intervention may modulate immune variables associated with disease progression in individuals with MS.

METHODS: The acute and chronic impact of 8 weeks of aerobic exercise on the immune response in MS and matched control subjects. Eleven MS and eleven healthy control subjects (8 women and 3 men in both groups) matched in age, weight, height, percent body fat and VO2peak completed the study (p>0.05). Subjects performed 30 minutes of cycle ergometry at 60% of VO2peak, three times a week for 8 weeks.

RESULTS: Following the intervention, plasma interleukin (IL)-6 at rest tended to decrease (p=0.08) and was similar between groups. Plasma tumor necrosis factor (TNF)-α concentration at rest tended to be higher in MS compared to controls throughout the study (p=0.08). MS subjects had elevated resting TNF-α after the 8 week program (p=0.04), while resting TNF-α remained unchanged in controls (p>0.05). Resting plasma interferon (IFN)-γ increased in MS subjects (p=0.008) whereas it remained unchanged in controls following the intervention. (p>0.05). The response of plasma IL-6, TNF-α and IFN-γ after a single bout of exercise was similar between MS and control subjects and remained unchanged following the training program (p>0.05). IL-6 increased significantly 30 minutes (+13%, p=0.02) and tended to increase 2 hours post exercise in both groups (+8, p=0.09). TNF-α decreased 2 hours (-28%, p=0.045) and 3 hours (-48%, p=0.001) post exercise in both groups. IFN-γ decreased 2 hours (-34%, p=0.02) and 3 hours (-28%, p=0.02) post exercise in both groups.

CONCLUSIONS: Our findings suggest that aerobic exercise training may modulate immune mechanisms at rest in people with MS. MS and control subjects displayed a similar cytokine response to a single bout of exercise. The influence of exercise on immune parameters associated with disease progression warrants further study.

Supported by a National Multiple Sclerosis Society Grant

1213 ***Board #5*** **June 1** **8:00 AM - 10:00 AM**

Impact of Active Iyengar Yoga Practice on Markers of Cell-mediated Cytotoxicity in Breast Cancer Survivors

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PURPOSE: To determine if an eight-week yoga practice improved markers of cell-mediated cytotoxicity in female breast cancer survivors.

METHODS: Survivors (Stages I-IV, age 61 ± 7.4 yrs.) were randomly assigned to yoga (Y, n=10) or waitlisted (WL, n=9) groups. Demands of Illness (DOI) and immune indices were evaluated pre- (T1) and post-yoga (T2). Iyengar yoga practice occurred twice weekly, 90-minute per day plus one home practice. Data were analyzed by Mann-Whitney U test.

RESULTS: The %CD16+CD56+ cells, %CD16brightCD56dim cells, and cytotoxicity against human leukemia cells (K562) were not altered from T1to T2. Cytotoxicity against human breast cancer cells (MCF-7) decreased in WL (39.0±21.4 at T1 vs 19.1±17.2, LU per 107effectors) but remained stable in Y (30.3±19.6 at T1 vs 31.2±17.7, LU per 107 effectors), such that at T2, Y had a significantly greater cytolytic response (p<0.05). DOI for treatment, exercise and diet significantly declined from T1 to T2 with yoga.

CONCLUSION: Yoga participation was associated with greater stability in cell-mediated cytotoxicity against a tumor target that is biologically relevant to the clinical diagnosis of breast cancer.

Supported by Cancer Prevention and Research Center WSU; University of Washington Center for Women's Health and Gender Research.

1214 ***Board #6*** **June 1** **8:00 AM - 10:00 AM**

Physical Activity, Biochemical And Immunological Parameters According To The Lipodistrophy In Hiv-1 Infected Individuals

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PURPOSE: To compare the physical activity, biochemical and immunological parameters according to the lipodistrophy in HIV-1 infected individuals.

METHODS: The sample was constituted by 39 HIV-1 infected men individuals, aged from 25 to 67 year-old (x: 42.19 ± 10.57 years) of the Secondary Immunodeficiency Ambulatory from Hospital das Clínicas (Faculty of Medicine - USP). Physical activity was determined through Baecke questionnaire (Baecke JA, et al. Am J Clin Nutr 1982; 36: 936-42) and separated according to the occupational (OPA), leisure time and locomotion physical activity (LLPA), physical exercises in leisure time (PELT) as well as the total score (TS) that considered all types of physical activity (OPA, LLPA and PELT). Plasma lipoprotein profile measured were total cholesterol (TC), triglycerides (TRI), high density lipoprotein cholesterol (HDL), and low density lipoprotein cholesterol (LDL). T lymphocyte subpopulation (CD4+) counts were analyzed by flow cytometry (Coulter Epics XL, Miami, FL, USA). Viremia was determined by polymerase chain reaction (PCR [Amplicor, Roche]). Volunteers established the presence (YES) or absence (NO) of lipodistrophy according to their self-perception.

RESULTS: There were not statistically significant differences in the body composition (body weight: 73.15 ± 10.85 kg x 76.76 ± 16.16 kg; body mass index: 24.67 ± 4.00 kg·m2 x 25.78 ± 3.90 kg·m2), physical activity (OPA: 2.46 ± 1.03 x 2.44 ± 0.93; LLPA: 2.36 ± 0.65 x 2.42 ± 0.71; PELT: 1.76 ± 0.68 x 1.65 ± 0.80; TS: 6.59 ± 1.45 x 6.52 ± 1.73), biochemical (CT: 169.85 ± 57.41 mg·dL x 177.40 ± 37.96 mg·dL; TRI: 224.07 ± 161.38 mg·dL x 213.86 ± 194.55 mg·dL; HDL: 40.64 ± 9.82 mg·dL x 42.20 ± 14.12 mg·dL; LDL: 88.46 ± 46.42 mg·dL x 99.42 ± 38.71 mg·dL) and immunological (CD4: 433.84 ± 356.26 cells·mm3 x 368.75 ± 271.66 cells·mm3; viremia [log]: 4.84 ± 0.55 x 4.43 ± 0.88) parameters when YES or NO groups were compared with each other, respectivelly.

CONCLUSION: Physical activity, biochemical and immunological parameters appear to be not different between HIV-1 infected men individuals which self-perceived the lipodistrophy when compared with those that not self-perceived it. The fact of lipodistrophy has been considered as any change in body composition after HIV infection or pharmacological treatment could produce bias.

F-18 Thematic Poster – Exercise, Pain and Hypoalgesia

JUNE 1, 2007 1:00 PM - 3:00 PM
ROOM: 334

1215 **Chair: Dane B. Cook.** *University of Wisconsin-Madison, Madison, WI.*

1216 ***Board #1*** **June 1** **1:00 PM - 3:00 PM**

Self-efficacy and Muscle Pain during Maximal and Submaximal Cycle Ergometry

Jennifer Scott, Rachael C. Gliottoni, Robert W. Motl. *University of Illinois Urbana Champaign, Urbana, IL.*

Based on a social cognitive perspective, self-efficacy might be inversely associated with ratings of quadriceps muscle pain during cycle ergometry. This is based on the proposition that self-efficacy attenuates affective and physiological responses associated with aversive stimuli.

PURPOSE: The present study involved an examination of the relationship between self-efficacy for tolerating muscle pain during exercise and ratings of muscle pain during maximal and submaximal cycle ergometry. Method: Sixteen college-aged females completed a measure of self efficacy for tolerating moderate-to-strong pain in the legs, and then undertook a maximal incremental exercise test on a cycle ergometer. Within one week, participants completed a 30-minute bout of submaximal exercise (80% V·O2peak) on a cycle ergometer. Ratings of quadriceps muscle pain intensity were recorded every minute during the maximal incremental exercise test and every five minutes during the submaximal exercise session.

RESULTS: Self efficacy for tolerating pain was moderately, inversely correlated with ratings of peak muscle pain during the maximal incremental exercise test (r = –.45). Self-efficacy for tolerating pain was moderately, inversely correlated with pain ratings averaged across the submaximal session (r = –.49), and the magnitude of the relationship increased as a function of time across the 30 minute bout of submaximal cycling (minute 5: r = –.39; minute 30: r = –.55).

CONCLUSION: Our results are consistent with social-cognitive theory and indicate that self-efficacy for tolerating pain is inversely associated with ratings of muscle pain during maximal and submaximal exercise in college-aged females. Such findings support an examination of strategies for manipulating self-efficacy and thereby reducing pain during exercise.

1217 ***Board #2*** **June 1 1:00 PM - 3:00 PM**

Effect of Caffeine on Leg Muscle Pain during Cycling Exercise: Possible Role of Anxiety Sensitivity?

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There is emerging evidence that ingestion of caffeine is associated with a reduction in the intensity of quadriceps muscle pain during moderate intensity cycle ergometry. The hypoalgesic effect of caffeine can be extended by (a) examining the effect of caffeine ingestion on muscle pain intensity ratings under conditions that produce stronger pain such as high intensity exercise and (b) investigating a psychological factor that might moderate the effect of caffeine on muscle pain intensity ratings during exercise such as anxiety sensitivity.

PURPOSE: This study had two purposes. The first purpose involved an examination of the effect of a moderate dose of caffeine on quadriceps muscle pain during a bout of high intensity cycling exercise. The second purpose involved an investigation of the moderating role of anxiety sensitivity in the hypoalgesic effect of caffeine during exercise.

METHODS: College-aged females (N = 16) ingested caffeine (5 mg·kg-1 body weight) or a placebo and 1 h later completed 30 min of cycling on an ergometer at 80% of peak oxygen consumption. The caffeine and placebo conditions were double-blinded and completed in a counter-balanced order. Perceptions of leg muscle pain were recorded during both bouts of exercise.

RESULTS: Caffeine resulted in a statistically significant and large reduction in leg muscle pain intensity ratings compared with placebo (d = –0.75), and the effect of caffeine was significantly larger in those with lower anxiety sensitivity scores (d = –1.15) than those with higher anxiety sensitivity scores (d = –0.32).

CONCLUSION: Our results support that caffeine ingestion has a large hypoalgesic effect during high intensity exercise and this effect is moderated by anxiety sensitivity in college-aged females.

1218 ***Board #3*** **June 1 1:00 PM - 3:00 PM**

Exercise Intensity and Duration as Factors Contributing to Hypoalgesia Among Nocioceptive C-Fibers

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Exercise Induced Hypoalgesia (EIH) is characterized by a temporary desensitization of the nocioceptive system both during and after physical exertion. Although EIH is well documented in the literature, the underlying mechanisms responsible for this phenomenon remain somewhat unclear.

PURPOSE: To observe the changes in nocioception of the C-Pain fibers both during and after moderately intense exercise.

METHODS: Fourteen healthy collegiate female athletes volunteered for this study. After an initial V02 peak assessment, subjects returned to the laboratory approximately one week later to exercise for 20 minutes on a cycle ergometer at a workload corresponding to 70%-75% of their V02 peak. Electrodiagnostic Pain (EP) assessment and Heart Rate (HR) were collected at time points corresponding to: pre-exercise (Baseline), 10 and 20 minutes into exercise, as well as 10 and 20 minutes into recovery. EP scores were collected using a Neurometer and were normalized by expressing each subjects scores as a multiple of their baseline value. HR was collected using a Polar HR monitor. Each dependent variable was analyzed using a repeated measures ANOVA with a significance level of $p<0.05$.

RESULTS: A table with the means and standard deviations for each variable can be found below.

	Baseline	Exercise 10	Exercise 20	Recovery 10	Recovery 20	p-value
Pain score %	100%± 0.00	125%±33.07	154%±89.81	111%±53.27	116%±65.94	p=0.01*
Heart Rate bpm	73.85±10.91	136.78±16.01	143.92±16.44	84±15.42	81.35±13.56	p=0.0001*

CONCLUSIONS: Based upon these data, it appears that exercise duration is an important factor in eliciting EIH. Although there are several physiological mechanisms that may be responsible for the temporary desensitization of the nocioceptive system, these findings suggest that there may be an accumulating effect of circulating opiates that may be responsible for at least some of the pain variations observed both during and after exercise.

1219 ***Board #4*** **June 1 1:00 PM - 3:00 PM**

Effect of Exercise on Reducing Peripheral Neuropathic Pain in Rats

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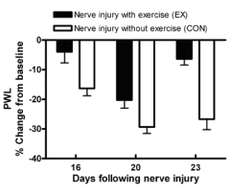
Neuropathic pain may not have an apparent source of nociception and often responds poorly to pharmacological interventions. Few studies relate regular exercise with reductions in neuropathic pain; therefore, we evaluated the effect of voluntary wheel running in an animal model of neuropathic pain, induced by partial peripheral nerve injury.

PURPOSE: To determine whether voluntary exercise would reduce thermal hyperalgesia in the setting of neuropathic pain.

METHODS: Female Sprague Dawley rats were randomized into 2 groups: 1) nerve injury with exercise (EX; n=8) and 2) nerve injury without exercise (CON; n=9). All rats were individually housed either with running wheels (EX) or standard cages (CON). At 1-week post randomization, baseline (pre-injury) behavioral testing (assessed by paw withdrawal latency [PWL] to thermal stimuli) was measured in both groups followed by peripheral nerve injury. After 48 hours of recovery, rats were returned to their respective cages and behavioral testing was conducted at several time points (day 2, 6, 9, 13, 16, 20, 23, and 27) following nerve injury.

RESULTS: Peripheral nerve injury produced thermal hyperalgesia evidenced by a greater negative percent change in PWL values when compared to baseline in all rats. Differences between EX and CON were observed at 16 days and onward, with the greatest difference at day 23 (6% EX versus 26% CON) favoring EX over CON, although it was not statistically significant (P=0.06).



CONCLUSION: Although a favorable trend of exercise was observed from 16 days and onward post nerve injury, it did not statistically significantly alter thermal hyperalgesia in the setting of neuropathic pain.

Supported by NIH K12 BIRCWH

1220 ***Board #5*** **June 1 1:00 PM - 3:00 PM**

Exercise Alters Pain Sensitivity in Gulf War Veterans with Chronic Musculoskeletal Pain

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Since returning from the Persian Gulf, nearly 100,000 veterans of the first Gulf War have reported numerous symptoms with no apparent medical explanation. In general, these Gulf War veterans (GV) attribute their illness to their service in the Gulf and report significantly more symptoms than soldiers not deployed to the Middle East. A primary complaint of these individuals is widespread chronic musculoskeletal pain (CMP) which results in decreased physical function and quality of life. CMP symptoms reported by GV are similar to those reported by women with fibromyalgia (FM), but CMP in GV has not received equivalent scientific attention. Research has indicated that women with FM report enhanced pain sensitivity following exercise, a response opposite to that of healthy women.

PURPOSE: To examine the impact of an acute bout of exercise on pain sensitivity in GV with medically unexplained CMP.

METHOD: Twenty-six GV (n=12 CMP; n=14 Healthy) completed a series of psychophysical pain assessments designed to determine pain sensitivity to heat and pressure stimuli before and after a bout of cycling exercise to exhaustion. Testing included: 1) pressure pain thresholds (PPTh) and tolerances (PPTo), 2) heat pain thresholds (HPT), and 3) pain intensity (PI) and affective (PA) responses to temperatures from 44-50°C. Repeated measures ANOVAs were used to determine group differences and the influence of exercise on heat PI and PA.

RESULTS: There were no group differences in age, height, weight or self-reported physical activity. There were no group differences in HPT, PPTh or PPTo. There was a significant Group×Exercise×Temperature interaction ($p<0.05$) for both PI and PA, characterized by consistently higher PI and PA ratings and an increase in ratings pre to

post exercise for GV with CMP compared to healthy GV. GV with CMP rated painful heat stimuli as significantly ($p<0.05$) greater for PI versus PA descriptors.

CONCLUSION: GV with CMP are generally more sensitive to heat pain stimuli than healthy GV. Exercise results in increased PI and PA responses for GV with CMP, but not healthy GV. Our results suggest that CMP complaints in male GV may be similar to those of females with FM.

METHODS: used to understand central mechanisms of pain in FM may be useful in understanding medically unexplained CMP in veterans who served in the Persian Gulf.

F-53 Thematic Poster – Antioxidants

JUNE 1, 2007 3:15 PM - 5:15 PM
ROOM: 334

1221 **Chair: Allan Goldfarb, FACSM.** *University of North Carolina, Greensboro, NC.*

1222 ***Board #1*** **June 1** **3:15 PM - 5:15 PM**

Effects of 2 Weeks Propolis Supplementation on the Exercise Induced Oxidative Stress by Exhaustive Exercise at the Level of 110% Anaerobic Threshold

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PURPOSE: To investigate the effect of 2 weeks Propolis supplementation on exercise Induced Oxidative Stress at the level of 110% Anaerobic threshold

METHODS: 40 untrained people were participated in this study. we used a randomized double-blind design. at first day, all participant performed maximal graded exercise test to find their 110% AT level. one week later, they exercised on the treadmill at the 110% AT level until they exhausted. after one week, in the experimental group, 20 subjects(44.7 ± 7.4yrs) took soft capsule type propolis (990mg/day, 110mg/capsule, 3times/day)for 2 weeks. In the control group, 20subjects(44.5±7.5) received the placebo. 5ml blood samples were taken by intravenous during the resting state, 1min after exhausted exercise at the level of 110% anaerobic threshold treadmill exercise, 30min and 90min recovery period after exercise. We examined the concentration of plasma malondialdehyde (MDA), the Total Antioxidant Status(TAS), blood cytokine level(IL-6, TNF-a) respectively.

RESULTS: In both group, all variables were not changed significantly after 2 weeks propolis & placebo supplemantation . But we could detect the trend as follow. MDA level were decreased and TAS level increased after propolis treatment group. on the other hand, there were a lot of variation in the IL-6 and TNF-a level during our study. this result were different from our previous study. At that time, we had found that MDA levels had decreased at resting level after treatment compared to the control group. The rate of decrease was also higher 1min and 30min after exercise in the propolis group, previous exercise protocol intensity was higher than present study. this time, exercise intensity were likely to 70% VO2max(moderate high intensity).

CONCLUSIONS: In these study, we could assume that propolis could help antioxidant system even in the moderately high intensity exercise.

1223 ***Board #2*** **June 1** **3:15 PM - 5:15 PM**

Impact of Oral Glycine Propionyl-L-Carnitine on Oxidative Stress, Antioxidant Status, and Exercise Performance

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Various forms of L-carnitine have been shown to have antioxidant properties and to improve circulation and exercise performance in individuals with vascular disease, possibly mediated by enhanced nitric oxide production.

PURPOSE: To compare the effects of a novel form of L-carnitine (glycine propionyl-L-carnitine {GPLC}) to a placebo on markers of aerobic and anaerobic exercise performance, antioxidant status, oxidative stress, nitric oxide, and skeletal muscle carnitine content.

METHODS: 32 healthy men or women (27±5 years) were randomly assigned in double-blind manner to receive either a placebo (n=9), GPLC at 1 g/d (n=12), or GPLC at 3g/d (n=11) in conjunction with an eight week program of supervised aerobic training. VO2peak, time to fatigue, and anaerobic threshold was assessed using a graded exercise treadmill test. Anaerobic power and work was assessed using a Wingate cycle test. Resting blood samples were analyzed for total whole blood glutathione, total plasma antioxidant capacity, and plasma nitric oxide. Muscle samples were analyzed for total, free, and acyl carnitine. All above variables were determined before and following the eight week intervention. Malondialdehyde (MDA) was measured pre and post both exercise tests; pre and post intervention.

RESULTS: With the exception of a significant ($P<0.05$) increased anaerobic threshold for both GPLC groups (9-10%) compared to placebo (2%), no exercise performance effects were observed ($P>0.05$). While both glutathione and antioxidant status were higher in the GPLC groups compared to placebo, these differences were not statistically significant ($P>0.05$). The percent change for nitric oxide was statistically greater for GPLC 3g/d (55±15) compared to GPLC 1g/d (10±15) and placebo (7±17, $P<0.05$). Muscle carnitine content was maintained at 3g/d of GPLC, but decreased following training in the other groups. Resting MDA was decreased 22-30% in the GPLC groups compared to no change in the placebo group following the intervention, but the same pattern of change was present in all groups in response to both exercise tests ($P>0.05$).

CONCLUSION: These findings indicate that GPLC supplementation may increase the anaerobic threshold, maintain muscle carnitine content at 3g/d, increase resting nitric oxide production, and decrease resting lipid peroxidation.

1224 ***Board #3*** **June 1** **3:15 PM - 5:15 PM**

Powdered Fruit and Vegetable Juice Concentrates Attenuate Carbonyl Proteins and TNF-alpha in Trained Men

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(Sponsor: Allan Goldfarb, FACSM)

PURPOSE: The aim of this study was to assess the effects of supplementation over 7 months with an encapsulated juice powder concentrate (JPC: Juice Plus+®, Memphis, TN) or placebo on markers of oxidation and immune activation in men at rest and after a controlled exercise bout.

METHODS: Trained men (n = 40, 34 ± 5 yrs, 55 ± 7 mL kg-1 min-1, non smokers) from a homogenous population (Special Forces: Cobra) were randomly assigned in a double blind manner to either JPC (n = 20) or placebo (n = 20) after a four week washout period. The assigned treatment was taken as three capsules twice daily for 28 weeks. Exercise and blood sample collection were carried out after completion of wash out (baseline) and at study weeks 4, 8, 16 and 28. Capillary blood from finger-tip was collected before exercise (BE), immediately after the exercise test (IE), at 30 minutes (30M) and at 30 hours (30H) after each test. The exercise test was performed at 70% of VO2max (previously determined) until exhaustion at 80 rpm on a bicycle ergometer. Blood samples were analyzed for plasma carbonyl proteins (CP) and tumor necrosis factor alpha (TNF-alpha). Analysis used repeated measures ANOVA with $p<0.05$ considered significant.

RESULTS: The CP concentrations after 16 and 28 weeks were significantly lower in the JPC group than in the placebo group ($p<0.001$) and lower than baseline for the JPC group ($p<0.05$). The exercise protocol had no effect on CP. TNF-alpha concentrations increased in both groups in the first 8 weeks ($p<0.05$) followed by a significant decrease in the JPC group for the next 20 weeks ($p<0.0001$). The values in the placebo group were unchanged during these 20 weeks compared to the first eight weeks.

CONCLUSIONS: These data suggest that compared to placebo over 7 months, JPC protected plasma proteins and reduced immune activation as shown by CP and TNF-alpha. Increase of TNF-alpha after 8 weeks of study in both groups may be due to a documented common upper respiratory tract infection in the cohort at this time point. The model of exercise did not influence the measured variables in this trained population.

Supported by NSA.

1225 ***Board #4*** **June 1** **3:15 PM - 5:15 PM**

Effect of an Isocaloric Carbohydrate +/- Protein Antioxidant Drink on Plasma Protein Carbonyls

Changmo Cho[1], Allan H. Goldfarb, FACSM[1], Hojune Cho[1], Sean Hickling[1], Brett Romano-Ely[2], M. Kent Todd, FACSM[2], Michael Saunders, FACSM[2]. *[1]Univ. of North Carolina Greensboro, Greensboro, NC. [2]James Madison University, Harrisonburg, VA.*
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PURPOSE: To ascertain if an isocaloric beverage with added protein and vitamins would influence oxidative stress following cycling to exhaustion compared to a carbohydrate only drink as indicated by protein carbonyls (PC).

METHODS: Twelve trained male subjects between 18-33 yrs volunteered for this study and performed this randomized cross over experiment. They cycled at 70% VO2 peak until fatigue and 22-24 hrs later at 80% VO2 peak until fatigue with either a carbohydrate {CHO} or carbohydrate + protein with vitamin E and C (CHOPA). Drinks were isocaloric and the amount given during recovery was doubled in concentration compared to during the exercise for the CHO and CHOPA. Blood was collected at rest and 24, 48 and 72 hrs after the exercise at rest. Protein and PC were analyzed spectrophotometrically in duplicate and compared to known standards. The data were analyzed by SPSS using repeated measures ANOVA.

RESULTS: Plasma protein concentration was not significantly different across time or treatment. In contrast, PC demonstrated a significant treatment ($p=0.037$) and time ($p= 0.004$) effect with no significant treatment * time interaction. PC was higher in the CHOPA treatment compared to CHO independent of time. In addition, there was an increase in PC at 24 (48%), 48 (59%) and 72 (67%) hrs after exercise compared to resting prior to the exercise.

CONCLUSIONS: These data suggest that giving an isocaloric drink with protein and antioxidants after two cycling bouts to exhaustion will exacerbate the increase in protein carbonyl increase compared to an isocaloric drink containing only carbohydrate. In addition, there was a modest but significant increase in protein carbonyls over time with this type of exercise independent of treatment.

1226 *Board #5* **June 1 3:15 PM - 5:15 PM**

Effect Of A Lipid Supplement On Aerobic Metabolism And Heart Rate Variability In Endurance Athletes.

Michael I. Kalinski, FACSM[1], Olga Yelisyeyeva[2], Andriy Cherkas[2], K Semen[2], Danylo Kaminsky[2], A Lutsyk[2]. *[1]Kent State University, Kent, OH. [2]Danylo Halytskyi Lviv National Medical University, Lviv, Ukraine.*

PURPOSE: To examine the effects of a lipid supplement (amaranth oil, AmO) on blood serum catalase and superoxide dismuthase (SOD) activities, thiobarbituric acid reactive species (TBARS) concentration and heart rate variability (HRV) in endurance athletes.

METHODS: The effects of AmO administration (1 ml of concentrated amaranth oil/day for 21 days) were studied in 24 male athletes, competing in running and triathlon endurance sports. AmO effects were evaluated by measuring activities of blood serum catalase, superoxide dismuthase (SOD), and thiobarbituric acid reactive species (TBARS) concentration. According to the values of total power (TP), all athletes were divided into two groups: group 1 and 2 (competed at the national and regional levels, respectively).

RESULTS: Catalase activity declined after AmO administration: in group 1 (35%, $p<0.05$), in group 2 (34%, $p<0.05$). SOD activity units were 14% higher in group 2 compared to group 1 after AmO supplementation, and TBARS concentration was 20% lower in group 1 compared to group 2, $p<0.05$. High frequency waves were five and a half fold higher in group 1 compared to group 2 in the supine position, $p<0.05$. After AmO supplementation the orthostatic test revealed significant changes in group 1 HRV including a decrease in SDNN (standard deviation of the NN interval), RMSSD (the square root of the mean squared differences of successive NN intervals) and TP. In group 2, TP (68%, $p<0.05$) and SDNN (82%, $p<0.05$) parameters during the orthostatic test were found to be slightly higher than in the supine position.

CONCLUSIONS: AmO administration equally decreased catalase activity in both groups. AmO administration decreased TBARS concentration in group 1 and increased SOD activity in group 2. Improvement in HRV was evident after AmO administration and was more pronounced in athletes with lower levels of oxidative stress.

1227 *Board #6* **June 1 3:15 PM - 5:15 PM**

The Preventive Effects of Toona Sinensis on Oxidative Damage Induced by Exhaustive Exercise in Rat Liver

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Toona sinensis (TS) has been demonstrated to possess anti-lipid peroxidation than other herbal medicines, and the greatest superoxide radical scavenger effects. However, the information to the effect of TS on oxidative damage induced by exhaustive exercise is scanty.

PURPOSE: To investigate the exhaustive exercise-induced oxidative stress and the protective effect of TS supplementation on malondialdehyde (MDA), superoxide dismutase (SOD), and glutathione peroxidase (GPx) in rat liver.

METHODS: Thirty-two male Sprague- Dawley rats were randomly divided into the following four groups: 1.control (C, n=8), 2.exhaustive exercise (E, n=8), 3.TS (T, n=8), 4.TS-exhaustive exercise (TE, n=8). The amount of TS supplementation was 5.2 g/day/kg wt for 6 weeks. The exhaustive exercise started at 10% grade, 15 m/min for 10 min followed by gradual increases of treadmill speed and times as 25 m/min for 30 min, 30 m/min for 30 min, 35 m/min for 30 min, 40 m/min for 30 min, 45 m/min for 30 min, until exhaustion. Two way ANOVA was performed to examine the effects of exhaustive exercise and TS supplementation on MDA, SOD, and GPx activities.

RESULTS: Exercised duration in E and TE groups were 67.74±24.42 and 90.16±28.80 minutes, respectively. The results showed that MDA in the exhaustive exercise rat liver (10.08 ±2.44 μm/mg protein) was significant higher ($p<.05$) than C group (5.83±1.29 μm/mg protein), T group (3.2±.84 μm/mg protein) and TE group (5.08±1.29 μm/mg protein). SOD activity of rat liver in TS supplemental group (22.3±3.19 U/mg protein) was significant higher ($p<.05$) than non-TS supplemental group (14.10±2.84 U/mg protein), while SOD activity of rat liver in exhaustive exercise group (14.9±2.85 U/mg protein) was significant lower than non-exercise group (21.49±3.18 U/mg protein). Moreover, GPx activity of rat liver in TS supplemental group (3186.94±36.06 μU/mg protein) was significant higher ($p<.05$) than non-TS supplemental group (2158.35±33.76 μU/mg protein), while there was not significant difference between exhaustive exercise and non-exercise group in GPx activity of rat liver.

CONCLUSIONS: It is concluded that exhaustive exercise could result in oxidative stress. However, TS supplementation is beneficial to decrease oxidative stress and increase antioxidant status.

Supported by NSC 94-2413-H-134-013

THEMATIC POSTER SESSIONS

G-45 Thematic Poster – Long-Term Changes in Exercise and Eating Behaviors Related to Weight Loss and Bone Mineral Density

JUNE 2, 2007 9:00 AM - 11:00 AM
ROOM: 334

1228 **Chair: Timothy Lohman.** *University of Arizona, Tucson, AZ.*

1229 *Board #1* **June 2 9:00 AM - 11:00 AM**

Predictors of Weight Regain in a Long-Term Follow-Up of a Weight Loss Intervention

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PURPOSE: A five-year follow-up was designed to compare psychological and behavioral predictors in two groups of women with higher and lower amounts of weight regain. We hypothesized that selected baseline and four month changes in psychological and behavioral variables based on previous short-term results would predict membership in one regain group or the other.

METHODS: Sixty-six women, representing 60% of the women who completed both the intervention and weight maintenance program, were measured for weight five years after completing a four-month weight loss intervention and four years after a 12-month weight maintenance program. For statistical analysis, the women were divided into two groups based on their weight regain as weight maintainers (WM): 25 with less than 60% regained, and weight regainers (WR): 41 with more than 60% regained.

RESULTS: The average weight regain from the lowest weight during the study to the 5-year follow-up was 6.7±4.9 kg. On average, the WM regained 2.7±2.5 kg and the WR regained 8.5±4.7 kg. The WR had higher scores at baseline in body pain (SF-36) and lower scores in eating control (Brownell), vitality (SF-36), exercise motivation (Exercise Intrinsic Motivation Index), and sports competence (Physical Self-Perception Questionnaire). Change over 4 months in vitality, fatigue (POMS), exercise motivation, and binge eating (Brownell) was also significantly different between groups. Multiple logistic regression analysis (backward) confirmed that exercise motivation ($p<0.05$) and sports competence ($p<0.01$) played the greatest role in discriminating between groups. In additional analyses, 5-year WM were more likely to have lost more weight by the end of the 4-month intervention than WR ($p<0.01$).

CONCLUSIONS: Several psychological and behavioral variables at baseline as well as selected variables measuring changes over four months of weight loss intervention, including 4-month change in weight are important predictors of long-term weight regain or weight maintenance. Supported by NIH Grant R01 DK57453.

1230 *Board #2* **June 2 9:00 AM - 11:00 AM**

Four-Year Body Composition Response to Resistance Training and Multilocus ADR Genotypes (The BEST Study)

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Responsiveness to comparable exercise programs varies between individuals. Since adrenergic receptors (ADR) have been linked to exercise, fat mobilization, and oxidation, genetic variation in these receptors may contribute to variation in body composition in response to exercise.

PURPOSE: To determine whether allele variation in ADRA2b, ADRB2, and ADRB3 can influence the relationship between body composition and 4 years of resistance exercise.

METHODS: Completers of a large randomized trial of resistance training in sedentary post-menopausal (PM) women, using or not using hormone therapy (HT), were followed for fours years and genotyped for ADRA2b, ADRB2 and ADRB3 genes using buccal cell DNA (N=126). Percent total body fat (%TBF), fat mass (g), and lean soft tissue (%LST) were assessed by dual-energy X-ray absorptiometry at baseline and 4 years. Exercise attendance and HT duration were measured by self-report.

RESULTS: Non-genetic baseline characteristics were similar between intervention groups; however, multiple linear regression demonstrated that carriers of any Glu27 allele ADRB2 had higher %TBF and lower %LST at baseline ($p=0.09$). Four year models, adjusting for age, exercise attendance, and HT, demonstrated a trend toward an increase in %TBF ($p=0.07$), fat mass ($p=0.05$) and decrease in %LST ($p=0.07$) for carriers of any Glu9 allele in the ADRA2b gene. Carriers of any Glu27ADRB2 demonstrated the opposite relationships, but did not reach significance. We noted a positive interaction between ADRA2b and ADRB3 and %TBF, fat mass, and %LST ($p=0.06$, 0.11, 0.06 respectively). In all of the 4year models, exercise always significantly decreased %TBF and increased %LST ($p<0.03$), independent of genotype, while HT had a negative influence on the same parameters ($p<0.05$).

CONCLUSION: Based on this sample, we conclude that there is a relationship between ADR genotypes, body composition, and exercise response in PM women.

Supported by NIH Grant R01 AR39559, Gatorade Sports Science Institute, Proctor & Gamble, Puritan, and Mission Pharmacal.

1231 ***Board #3*** **June 2** **9:00 AM - 11:00 AM**

Predictors of Successful Weight Control: Cross-cultural Moderators of Treatment Outcomes

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PURPOSE: Given the heterogeneity of effect sizes within the population for any treatment, identifying moderators of outcomes is critical (e.g., JAMA 296:1286-9). It fosters targeting limited resources to those most likely to succeed and allows for a better matching between treatments and individuals. In weight management, few studies have been dedicated to describe baseline predictors of treatment success. The Healthy Weight for Life (USA) study is one of the few. Its findings are now being cross-validated in Portuguese samples. This paper describes these cross-cultural comparisons.

METHODS: Three separate overweight/obese samples were analyzed. The American sample (US) included 158 perimenopausal women (age: 48.0±4.5 y; BMI: 31.0±3.8 kg/m2) and two Portuguese samples (PT1, PT2) comprised of 140 (age: 38.3±5.9 y; BMI: 30.3±3.7 kg/m2) and 89 premenopausal women (age: 38.0±7.7 y; BMI: 32.3±4.3 kg/m2), respectively. Weight control programs were cognitive-behavioral in nature, based on regular group meetings to change nutrition and physical activity. Interventions lasted 4 (US, PT1) to 10 months (PT2). Subjects were assessed at baseline and scores evaluated against final and/or follow-up body weight change.

RESULTS: In the US sample, the number of recent previous diets, more unrealistic expectations, poorer weight-specific quality of life, lower self-motivation, less exercise self-efficacy and more perceived barriers, and poorer body image were predictors of smaller weight losses at 4 and 16 months ($p<0.05$). In PT1, findings for previous dieting attempts, lower self-motivation, and body image were replicated in the short-term. In opposition, higher expectations predicted larger weight losses in PT1 ($p<0.05$). Preliminary results with PT2 showed that previous dieting again negatively predicted weight loss at 1-year ($p<0.001$). Long-term results for PT1 and different predictors for PT2 are currently being analyzed and will be presented.

CONCLUSION: Baseline predictors of success in obesity treatment can be identified in different study samples. Similar prediction patterns have emerged across cultures although some differences may also exist, namely regarding initial expectations. Collectively, previous dieting consistently negatively moderates body weight loss.

1232 ***Board #4*** **June 2** **9:00 AM - 11:00 AM**

Predictors of Compliance with 5-Year Follow-up Assessments in a Weight Loss Intervention

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Long-term weight loss has proved challenging, and studies often report poor compliance and high rates of attrition. Understanding characteristics of individuals willing to return for long-term (5 year) follow-up may inform strategies for improving intervention and measurement adherence and compliance.

PURPOSE: To compare baseline characteristics and changes during weight loss in women who agreed to five-year follow-up assessments against women lost to follow-up.

METHODS: To compare baseline characteristics and changes during weight loss in women who agreed to five-year follow-up assessments against women lost to follow-up.

RESULTS: Women who returned for 5 year measures (n=66) lost more WT (6 vs 4 kg) during the 4-month intervention. Group baseline differences ($p< .05$, favoring "returners") were found in weight outcome expectations, WT loss/exercise readiness, attitude towards impact of weight on self-esteem, self-efficacy in situations of social pressure and physical discomfort, and measures related to body image and physical self-esteem (e.g., body shape, cathexis, and attractiveness; physical self worth and strength).

CONCLUSIONS: Psychosocial characteristics of women who complied with long-term follow-up after weight loss differed from non-compliers in potentially important ways. Measures of weight loss attitudes and expectations, body image and physical self-perception may relate to long-term retention, and represent targets for intervention. Supported by NIH Grant #DK57453.

1233 ***Board #5*** **June 2** **9:00 AM - 11:00 AM**

Strength Training Exercise Over 6 Years Predicts Increased Bone Mineral Density In Early Postmenopausal Women

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PURPOSE: The purpose of this study was to examine the relationship between long-term strength training exercise and changes in bone mineral density (BMD) among calcium-supplemented sedentary postmenopausal women using and not using hormones (HT) who participated in the Bone Estrogen Strength Training (BEST) study.

METHODS: Body composition and BMD (by dual x-ray absorptiometry (DXA)) were measured at baseline and annually for 6 years. Those randomized to exercise participated in progressive weight training sessions three times weekly at 70-80% of one repetition maximum. Controls were asked to continue their standard activity routine but were allowed to cross over to exercise at the end of one year. For 6 years, exercise frequency was logged at the training facilities. All women were asked to take 800 mg of calcium citrate daily and to monitor any changes in HT use.

RESULTS: At 6 years, 108 women (56.2±4.2 years old, 6.1±3.4 years postmenopausal at baseline) of the 320 women with measurements at baseline had complete data. Six-year exercise attendance was 42.0%±29.7% for randomized exercisers and 23.0%±22.0% for crossovers including 0% for their initial year as control and 0% for non-exercising controls. At 6 years, 60.2% were on HT (56.5% at baseline) and 39.8% were not (43.5% at baseline). In multiple linear regression adjusted for age and baseline body weight and BMD, 6-year change in body weight and stratified by HT use, 6-year change in femur trochanter (FT) and femur neck (FN) BMD were positively related to 6-year mean exercise frequency among women using HT ($p<0.01$ and $p=0.08$, respectively). Among women not using HT, exercise frequency was significantly and positively associated with change in lumbar spine (LS) and ultra-distal radius BMD (p=50% attendance) gained on average 3.4% FT BMD (adjusted mean) compared with all other women, who lost between 1.2% and 2.1% BMD. For HT non-users, women with the higher ExFreq gained 1.8% LS BMD while lower frequency exercisers lost 3.1%.

CONCLUSIONS: Long-term strength training exercise appears to enhance BMD at different bone sites in postmenopausal women, dependent on HT use. While the hip region responds to the combination of exercise and HT, the spine and forearm show improvement among HT non-users. Supported by NIH Grant R01 AR39559 and Mission Pharmacal.

1234 ***Board #6*** **June 2** **9:00 AM - 11:00 AM**

Four Years of Strength Training Predicts Improved Subjective Body and Self Satisfaction in Postmenopausal Women

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The long-term benefits of exercise on physical health are well-known. The promotion of mental health through physical activity has been less well studied, especially in postmenopausal women.

PURPOSE: The aim of this study was to examine the changes in subjective self and body satisfaction in postmenopausal women participating in a 4-year progressive strength training intervention study (Bone Estrogen Strength Training (BEST) study).

METHODS: One hundred, fifty women (56.0±4.5 years): 80 randomized to a progressive strength training program (70-80% of one repetition maximum), 49 controls who crossed over to exercise after one year, and 21 non-exercising controls completed the Body and Self Cathexis, Beck Depression, and Rosenberg Self-esteem/Self-concept questionnaires at baseline and 4 years. Exercise frequency (ExFreq) was measured as the mean percent of 3 weekly weight lifting sessions attended over 4 years.

RESULTS: Women in the highest tertile of ExFreq improved on average 9.5±22.7 points in the Body Cathexis Score (change from baseline; $p<0.01$) compared to a decreased score of 1.0±22.3 for women in the lowest tertile of ExFreq ($p<0.05$). In multiple linear regression, the highest level of ExFreq (=70.0±12.9% or about 2 sessions/wk) was associated with an improved total Body Cathexis Score compared to the lowest tertile of ExFreq (= 4.7±5.3%), independent of changes in Beck and Rosenberg indices ($p=0.01$). Although the strongest associations with the total Self Cathexis Score were found with Beck and Rosenberg scores ($p<0.001$), ExFreq was also marginally significantly related to the total Self Cathexis Score ($p<0.10$). Further, higher levels of ExFreq during the 4 year period were associated with improvement in the scores of individual Cathexis questions related to satisfaction with the body: physical stamina, muscular strength, energy level, age, health, and posture, and with the self: self-confidence, athletic skills, gracefulness, ability to discipline self, and degree of self-consciousness ($p<0.001$ to $p<0.10$).

CONCLUSIONS: Long-term strength training exercise appears to improve subjective body and self satisfaction in postmenopausal women as measured by the Cathexis questionnaire. The mental health of postmenopausal women may benefit from this form of exercise. NIH grant RO1 AR39559

1235 ***Board #7*** **June 2** **9:00 AM - 11:00 AM**

Nutrient and Bone Mineral Associations in Postmenopausal-Women Completing Four Years of the B.E.S.T. Exercise Study

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PURPOSE: To assess, in postmenopausal women participating in an exercise study, the associations over four years of bone mineral density (BMD) and mean nutrient intakes.

METHODS: The Bone Estrogen Strength Training (BEST) study was a partially

randomized clinical trial of the effects of progressive resistance exercise on BMD in healthy, nonsmoking, postmenopausal women. BMD was measured at the femur neck, trochanter, lumbar spine L2-L4, and total body using dual energy X-ray absorptiometry. In the first year, subjects were randomized to either exercise or no exercise conditions within groups stratified by hormone replacement therapy (HRT) use. In years 2-4 controls were permitted to begin the exercise program. Subjects took an average of 711 mg of supplemental calcium daily. Mean nutrient intakes were collected annually over four years using Arizona Food Frequency Questionnaires. Linear regression was used to test the association of 32 nutrient and nutrient combinations on BMD at each bone site (dependent variables) measured at year four (N=130; 56±4.3 years). All regression analyses were adjusted for the effects of year 1-4 mean exercise compliance, 1-4 year mean protein intake, 1-4 year mean total fat intake, years post menopause, and total energy intake. Associations were considered significant at $p<0.10$.

RESULTS: Regression analyses of some nutrient associations on BMD were significant ($p<0.10$). Significant negative associations in the HRT group include: Femur neck: carbohydrate; Trochanter: carbohydrate; Lumbar spine: potassium, total fiber, vitamin B12, docosahexaenoic acid (DHA), docosapentaenoic acid (DPA), polyunsaturated fatty acid, omega 3 fatty acid, eicosapentaenoic acid (EPA)+DHA; Total body: carbohydrate, DHA, DPA, linolenic acid, omega 6:omega 3, EPA, omega 3 fatty acid, EPA+DHA. For the HRT group, zinc had a positive association with total body. In the no HRT group, caffeine had a positive association with the spine. Omega 3 fatty acid in the spine and total body had the highest significance and magnitude of any nutrient.

CONCLUSIONS: The relationship between 4 year average nutrient intake and BMD associations varied with HRT use. Spine and total body BMD had more significant nutrient associations than femur neck and trochanter.

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1236 ***Board #8*** **June 2** **9:00 AM - 11:00 AM**

Measures of Exercise Motivation Predict Long Term Weight Maintenance in Middle-Aged Overweight Women

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BACKGROUND: Previous work with exercise motivation indicates an association with weight loss and weight maintenance.

PURPOSE: This study investigates the psychosocial variables related to exercise motivation and evaluates their association with successful long term weight maintenance in middle-aged overweight women 5 years after participating in the weight loss intervention program, Healthy Weight for Life.

METHODS: Women who had participated in the weight loss intervention program in 2001 were contacted 5 years after and invited to participate in a follow up study to assess different aspects of long term weight maintenance. Of the 111 women that completed the initial 4 month intervention and completed the 12 month post intervention maintenance phase, 66 agreed to participate in the follow up. Participants underwent follow-up measurements of height and weight and filled out questionnaires. Height and bodyweight (BW) measurements were obtained for all 66 participants. Of these 66participants, 58 women (baseline age 48 ± 4.1yr; baseline weight 82 ± 12.2kg, baseline BMI 30.3 ± 3.7) had complete data.

RESULTS: Mean BW change from baseline to 5-yr for the group was -2.4 ± 5.8kg, with a range of -14.9kg to 7.7kg. Backward multiple linear regressions predicting 5-yr BW change showed that baseline measures of exercise self efficacy (ESE) and exercise intrinsic motivation (EIM) were predictive of long term weight maintenance. The baseline ESE subscale "resisting relapse" predicted better weight maintenance ($p<0.04$) while the baseline EIM subscale "pressure/tension" was associated more with weight gain ($p<0.02$) over the 5yr period. In a separate model using 5-yr changes in self motivation scores, a positive association was found with changes in 5-yr BW ($p<0.01$). Improving self-motivation appeared to coincide with better maintenance of BW.

CONCLUSION: Baseline exercise motivation and improvement in self motivation predict long term weight maintenance.

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1237 ***Board #9*** **June 2** **9:00 AM - 11:00 AM**

Can Exercise, Calcium Supplementation, And Changes In Body Composition Explain Bone Responders And Nonresponders?

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PURPOSE: To determine whether 4-year bone mineral density (BMD) changes were different between responders (R) and nonresponders (NR) after adjusting for age, 4-year exercise frequency (EX Freq), 4-year calcium supplementation (CA) and 4-year changes in body composition (BC).

METHODS: Sedentary postmenopausal women (40-65 years) with HT (1-3.9 years) or without HT (≥1 year) were recruited to participate in a study designed to determine the effects of strength and weight-bearing exercise training on BMD in calcium-supplemented postmenopausal women. After year 1, women randomized to control were invited to self-select exercise or control. One hundred and sixty-seven women completed 4 years of the study. Regional BMD and BC were measured using dual-energy x-ray absorptiometry at baseline and yearly thereafter. EX Freq, CA and HT use were monitored throughout the study. Hierarchical multiple regression analyses were used to predict 4-year BMD changes from EX Freq, CA, age, and 4-year changes in BC. Analyses were conducted separately for HT users (n = 115, 55.3 ± 4.3 yrs) and non-users (n = 52, 57.5 ± 4.7 yrs). Factor analyses were used to identify groups of women who had similar patterns of 4-year BMD changes from: those who did not train (Ctrl, n = 23) and those who did train (EX, n = 52) for 4 years of the study. Those with increasing BMD patterns were defined as Rs and those with decreasing BMD patterns were defined as NRs. Adjusted 4-year BMD changes were calculated from the above regressions. Independent t-tests were used to determine whether R and NR differed in their 4-year BMD changes at the spine, trochanter and femoral neck.

RESULTS: For the Ctrls, the mean differences between R and NR for the spine, trochanter and neck BMD changes were 0.09, 0.03, and 0.08 g/cm2 ($p = 0.00$) prior to adjustment and were 0.02, 0.01, and 0.02 g/cm2 ($p > 0.05$) after adjustment. For the EXs, the mean differences between R and NR for the spine, trochanter and neck BMD changes were 0.13, 0.08, and 0.08 g/cm2 ($p = 0.00$) prior to adjustment and were 0.02 ($p = 0.05$), 0.02 ($p = 0.003$), and 0.01 g/cm2 ($p = 0.16$) after adjustment.

CONCLUSIONS: EX NRs and Ctrl group Rs existed. Age, EX Freq, CA and changes in BC accounted for the differences between R and NR in all cases except for the trochanter and spine BMD changes in EXs where mean differences were reduced but not eliminated.