

AMERICAN COLLEGE OF SPORTS MEDICINE

CENTRAL STATES CHAPTER

2000 ANNUAL MEETING



EMBASSY SUITES HOTEL

COUNTRY CLUB PLAZA

October 20-21, 2000

**The American College of Sports Medicine's Professional Education Committee certifies
that this Continuing Education offering meets the criteria for 10.0
credit hours of ACSM Continuing Education Credit.**

Meeting Objectives:

1. To disseminate information regarding exercise, nutrition, and physical activity in relationship to public health and at-risk populations.
2. To present current basic and applied research initiatives.
3. To discuss career development and employment opportunities for students and professionals

Friday October 20

- 8:00 am **Onsite registration Begins** (Hotel Lobby)
- 8:45-9:00 am **Welcome and Opening Remarks** (Vera Cruz I & II)
Joe Donnelly, Ph.D, FACSM, President CSC/ACSM
Debra Bemben, Ph.D., FACSM, Past-President CSC/ACSM
- 9:00-10:30 am **General Session** (Vera Cruz I & II)
- 9:00-9:45 am Mike Rogers, Ph.D., Wichita State University *mrc.twsu.edu*
"Balance and Fall Prevention in Older Adults"
- 9:45-10:30 am Susan Bloomfield, Ph.D., FACSM, Texas A & M University
"Bone Loss With Spaceflight: Mechanisms and Countermeasures"
- 10:30-10:45 am **Morning Break** (Sponsored by *Glaxo Wellcome*)
- 10:45-12:15 pm **Concurrent Sessions**
- Science** (Vera Cruz I & II)
- 10:45-11:30 am Barry Scheuermann, Ph.D., Kansas State University
"Integrating metabolic responses with Muscle Recruitment during Exercise"
- 11:30-12:15 pm Daniel Wilson, Ph.D., Southwest Missouri State University
"Lumbar Spine Forces During Exercise"
- Health/Clinical** (Lapaz III)
- 10:45-11:30 am Mary Dinger, Ph.D., CHES, University of Oklahoma
"Practical Assessment of Physical Activity"
- 11:30-12:15 pm Steve Figoni, Ph.D., FACSM, Cleveland Chiropractic College
"Physical Activity Intervention Trial for Women with Mobility Impairment in Kansas City"
- 12:15-1:45 pm **Lunch, SRA Presentations and Keynote Address** (Morelia I)
- J. Mark Davis, Ph.D., FACSM, University of South Carolina
"Nutrition for Optimal Performance" (sponsored by *Gatorade*)

- 1:45-5:00 pm **Mini-Symposium: Exercise and Health Issues in Postmenopausal Women**
(Sponsored by *GE Lunar Corporation*) (Vera Cruz I & II)
- 1:45-2:45 pm Jill Kanaley, Ph.D., FACSM, Syracuse University
“Body Composition Changes with Menopause”
- 2:45-3:30 pm Debra Bembem, Ph.D., FACSM, University of Oklahoma
“Exercise and Bone Health in Postmenopausal Women”
- 3:30-3:45 pm Discussion
- 3:45-4:00 pm **Afternoon Break** (Sponsored by *Hans Rudolph, Inc.*)
- 4:00-5:00 pm Lee Alekel, Ph.D., RD, Iowa State University
“Hormonal and Nutritional Interventions for Menopausal Women”
- 1:45-3:45 pm **Clinical** (Lapaz III)
- 1:45-2:45 pm Brian McCluskey, Ph.D., Rehabilitation Services of Columbus Georgia, Inc
“Bring Science into the Rehabilitation Clinic... Or Else!”
- 2:45-3:45 pm Stan Brown, Ph.D., FACSM, Southwest Baptist University and
Barbara Bushman, Ph.D., FACSM, Southwest Missouri State University
“Physiology of Water Immersion Exercise”
- 3:45-4:00 pm **Afternoon Break** (Sponsored by *Hans Rudolph, Inc.*)
- 4:00-5:00 pm **Student Session** (Lapaz III)
Matthew Mayo, Ph.D., The University of Kansas Medical Center
“Biostatistics: Handling Repeated Observations Over Time”
- 5:00-6:30 pm **Poster Session** (Lapaz I & II)

Saturday, October 21

- 7:30-8:15 am **Business Meeting - Professional Members** (Vera Cruz I & II)
- Student Meeting - Student Members** (Lapaz III)
Joe Pujol, Ph.D., Jeremy Barnes, Ph.D., and Mark Langenfeld, Ph.D. Southeast Missouri State University
"ACSM Certifications"
- 8:30-10:00 am **Oral Presentations** (Vera Cruz I & II)
- 8:30-8:45 am **Student Research Award Winner: M.D. Luttrell, University of Kansas**
"Effects of Powercranks® Training on Cardiovascular Fitness and Cycling Efficiency". M.D. Luttrell and J.A. Potteiger FACSM, University of Kansas
- 8:45-9:00 am **Student Research Award Winner: Alexander Koch, University of Kansas**
"Minimal Effect of Carbohydrate Ingestion on the Immune Response to Acute Resistance Exercise". A.J. Koch, J.A. Potteiger FACSM, M.A. Chan, S.H. Benedict, and B.B. Frey, University of Kansas
- 9:00-9:15 am "Endothelial Nitric Oxide Synthase: Effects of Exercise Training and Hyperthyroidism". T.K. Smith, K.D. Wyatt, E.A. Buhr, K.J. Hildenbrand, and R.M. McAllister, Kansas State University
- 9:15-9:30 am "Validation of a Single-Day Maximal Lactate Steady State Assessment Protocol in Trained Runners". K. Kuphal, J.A. Potteiger FACSM, M. Hise, B. Frey, J. Acosta, and J. Chartier, University of Kansas
- 9:30-9:45 am "Fear of Falling and Functional Ability in Older Adults Aged 77-100 Years". N.L. Rogers, M.E. Rogers, B.S. Chaparro, and L. Stumpfhauser, Wichita State University.
- 9:45-10:00 am "The Effects of 6-Months of Aerobic Exercise or High Intensity Resistance Exercise on Body Mass and Body Composition in Overweight Middle Age Men". J.P. Thyfault, M. Hulver, M. Carper, J. Acosta and J.A. Potteiger FACSM, University of Kansas.
- 10:00-10:15 am **Morning Break**

10:15-11:00 am

Concurrent Sessions

Health (Vera Cruz I & II)

Esabelle Jowers, Ph.D., Kansas State University

“Evaluating School-Based Physical Activity and Nutrition Promotion Initiatives: The Healthy Youth Places Project”

Clinical (Lapaz III)

James Cho, MS PT, and Sandy Billinger, Stroke Wellness and Research Center, Fort Hays State University

“The Effects of an Aerobic Exercise Program with Physiological, Sensory Organization, Limits of Stability and Gait Performance Measurements in Chronic Stroke Survivors”

11:00-12:00 pm

General Session (Vera Cruz I & II)

J. Mark Davis, Ph.D., FACSM, University of South Carolina

“CNS Mechanisms of Fatigue: Nutritional Influences” (sponsored by *Gatorade*)

12:00-12:15 pm

Concluding Remarks (Vera Cruz I & II)

Debra Bembem, Ph.D., FACSM, Past-President CSC/ACSM

Joe Donnelly, Ph.D, FACSM, President CSC/ACSM

2000 CSC/ACSM RESEARCH ABSTRACTS

Oral Presentations

EFFECTS OF POWERCRANKS® TRAINING ON CARDIOVASCULAR FITNESS AND CYCLING EFFICIENCY

Luttrell, M.D. and J. A. Potteiger, Department of Health, Sport and Exercise Sciences
University of Kansas

Purpose: To examine the effects of 6 weeks of training in endurance-trained cyclists using Powercranks® (n=6) or normal cranks (n=6) on maximal oxygen uptake (VO₂max) and anaerobic threshold (AT) during a graded exercise test (GXT), and heart rate (HR), oxygen consumption (VO₂), respiratory exchange ratio (RER), gross efficiency (GE), and blood lactate concentration ([La⁻]) during a 1-h constant load ride. **Methods:** Subjects in both groups performed supervised training on a cycle ergometer for 1-h, 3 d wk⁻¹ for 6 wk, with training intensity set at 70% VO₂max. The GXT and 1-h submaximal test was performed pre- and post-training to assess differences in the variables tested. The 1-h submaximal ride was performed on normal cranks at 70% VO₂max. VO₂, RER, GE, and HR were determined at 15-min intervals during the 1-h submaximal test. Blood [La⁻] was determined from samples collected pre- and post-exercise. **Results:** No significant differences were observed for VO₂max or AT during the GXT. The Powercranks® group had significantly higher GE values (p < 0.05) than the Normal Cranks group (23.6 ± 1.3% versus 21.3 ± 1.7%, and 23.9 ± 1.4% versus 21.0 ± 1.9% at 45 and 60 min., respectively), and significantly lower HR and VO₂ values during the 1-h submaximal ride following training. No significant differences in blood [La⁻] or RER were reported. **Conclusion:** These results indicate that 6 weeks of training with the Powercranks® reduces energy expenditure during a 1-h submaximal ride compared to training with normal cranks.

MINIMAL EFFECT OF CARBOHYDRATE INGESTION ON THE IMMUNE RESPONSE TO ACUTE RESISTANCE EXERCISE.

A.J. Koch, J.A. Potteiger FACSMM, M.A. Chan, S.H. Benedict, and B.B. Frey.
(Sponsor: J.A. Potteiger, FACSMM) Exercise Physiology Laboratory, University of
Kansas, Lawrence, KS 66045

The effect of carbohydrate supplementation (CHO) on the lymphocyte response to acute resistance exercise was examined in 10 resistance-trained males. Subjects completed a randomized double-blind protocol with sessions separated by 14 d. The exercise session consisted of a high intensity, short rest interval squat workout. Subjects consumed 1.0 g/kg body mass⁻¹ CHO or an equal volume of placebo (PLC) 10 min prior to and 10 min following exercise. Blood was collected at rest (REST), immediately post exercise (POST), and at 1.5 h and 4.0 h of recovery and analyzed for plasma glucose, serum cortisol, leukocyte subsets, and phytohemagglutinin (PHA)-stimulated lymphocyte proliferation. A significant treatment x time effect was observed for lymphocyte proliferation between CHO and PLC, but post-hoc analyses revealed no between-treatment differences at any post-exercise time point. Lymphocyte proliferation was significantly depressed below REST at POST (-39.2% for PLC, -25.7% for CHO). Significant fluctuations in leukocyte subset trafficking were observed for both treatments at POST, 1.5 h and 4.0 h. Plasma glucose was significantly increased POST in CHO compared to PLC. Cortisol was significantly increased from REST to POST in both treatments. These data support a minimal effect of carbohydrate ingestion on the lymphocyte response to high-intensity resistance exercise.

Supported by a student grant from the Gatorade Sports Science Institute

ENDOTHELIAL NITRIC OXIDE SYNTHASE: EFFECTS OF EXERCISE TRAINING AND HYPERTHYROIDISM

T.K. Smith, K.D. Wyatt, E.A. Buhr, K.J. Hildenbrand, and R.M. McAllister, Departments of Biology & Kinesiology, Kansas State University, Manhattan, KS 66506

In endothelium-dependent vasodilation, L-arginine is converted to citrulline in the endothelium, with the simultaneous release of nitric oxide (NO), a vasodilator. This reaction is catalyzed by nitric oxide synthase (NOS). Exercise training enhances endothelium-dependent vasodilation, presumably by increasing shear stress in a chronic but episodic manner. Hyperthyroidism has a similar but continuous effect. We tested the hypothesis that NOS activity in the aorta increases in exercise-trained and hyperthyroid rats. Rats were assigned to one of three groups: control (CO, n=5), exercise-trained (TR, n=5), or hyperthyroid (HY, n=4). TR rats ran on a treadmill at 30 m/min, 5 d/week for 11-15 weeks. HY rats were injected every second day with T₃ (300 ug/kg) for 17-20 weeks. Aortas were excised and endothelial proteins, including NOS, were extracted. NOS activity was determined using a ³H[L-arginine] to ³H[citrulline] assay. Left ventricular wt/body wt ratio was greater in HY (CO, 2.08 ± 0.22 mg/g; TR, 2.02 ± 0.04; and HY, 2.49 ± 0.04; P < 0.05), as was resting oxygen consumption (20.84 ± 1.38 ml/min/kg for HY, 10.53 ± 0.38 for CO; P < 0.05), indicating T₃ treatment efficacy. Citrate synthase activity indicated significantly increased oxidative capacity in the soleus muscle (CO=21.5±2.1 umol/min/g, TR=32.2±1.7, HY=35.3±0.9; P < 0.05, TR & HY vs. CO), another indication of T₃ and training efficacy. There were not any significant differences in aortic NOS activity among groups (CO=65±14 counts/hour/ug protein, TR=57±20, HY=112±19; ns). We conclude that the increase in endothelium-dependent vasodilation associated with training and hyperthyroidism does not appear to be a result of increased NOS activity.

Supported by NIH 57226, AHA-KS-98-GB-25, and a Howard Hughes Medical Institute Undergraduate Biology Education Program Grant.

VALIDATION OF A SINGLE-DAY MAXIMAL LACTATE STEADY STATE ASSESSMENT PROTOCOL IN TRAINED RUNNERS

K. Kuphal, J. Potteiger, M. Hise, B. Frey, J. Acosta, J. Chartier
University of Kansas, Lawrence, KS

The purpose of this investigation was to assess the validity and reliability of the single-day Palmer protocol for measuring MLSS. Nine endurance trained males (age 21.1 ± 1.6 y, VO₂max of 63.2 ± 3.2 ml · kg⁻¹ · min⁻¹) performed the single-day Palmer protocol on two occasions and a multi-day MLSS assessment protocol. The single-day Palmer protocol consisted of the subjects running a maximum of three 9-minute stages starting at an intensity based on the velocity corresponding to 87% maximum heart rate, breathing frequency of 32 breaths · min⁻¹, rating of perceived exertion of 12, and an average race velocity of a timed event ≥ 8 km. The MLSS for the multi-day protocol was defined as the highest velocity associated with a rise in [La⁻] ≤ 1.0 mmol · L⁻¹ during the final 20 min of a 30 min run. Concurrent validity was assessed by calculating a Pearson product correlation coefficient between the running velocities at MLSS from the multi-day protocol and from the first single-day Palmer protocol. Test-retest reliability was assessed by calculating a Pearson product correlation coefficient between the running velocities from the two trials of the single-day Palmer protocol. The single-day Palmer protocol successfully estimated MLSS in seven of nine subjects. The MLSS velocity from the single-day Palmer protocol (226.3 ± 22.6 m · min⁻¹) produced a strong correlation of 0.97 (p < 0.001) with the MLSS velocity from the multi-day assessment protocol (236.4 ± 27.8 m · min⁻¹). An equally strong correlation of 0.97 (p < 0.001) was calculated from the running velocity of the first trial of the single-day Palmer protocol with that of the second trial (241.8 ± 32.1 m · min⁻¹), suggesting test-retest reliability of the single-day Palmer protocol. It was concluded that the single-day Palmer protocol was valid and reliable in the estimation of MLSS.

FEAR OF FALLING AND FUNCTIONAL ABILITY IN OLDER ADULTS AGED 77-100 YEARS

N.L. Rogers¹, M.E. Rogers², B.S. Chaparro¹, and L. Stumpfhauser³. ¹Department of Psychology and ²Center for Physical Activity and Aging, Wichita State University; ³Quality of Life Center at Larksfield Place, Wichita, KS; email: nlrogers@twsu.edu

Fear of falling (FOF) may contribute to functional decline, frailty, decreased mobility, isolation, and lower life satisfaction. By influencing the intensity and frequency of physical activity, FOF can increase the risk for falling by leading to deconditioning. FOF was determined using the Activities-Specific Balance Confidence (ABC) Scale (Powell and Meyers, 1995) in 92 (35 men, 57 women) independently-living retirement community residents aged 77-100y (85.7±5.1y; mean±SD). The ABC Scale assesses FOF when performing a variety of balance-related activities. Participants also completed a battery of functional fitness tests from the Health and Lifestyle Review (HLR), an internet-based assessment tool developed by Wichita State University and Larksfield Place. Functional fitness assessments included tandem balance, 8' and 20' walking speed, Timed Up-&-Go (TUG), chair stand, grip strength, dumbbell curl, sit-&-reach, scratch test, and activities of daily living (ADL)/instrumental ADL (IADL) scales. Subjects were dichotomized into groups (low FOF, high FOF) utilizing the median ABC score (85.6/100) as a dividing point. Participants with a high FOF demonstrated lower functional fitness in tests of tandem balance (3.1 vs 2.3, $p<0.001$), 8ft (3.5 vs 2.2s; $p<0.001$) and 20ft (8.3 vs 5.3s; $p<0.001$) walking speed, TUG (16.0 vs 7.3s; $p<0.001$), repeated standing from a chair for 30s (8.9 vs 12.4 reps; $p<0.001$), combined grip strength (19.2 vs 23.8 kg; $p<0.01$), repeated dumbbell lifts in 30s (11.8 vs 14.8 reps; $p<0.001$), upper body flexibility (scratch test) (-6.8 vs -4.4 inches; $p=0.04$), and lower body flexibility (chair sit-&-reach) (-4.6 vs -2.8 inches; $p=0.02$). In addition, those with high levels of FOF reported lower abilities to perform ADL (19.8 vs 20.7 points; $p<0.001$) and IADL (10.4 vs 13.4 points; $p<0.001$). These results indicate that older adults with high FOF exhibit low functional abilities and greater self-reported difficulty performing ADL and IADL. Further research is needed to assess the effects of specific intervention programs on functional abilities in individuals with high FOF. Programs that positively impact the functional fitness of those with high FOF may increase confidence when performing activities that contain components of balance; thus, enhancing the quality of life for this segment of the older adult population.

THE EFFECTS OF 6-MONTHS OF AEROBIC EXERCISE OR HIGH INTENSITY RESISTANCE EXERCISE ON BODY MASS AND BODY COMPOSITION IN OVERWEIGHT MIDDLE AGE MEN.

J.P. Thyfault, M. Hulver, M. Carper, J. Acosta, and J.A. Potteiger, FACSMS.
University of Kansas Exercise Physiology Laboratory: Lawrence, Kansas.

The purpose of this investigation was to compare the effects of 6-months of aerobic exercise vs. 6-months of resistance exercise on body mass (BM), body fat percent (%Fat), and fat free mass (FFM) in 14 healthy, overweight, middle-age men. Upon signing an informed consent form, subjects were randomly assigned to either an aerobic ($n=7$; age, 36.3 ± 2.5 ; BMI, 31.3 ± 3.6) or a resistance training ($n=7$; age, 35.3 ± 6.4 y; BMI, 30.7 ± 3.5) group. All exercise sessions were supervised. The aerobic exercise program elicited a target heart rate between 70-80% of maximal aerobic power and began at $3 \text{ d}\cdot\text{wk}^{-1}$ for 20 m and progressed to $5 \text{ d}\cdot\text{wk}^{-1}$ for 50 m. The primary mode of exercise was walking and/or jogging. The resistance training consisted of a linearly periodized high intensity resistance training program designed to target all major muscle groups. Training began at 3 d and progressed to $4 \text{ d}\cdot\text{wk}^{-1}$. Both groups completed 4 d dietary food records at baseline, 3, and 6-months and were provided nutritional counseling and instructed to reduce caloric intake. BM, %Fat, and FFM were measured at baseline, 3, and 6-months. FFM and %Fat were analyzed using a Lunar DEXA. There was no significant difference in BM between groups, however there was a within group effect with the aerobic group decreasing from baseline ($102.7\pm 10.4 \text{ kg}$) to 6 months ($95.9\pm 6.9 \text{ kg}$). There was no significant change in %Fat between groups but both groups experienced significant reductions in %Fat from baseline (resistance $33.9\pm 5.9\%$; aerobic $33.9\pm 5.9\%$) to 6 month (resistance $32.2\pm 7.1\%$; aerobic $31.7\pm 6.4\%$). A significant decrease in FFM from baseline ($66.7\pm 6.50 \text{ kg}$) to 6 months ($65.4\pm 6.7 \text{ kg}$) in the aerobic group was also observed. We concluded that aerobic exercise was effective in reducing BM, by decreasing both %Fat and FFM. Resistance exercise was not effective for reducing BM but does have a positive effect upon body composition, as indicated by a significant decrease in %Fat, and a nonsignificant increase in FFM. This research was funded by the American Heart Association. #99511162

2000 CSC/ACSM RESEARCH ABSTRACTS

Poster Presentations

RELIABILITY OF THE SINGLE BREATH EXHALATION TECHNIQUE FOR PULMONARY DIFFUSING CAPACITY DURING EXERCISE

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Dept of Kinesiology, Kansas State University, Manhattan, KS 66506

The single breath exhalation technique is an established technique for measuring lung diffusion capacity (DLCO) and pulmonary blood flow (Q_c). During exercise however, maintaining a constant flow rate for a prolonged period of time is a difficult maneuver for many subjects, which may affect the accuracy and reliability of this technique. Therefore, we were interested in determining the reliability of this technique plus the minimal exhalation time acceptable for the measurement of DLCO and Q_c during exercise. Nine subjects walked (3-mi/hr) while performing multiple randomized breathing maneuvers at a constant flow rate for DLCO and Q_c determination at 1, 2, 3, 4, and 5 seconds. Reliability estimates for each time period were determined by coefficient of variation (CV) and differences in DLCO and Q_c between time periods were analyzed by repeated measures ANOVA. The CV between repeat trials was <10% for DLCO and <9% for Q_c for 3-5 sec but unreliable for 1 and 2 sec. DLCO measurements during 1 and 2 sec exhalation (41.7 ± 0.6 ml/mmHg/min) were $17.3 \pm 0.2\%$ greater ($P < 0.05$) than 3, 4, and 5 sec exhalations (35.7 ± 0.6 ml/mmHg/min). The 1-sec exhalation for Q_c (13.9 ± 0.7 l/min) was significantly greater than 2-5 sec (9.6 ± 0.4 l/min). These results suggest that the single breath exhalation technique for DLCO and Q_c show reliable and consistent estimates if a constant exhalation is maintained for ≥ 3 sec during exercise.

Support from Parker B. Francis Foundation

TIME-COURSE CHANGES IN METABOLIC PROFILES IN RESPONSE TO
LONG-TERM EXERCISE IN OVERWEIGHT WOMEN WHO GAIN WEIGHT

E.P. Kirk, J.E. Donnelly, FACSM, D.J. Jacobsen, FACSM, J.A. Potteiger,
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It is thought that weight loss through exercise is necessary to improve metabolic profiles. However, it has been suggested that metabolic profiles can be improved in the absence of weight loss. Furthermore, the time-course for these changes to occur among overweight women who gain weight is uncertain as the majority of studies do not use serial measures but instead rely on pre-post test measures. To this end, we compared the length of time necessary for previously sedentary females to improve their metabolic profiles (cholesterol, glucose, insulin) in response to 16 months of aerobic exercise who gained weight. Six females age 23 ± 6 yrs, BMI = 30.6 ± 3.3 kg/m² performed verified, supervised exercise for 16 months, 5 d/wk, 45 min/sess at 75% of HRR. All assessments were completed at baseline, 9 months, and 16 months.

Variable	Baseline	9 Months	16 Months
Fasting Glucose (mg·dl ⁻¹)	101.7±5.8	101.0±5.2	97.3±5.1
Fasting Insulin (μu·ml ⁻¹)	13.0±6.6	12.2±4.7	12.5±4.2
HDL Cholesterol (mg·dl ⁻¹)	51.7±12.8	59.2±9.1	61.0±12.6
Weight (kg)	83.5±13.5	84.7±13.9	86.6±13.5
FatWt(kg)	31.1±8.3	33.0±9.2	33.3±8.6

Values are mean ± standard

There were no significant changes in the metabolic profiles for women who gained weight across 16 months of exercise. However, there were trends in improvements for fasting glucose, fasting insulin and HDL with most of the improvement seen in 9 months compared to 16 months. Subsequently, it appears that women who gain weight can not significantly alter their metabolic profile across 16 months of moderate aerobic exercise. Conversely, the metabolic profile does not worsen suggesting that exercise may provide a protective mechanism for some metabolic functions.

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EFFECT OF ALTITUDE AND MAXIMAL EXERCISE UPON FINE MOTOR
COORDINATION.

Jamie Hassler, Edward Sutton, and James Padfield
Truman State University, Kirksville, MO

Abstract

Fatigue and exposure to altitude have been shown to have detrimental and independent effects upon rifle marksmanship. To investigate the effect of exercise and altitude upon other measures of fine motor coordination, eight subjects acclimated to low altitudes participated in a maximal exercise test on a bicycle ergometer at both 3700 m and 300 m elevations. In addition, each subject was tested in both resting and post-exercise trials (randomized cross-over design) for fine motor performance at both elevations. The study design allowed for the independent analysis of altitude and fatigue while controlling for the effects of decreased temperature at high altitude. At altitude, maximal aerobic power decreased 26%, while fine motor performance decreased 17%. Fatigue decreased fine motor performance 10%. Data were analyzed using a repeated measures analysis of variance, and indicated that both altitude ($p < .01$) and fatigue ($p < .05$) independently decreased fine-motor performance.

FEASIBILITY OF A PHYSICAL ACTIVITY PROGRAM AT A SHELTERED WORKSHOP FOR ADULTS WITH MULTIPLE DISABILITIES

D.L. Sharp¹, M.E. Rogers¹, and K.H. Pitetti². ¹Center for Physical Activity and Aging, Department of Kinesiology and Sport Studies, and ²Department of Physical Therapy, Wichita State University, Wichita, KS; e-mail: sharpdlsharp@aol.com

Providing physical activity programs for people with multiple disabilities may be a means to increase their physical function and independence; thus, reducing their risk for becoming institutionalized and/or developing additional disabilities. However, little has been done to develop such programs for this population. The purpose of this study was to assess the feasibility of a physical activity program at a sheltered workshop for adults with multiple disabilities including mental retardation, Down syndrome, autism, speech/language impairments, behavior disorders, hyperactivity, and developmental delays. Sixteen clients were asked and 11 volunteered to participate in the program. Six of the 11 volunteers completed assessments before and after the program to determine strength, flexibility, and motor skills. Three of these 6 did not participate in the activity program and served as a control group. The remaining three volunteers who completed all assessments, participated in the physical activity program (45 min, 2d•wk⁻¹, 8 wk) which consisted of a warm-up, exercises utilizing Thera-band™ elastic bands, and a cool-down. Adherence was 100% for these participants. Slight improvements were observed for the majority of tests in 2 of the participants. In the other participant, no improvements were observed. For controls, no changes or slightly lower test scores were observed. The results of this study are encouraging and indicate that this limited activity program(45 min, 2d•wk⁻¹, 8 wk) was beneficial to those who participated. Additional studies are needed to assess the long-term effects of physical activity on populations with multiple disabilities

POST EXERCISE HYPEREMIA DOES NOT OVERSHOOT PEAK OSCILLATORY BLOOD FLOW DURING EXERCISE

B.L. Lutjemeier, A. Miura, S. Koga, B.W. Scheuermann, and T.J. Barstow, FACSM.
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Previous research in muscle blood flow suggested that, immediately following exercise, there is an overshoot of the blood flow to the working muscle, implying inadequate flow during exercise. The purpose of this study was to further characterize this post exercise hyperemia (PEH). For the preliminary study, 3 male subjects performed discontinuous, incremental knee extension exercise under four conditions in a 2 x 2 design: supine and upright, with a long (22 cm), and short (10 cm) kicking length. Each increment consisted of 2 minutes of kicking with one minute of rest. Exercise intensities ranged from easy to very difficult. The contraction frequency was set at 40 kicks/min. Mean blood velocity was determined cardiac cycle by cycle using Doppler sonography and converted to flow using a cross sectional area for the femoral artery derived from ultrasound. Peak blood flow early in recovery was often greater than the mean blood flow during the last 30 seconds of exercise, consistent with previous interpretations. However, when PEH was compared to the 10 highest individual cardiac-cycle averaged values during exercise, which reflected the true oscillatory behavior of the blood flow response, there was no difference. This was true across all exercising conditions. Thus, in humans performing knee extension exercise, the post exercise blood flow response does not show an overshoot when compared to the peak blood flow oscillations observed during exercise, even at high exercise intensities.

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RELATIONSHIP BETWEEN CARDIOVASCULAR RISK FACTOR REDUCTION
AND BODY WEIGHT CHANGES IN EXERCISING OVERWEIGHT ADULTS
C.A. Meek-Stephens, D. J. Jacobsen, FACSM, J.E. Donnelly, FACSM, University of
Kansas, Lawrence KS, 66045. meekstep@ukans.edu

Obesity increases the incidence of diabetes and cardiovascular disease in adults. Risk factors such as hypertension, obesity, hyperlipidemia, and insulin resistance may respond favorably to moderate levels of physical activity, thereby protecting against CVD (Smith et al 1999). It would be important if exercise could decrease cardiovascular risk factors independent of changes in body weight. The purpose of this study was to determine the effect of 16 months of exercise on body composition and blood chemistry profiles for 25 sedentary, moderately overweight adults. All subjects performed a verified supervised exercise program of five d/wk, 45 minutes/session at 75% HRR. Peak oxygen consumption (indirect calorimetry) and maximal heart rate (ECG) were measured for each subject during a maximal exercise test to volitional fatigue before and after the exercise program. Body composition was determined by hydrostatic weighing at residual volume. Dietary intake was ad libitum with no change in energy intake among the subjects across the study. HDL, LDL, total cholesterol, triglycerides, glucose and insulin values were assessed using standard enzymatic techniques. Exercise protocol adherence was excellent ($93 \pm 2\%$). VO_2 max was improved in all subjects from 35 ± 5 ml/kg/min. at baseline to 42 ± 7 ml/kg/min. Despite a caloric expenditure of ~ 454 kcal/session, 8 of the 25 subjects (GW group=32%) gained 2.63 ± 2.87 kg. The remaining 17 subjects (LW group) had a weight loss average of 4.03 ± 4.13 kg. Body fat was reduced in the LW group. Total cholesterol increased for the GW group from 164 ± 41 mg/dl at baseline to 178 ± 34 mg/dl. at 16 months. However, HDL cholesterol was also increased from 52 ± 11 mg/dl at baseline to 59 ± 11 mg/dl at 16 months but was not statistically significant. Insulin resistance and glucose tolerance were improved in the LW group. The results suggest that VO_2 max may be improved in exercising overweight adults even with a weight gain. However, loss of body weight in exercising overweight adults appears to improve VO_2 max, glucose intolerance, insulin resistance, and body fat, suggesting a reduction of cardiovascular risk factors. This study also suggests that weight loss resulting from exercise may be related to energy expenditure during exercise. Exercise prescriptions for weight loss should reflect anticipated energy expenditure rather than the standard criteria of target heart rate.

EFFECTS OF CYCLOSPORINE-A ON SKELETAL MUSCLE CHARACTER IN RATS
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Transplant patients treated with Cyclosporine-A (CsA) often exhibit weight loss and low exercise tolerance. Limited research on both cultured and in vivo myocytes investigating these side effects of CsA are conflicting, but some studies have shown changes in the muscle character (e.g., Type I to Type II muscle fiber type shifts) with CsA administration. We compared oxidative enzyme activities and skeletal muscle fiber type composition of rats treated with CsA (CsA, n=10) to control counterparts (Veh, n=10). We hypothesized that CsA treatment would increase Type II muscle fiber content, as well as oxidative enzyme activities in the soleus muscle. CsA rats were treated for 21 consecutive days with CsA (20 mg/kg) dissolved in olive oil, and Veh rats were given olive oil only. Rats were sacrificed at 22 days, and soleus muscles were excised bilaterally. One soleus muscle was frozen for biochemical assays and the other was mounted and frozen in liquid isopentane for histochemistry. As expected, total white blood cell count decreased in CsA rats (Veh, $9.4 \pm 1.0 \times 10^3$ /ul; CsA, 7.5 ± 0.9 ; $P=0.06$). Changes in body weight over the treatment period were not different between groups (CsA, $+13 \pm 3\%$; Veh, $+18 \pm 2\%$; n.s.). Soleus wt/tibial length ratio also did not differ between groups (Veh, 0.0038 ± 0.0002 g/mm; CsA 0.0035 ± 0.0002 ; n.s.). Soleus citrate synthase activity was increased with CsA treatment (Veh, 24.2 ± 1.5 umol/min/g; CsA 28.9 ± 1.2 ; $P<0.05$). 3-hydroxyacyl-CoA dehydrogenase activity was elevated in the same muscle (Veh, 10.9 ± 0.6 umol/min/g; CsA, 13.0 ± 0.6 ; $P<0.05$). Type II fiber content was not changed with CsA treatment (Veh, $18.5 \pm 3.2\%$, n=4; CsA, $20.1 \pm 5.4\%$, n=3; n.s.). We conclude that CsA appears to affect skeletal muscle metabolic proteins, but not contractile proteins.

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MICROCURRENT ELECTRICAL NERVE STIMULATION AND CRYOTHERAPY DO NOT AFFECT PERCEIVED PAIN FROM DELAYED ONSET MUSCLE SORENESS

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The goal of this project was to examine the combined effects of microcurrent electrical stimulation and cryotherapy on the perceived pain of Delayed Onset Muscle Soreness (DOMS). The design and setting of this study was DOMS was induced in the wrist flexors of the non-dominant arm using a programmed bout of eccentric exercise. At 24 hour (h) intervals, MENS, ICE, or MENS+ICE were administered using a standard procedure. Perceived pain was assessed on a verbal descriptive scale immediately following, and at 24h, 48h, 72h, and 96h post exercise. Forty college-age (19 to 31 years) subjects (22 females, 18 males) which were not involved in a weight lifting program, were randomly assigned to a control, MENS, ICE, or MENS+ICE group. A three-way mixed factor ANOVA was used to evaluate the interactive effects of ICE, MENS and time on pain rating ($\alpha = 0.05$). Results indicated no statistically significant interactions among ICE, MENS and time. In addition, there was no statistically significant main effect for MENS ($F_{1,36} = 0.71, p = 0.404$) nor for ICE ($F_{1,36} = 0.18, p = 0.673$). There was, however, a significant main effect of time ($F_{2,144} = 6.64, p = 0.002$). The peak pain rating was provided at 48h and declined at 72h and 96h post exercise. This study does not support the use of MENS or ICE to reduce perceived muscle pain derived from DOMS.

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EFFECT OF EXERCISE ORDER ON CALORIC EXPENDITURE DURING PROLONGED EXERCISE IN FEMALES

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Previous research on the effect of prior exercise on subsequent metabolic function has been equivocal, with some studies noting a greater fat oxidation in the latter stages of prolonged exercise when the prior stages consisted of weight training. The purpose of this study was to determine the effect of prior exercise on metabolic functions during prolonged running. Ten moderately trained college females (Mean \pm SD - age: 20.3 \pm 1.2 yrs, weight: 58.8 \pm 4.5 kg) performed two trials with differing preliminary exercise. During one trial the preliminary exercise consisted of 20 minutes of circuit weight training using Nautilus equipment. Three sets of 10 repetitions on five exercises were performed, with a one-minute recovery between sets. Loads were approximately 60% of 1-RM for each exercise. During the other trial the preliminary exercise consisted of jogging on a motorized treadmill at a pace deemed comfortable by the subject. The second part of each trial consisted of treadmill running with metabolic function measured by a computerized metabolic cart (SensorMedics 2900). Averages over the final 10 minutes of exercise indicated no significant difference ($p > 0.05$) in VO_2 , ml/kg/min ($t = 0.44$), respiratory exchange ratio ($t = 0.86$), or caloric expenditure ($t = 0.78$). During the second exercise of both trials, approximately the same percent of calories expended were from fat. Therefore, it does not appear that a preliminary session of weight training prior to running produces any greater fat utilization during a subsequent bout of running than does any other prior exercise.

USE OF AN INTERNET-BASED ASSESSMENT TO DETERMINE FUNCTIONAL FITNESS IN THE OLDEST-OLD

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The oldest-old (age 85+ years) represent the fastest growing segment of the population. Physical frailty is common in this cohort and often leads to placement into assisted living programs. However, little is known about the functional capacities of this population. Much of the disability that occurs in later life may be preventable through early detection of functional deficits followed by appropriate physical activity interventions. The purpose of this study was to assess functional ability in the oldest-old using our Health and Lifestyle Review (HLR), a standardized functional assessment accessed by the internet. This study also contributed to our centralized national HLR database of functional ability. Independently-living persons (N=100; 38 men, 62 women) were recruited from a retirement community and were subsequently divided into two age groups ($p < 0.001$): 76-84y (n=40, $80.9 \pm 2.3y$, mean \pm SD) and 85-100 (n=60, $88.9 \pm 3.7y$). The functional test battery included tandem balance, chair stand, 8' and 20' walking speed, grip strength, sit-and-reach, scratch test, dumbbell curl, Timed Up-&-Go, height, weight, BMI, and fear of falling (FOF)/activities of daily living (ADL)/instrumental ADL (IADL) scales. Height ($1.62 \pm 10m$), weight ($66 \pm 16kg$), and BMI (25.9 ± 5.0) were not different ($p = 0.2-0.9$) between age groups. Differences ($p < 0.05$) in functional performance were observed for all lower body tests of strength and flexibility, balance, walking speed, and Timed Up-&-Go. Differences were not observed for upper body tests of flexibility and strength. The older group reported lower IADL ($p = 0.02$) but not ADL ($p = 0.28$) scores. FOF did not differ ($p = 0.53$), supporting our earlier research that age is not associated with FOF. These results indicate that lower body functional capacity is significantly diminished in the oldest-old. These declines negatively impact the ability of the oldest-old to perform IADL. However, upper body function and ADL ability is maintained relative to lower body function and IADL in the later years of life. If upper body performance were to decline, it is possible that ADL scores would decline as well, leading to placement in assisted living programs. The HLR appears to provide a viable means for assessing functional abilities in the oldest-old and offers great potential for tracking and predicting changes.

THE EFFECTS OF 35 D OF CREATINE SUPPLEMENTATION, FOLLOWED BY A 28 D WASH OUT PERIOD, ON LOWER LEG ANTERIOR COMPARTMENT PRESSURE.

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Purpose: The purpose of this investigation was to determine if 35 days (d) of creatine (Cr) supplementation followed by a 28 d wash out period, had any adverse side effects on lower leg anterior compartment pressure (ACP) in 16 physically active, healthy, college aged males ($VO_2 \text{ max } 47.6 \pm 5.1 \text{ ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$). **Methods:** Subjects were tested for body mass, body composition, resting blood pressure and leg volume at pre-, 7 d and 35 d of supplementation and 28 d post-supplementation. Subjects were divided into two treatment groups: 1) high dose ($0.3 \text{ g Cr}\cdot\text{kg body mass}^{-1}\cdot\text{d}^{-1}$ for 7 d followed by $0.03 \text{ g Cr}\cdot\text{kg body mass}^{-1}\cdot\text{d}^{-1}$ for 28 d), 2) low dose ($0.03 \text{ g Cr}\cdot\text{kg body mass}^{-1}\cdot\text{d}^{-1}$ for 35 d). Following 35 d, Cr supplementation was terminated and both groups engaged in a 28 d wash-out period in which no Cr supplement was ingested. At baseline, 7 d and 35 d of Cr supplementation, and 28 d post-supplementation ACP was measured at rest and immediately, 1, 5, 10, and 15 min post-exercise following a level treadmill run at 80% $VO_2 \text{ max}$. Muscle samples from the *m. vastus lateralis* were collected at baseline, 7 d and 35 d of Cr supplementation, and 28 post-supplementation and analyzed for adenosine triphosphate ([ATP]), [Cr], Cr phosphate ([PCr]), and total Cr ([TCr]) concentrations. **Results:** A significant increase in [Cr], [PCr], and [TCr] was observed for both groups. There were no significant differences between groups for body mass, percent body fat, leg volume, and systolic and diastolic blood pressures at any measurement time. There was no significant group by time interaction, but there was a significant time effect for groups when combined. Resting ACP was significantly increased from baseline at 7 d supplementation. Immediate post-exercise ACP was significantly increased from baseline at 7d and 35 d supplementation. One min post-exercise ACP was significantly increased from baseline at 7 d and 35 d supplementation, and 28 d post-supplementation. Five and 10 min post-exercise ACP was significantly increased from baseline at 7 d supplementation. There were no significant differences in 15 min post-exercise ACP at any time period. **Conclusion:** We conclude that 35 d of Cr supplementation significantly increases ACP at rest and following exercise, and ACP begins to return to normal after 28 d of no Cr supplementation. Supported by the National Athletic Trainers Association.

**Physical Fitness Testing Using National Youth Sports Program Campers
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The National Youth Sports Program (NYSP) has been in existence for over 20 years and is funded by the Federal Government and sponsored through the NCAA. During the Summer of 2000, the program was expanded to include a special category for boys and girls ages 13-16 and was called the "Senior Program". Along with traditional activities, the new program was to include unique educational opportunities. The main purpose of this study was to train the campers themselves to become proficient as fitness testers. A secondary purpose was to compare the scores of the campers with normed data using age and gender as independent variables and comparing their scores with national data. The parameters tested were percent body fat, sit and reach flexibility, grip strength and VO₂ using a step test. Each fitness parameter was analyzed separately by a 2x2 ANOVA and served as dependent variables. With respect to the main purpose, it was determined that student campers could be trained as testers with a minimal amount of training from test-retest results ($r = .76$). To determine if the campers scores were valid with the literature, a 2(gender) x 2(age) analysis of variance (ANOVA) with body fat identified correctly as the dependent variable yielded a significant main effect for gender [$F(1,56) = 9.2, p < .005$]. No significant differences were found between boys and girls on flexibility. A second and similar 2x2 ANOVA with grip strength as the dependent variable yielded a significant main effect for age [$F(3,54) = 4.76, p < .001$] and gender [$F(1,56) = 12.3, p < .001$]. A third 2 x2 ANOVA with VO₂ as the dependent variable yielded a significant main effect for gender [$F(1,56) = 4.7, p < .001$]. Our results showed that our boy campers were leaner and had higher VO₂ than aged matched girls. Boys had higher grip strength than did girls and grip strength increased across age of both genders. There was no difference in flexibility. These youth fitness results are typical in the literature with the exception of VO₂ being high in the campers.

**RELATIONSHIP OF GRIP STRENGTH AND EXERCISE HISTORY TO BONE
MINERAL DENSITY IN ADULT FEMALES.**

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Bone health is a major concern for women in the effort to forestall osteoporosis. Single ray absorptometry (SDA) is one of the first line of defense often suggested by physicians for determining bone health. The purpose of this study was to evaluate the relationships of bone mineral content (BMC) to age, body dimensions, and grip strength. Seventy-eight female university staff volunteered to be evaluated for calcaneal BMC by SDA at a yearly screening. Body dimensions included height (Ht), body mass (BM), and body mass index (BMI). Right and left isometric grip strengths were assessed using a Jamar dynamometer and considered as a total strength index (TS). Exercise history included ratings of intensity, duration, and sessions/wk and were used to produce an activity index (AI). BMC was moderately but significantly correlated with age ($r = -0.43$), Ht ($r = 0.27$), BM ($r = 0.36$), BMI ($r = 0.28$), TS ($r = 0.46$), and AI ($r = 0.36$). Despite holding age constant by partial correlation, Ht ($r = 0.25$), BM ($r = 0.36$), BMI ($r = 0.28$), TS ($r = 0.37$), and AI ($r = 0.31$) remained significantly correlated with BMC. A multiple regression equation indicated that TS (32%) and AI (30%) made slightly greater contribution to the explained variance ($r^2 = 0.42$) in BMC than did age (20%) and BMI (18%). Individuals with low BMC (<1 SD, $n = 13$) did not differ significantly in BM, BMI, and TS from those with high BMC (>1 SD) when age was held constant by ANCOVA, but low BMC individuals did have a significantly lower AI. These results would suggest that bone health in women may be enhanced by higher activity and strength levels.

GENDER DIFFERENCES IN UPPER BODY STRENGTH ARE NOT ELIMINATED BY ALLOMETRIC SCALING.

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The purpose of this study was to evaluate the efficacy of allometric scaling to compare the differences in upper body strength between college men and women. Untrained male ($n = 333$) and female ($n = 328$) members of a general fitness class were measured at the beginning of the class for one-repetition maximum (1-RM) bench press (BP), body mass (BM), and lean body mass (LBM). Jackson-Pollock three-site gender-specific generalized prediction equations were used to assess LBM. The commonality of slope of the relationship between BM and BP for men and women was evaluated using a multiple, log-linear regression model. The nonsignificant interaction term ($p = 0.23$) for gender \times \ln BM confirmed a similarity of slope and revealed the exponent for BM to be 0.66, similar to the theoretical value of 0.67. Computing separate allometric equations for men ($BP = 4.18 BM^{0.66}$) and women ($BP = 2.18 BM^{0.66}$) indicated that men were approximately 1.9 times stronger in the upper body than women after the influence of BM is partialled out. Computing separate equations using LBM revealed that men ($BP = 0.80 LBM^{0.97}$) were approximately 1.6 times stronger than women ($BP = 1.25 LBM^{0.97}$). Because the 95% confidence interval for the LBM exponent encompassed 1.00, it suggested that strength comparisons can be made using a ratio scale when considered relative to LBM (i.e., BP/kg LBM). However, when considering strength relative to BM, an allometric scale appears preferable. Further investigation is warranted, however, since the correlation between the scaled variable (BP/BM^b) and BM was significant in men ($p = 0.03$) but not in women ($p = 0.98$).

COMPARISON OF FITNESS PARAMETERS BETWEEN CHILDREN AGES 11-13: INVOLVEMENT VERSUS NON-INVOLVEMENT IN IRONKIDS™ COMPETITION

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The purpose of this study is to determine if training for an event will increase a child's level of fitness. In addition, this study will compare exercise compliance between children involved in an event (i.e. Ironkids™) and those not involved in an event. It is hypothesized that children involved in preparing for an event will show increased fitness when compared with those not preparing for an event. From the findings, event may be utilized as a motivator for increased activity in youth. A total of thirty-five (35) children (ages 11-13) were tested using the PRUDENTIAL FITNESSGRAM. This is a "comprehensive fitness program for school-aged children and youth." It consists of the following health-related fitness assessments: Pacer, BMI, Curl-ups, Trunk Lift, Push-ups, and Sit-and-Reach. Each subject participated in the above assessments prior to physical education exercise training as well as after (post) participation in the event. These assessments are part of the physical education curriculum of USD 259. Statistical procedures included a Repeated Measures ANOVA to determine variance between involved (Ironkids™) subjects and non-involved subjects. The study showed that children involved in the event had a better overall fitness level than those not involved in the event. The scores for the strength and endurance components of the PRUDENTIAL FITNESSGRAM tended to be higher than those children competing in the event. The body composition tests showed that the children competing in the event tended to have less body fat and body weight than those not competing in the event. The data taken from this study can show that event training for children ages 11-13 has a positive impact on physical fitness levels when compared to children not training for an event.

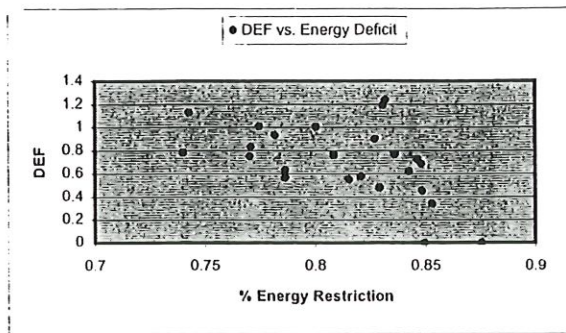
RELATIONSHIP BETWEEN ENERGY DEFICIT AND EFFICIENCY OF WEIGHT LOSS DURING A VERY LOW ENERGY DIET

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The energy-deficit-efficiency factor (DEF) was developed by Sweeney et al. (AJCN, 1993) as a means of quantifying the efficiency of weight reduction interventions. DEF is calculated as loss of body energy storage/energy deficit created by energy restriction (ER). This investigation examines individual responses to a very low energy diet (VLED). The purpose of this investigation was to determine the relationship between efficiency of weight reduction and individual level of energy deficit induced by VLED. Twenty-four moderately obese subjects were assigned to an energy restriction of 2092 kJ/day for three months. Body composition and resting metabolic rate (RMR) were assessed at baseline and three months. Body composition was assessed by dual energy x-ray absorptiometry (DEXA). Energy of fat mass and fat-free mass is estimated as 39344 kJ/kg and 5525 kJ/kg respectively (J Nutr, 1976). RMR was calculated by indirect calorimetry using a ventilated hood following a 12-hour fast. Maintenance energy requirement

(EREQ) is estimated as $RMR \times 1.4$ (AJCN, 1997). Energy deficit is calculated as $EREQ - ER$.

Individual energy deficits induced ranged from 74 to 88 percent deficiency of EREQ. A small but statistically significant correlation ($r=0.35$) was found between % ER and DEF. Lower DEF values were found as %ER deficiency approaches 90%. These findings suggest that an energy restriction too severe may be related to lower efficiency of weight loss. VLED may show diminishing levels of efficiency as extreme levels of energy deficiency are created.



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ELEMENTS OF GOOD PROVIDER-PATIENT RAPPORT IN CARDIAC REHABILITATION PROGRAMS.

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Abstract

The purpose of this study was to complete a qualitative, exploratory analysis of the elements of the provider-patient relationship which female patients between the ages of 65 and 75 perceived as enhancing the quality of their cardiac rehabilitation experience. The subjects were seven female patients from the Denver area; interviews were privately conducted between the researcher and the patient using a standard set of questions. A qualitative analysis of the interview transcripts indicates that patients were generally comfortable being addressed on a first-name basis, and most patients liked to talk to the providers about their (the patient's) families and similar semi-personal matters while exercising in the clinic. Most – but not all – of the patients preferred providers with an assertive, outgoing personality. Patients seemed to value demonstrations of caring from the providers, including verbal encouragement and low-level emotional gestures (e.g., a pat on the back or shoulder). Patients appreciated a distinctive dress identity amongst all the providers, but felt that casual dress (e.g., a monogrammed polo shirt) was most appropriate for the cardiac rehabilitation setting.

DIFFERENCES IN ENERGY EXPENDITURE BETWEEN MALES AND FEMALES IN RESPONSE TO EXERCISE

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Imbalances between energy expenditure and energy intake result in either weight gain or weight loss. The purpose of the current investigation was to determine whether gender elicits a difference in energy expenditure from exercise and/or habitual physical activity when men and women are given the same exercise prescription. Thirty-five previously sedentary, moderately obese males and females participated in a long-term (52 weeks), supervised, verified, exercise program designed to determine the effects of exercise on body weight and body composition. Subjects were randomly assigned to a control group (CON) or an exercise group (INT). INT exercised 5 days/week for 45 minutes at 70-85% HRR with no diet intervention. Energy expenditure of exercise (EE) was directly measured by indirect calorimetry during weeks 5, 13, 30, 39, and 52. The Stanford 7-day Physical Activity Questionnaire (PAQ) (Blair et al., 1993) was administered at baseline, 4, 9, and 12 months to detect habitual physical activity (PA) not including prescribed exercise. PA was determined by physical activity of at least moderate intensity (> 3 METS) recalled over 7-days. EE and weekly PA were averaged over 12 months.

Variable	CON ♂ (n=10)	CON ♀ (n=12)	INT ♂ (n=9)	INT ♀ (n=17)
Body Weight Change (kg)	0.4 ± 4.9	4.1 ± 4.2	-5.1 ± 5.0 ^δ	0.8 ± 2.9* ^δ
EE (kJ/session)	None	None	2348 ± 398	1599 ± 285
EE (kJ/kg)	None	None	25.4 ± 4.7	20.0 ± 3.6
PA (kJ/week)	5613 ± 548	4600 ± 440	7275 ± 749	4307 ± 578*
PA (kJ/kg)	142.7 ± 2.1	141.1 ± 1.7	143.6 ± 2.5	140.6 ± 2.5*

*Sig. difference btw ♂ and ♀ within group, ^δ Sig. difference btw CON and INT within sex
 INT females maintained body weight (BW) while INT males lost significant BW (p<0.05). The differences in BW change may be attributed to the differences in energy expenditure. INT males expended approximately 8.4 kJ/kg BW/day more than INT females in exercise and PA. This results in an additional energy expenditure of approximately 350,220 kJ over 52 weeks while there was no significant difference in PA between the males and females in the CON group. In relative and absolute terms, INT males expended more energy and lost more BW. However, the energy expenditure of INT females enabled them to maintain BW where CON females gained weight over 52 weeks.

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Physical Activity Associated with Golf Participation: Walking vs. Carting

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The purpose of this study was to examine differences in heart rate, distance walked and number of steps between walking (WK) and carting (CT) nine holes of golf. Fifteen female subjects played the same nine-hole course walking and carting in balanced crossover order. Heart rate was sampled every 5 sec. from chest-strap heart rate monitors. Walking distance and total steps were determined from pedometers calibrated for each individual's stride length. Minimum and maximum heart rates were similar whether carting or walking, but mean heart rates were lower during carting (WK = 105.5±13.4, CT = 94.9±11.2). Distance and total steps were significantly higher for walking (2.92±0.55 mi., 6562±908 steps) than carting (1.77± 0.31mi., 3939±387 steps). Even though walking the course nearly doubled total distance walked during a round, carting resulted in more activity than might be assumed. On most modern courses carts are restricted to paved cart paths over the majority of the course. This results in players walking from their cart to the ball; then back to the cart, on to their next shot, or ahead to the green. They also accumulate activity walking around the green for approach shots, lining up shots, and looking for balls. Data from this study projected over a typical 18 hole round would result in nearly 6 miles and over 13,000 steps for walkers compared to ~3.5 miles and nearly 8,000 steps for players using motorized carts. Total steps can be evaluated relative to the recommendation that accumulating 10,000 steps per day is a useful target for health benefits. Both walking and carting have potential to contribute to the accumulation of minimal recommended activity for maintaining or improving health. Walking provides more activity with a higher mean heart rate and should clearly be preferred for total activity and energy expenditure. Carting provides more activity than commonly assumed and could contribute to daily accumulation of health related activity, especially for elderly and at risk individuals.

ABDOMINAL STRENGTH VS. ENDURANCE AND ITS RELATIONSHIP TO LOW BACK INJURY AMONG UNIVERSITY FOOTBALL ATHLETES

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The abdominal musculature is necessary to translate the force generated by the lower extremity during explosive power movements in football. The potential for injury in football, in particular low back injury, may be related to inadequate abdominal strength. Unfortunately, tools have not been available to properly assess abdominal strength. The routine use of timed sit-ups is a measure of endurance and may not correlate to absolute strength. We recently developed and validated a new technique for assessing abdominal strength (Am. J. Health Studies, 1999). This new test (ABMED) demonstrated a low correlation to the standardized sit-up test. The current study evaluated 41 university football players (level IA), by position, for abdominal strength using the ABMED, and for abdominal endurance using a standardized one-minute sit-up protocol. Each participant answered a series of questions regarding the incidence of low back pain. ABMED measures were assessed using two trials. Both trials were statistically similar. There was no relationship ($r=.005$) between abdominal strength (ABMED) and endurance (sit-ups). Very low correlations were observed between abdominal strength and body weight ($r=.088$) and height ($r=.199$). There was no significant difference in abdominal strength or endurance between those athletes who had (vs. had not) injured their back or experienced (vs. not experienced) recurring low back pain. However, when analyzed by position, offensive linemen who had experienced prior back pain or who had recurring low back pain possessed significantly ($p=.004$) weaker abdominals (30 ± 3.8 kg) than those who had not experienced any prior or recurring pain (42.5 ± 4.1 kg). This was not true for abdominal endurance, suggesting that the use of sit-ups as a tool for assessing abdominal strength may be inappropriate. Abdominal strength as measured using ABMED may be a better means than timed sit-ups to discern the incidence of low back injury among offensive linemen.

BONE MINERAL DENSITY AND BODY FAT DIFFERENCES IN A SAMPLE OF COLLEGE-AGED FEMALES

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Purpose: The purpose of this study was to determine if bone mineral density and body composition measurements differed between college-aged females who participated in high school sports and those who were not high school athletes. **Methods:** One hundred and twenty-five college-aged females ($M = 21.03$, $SD = 2.43$) who completed a survey and agreed to all requirements participated in the study. Dual-energy X-ray absorptiometry (DEXA) was used to assess bone mineral density (BMD) of the anteroposterior (AP) lumbar spine (L2-L4) and total body. Body composition measurements were assessed using DEXA and bioelectrical impedance analysis (BIA). **Results:** The MANOVA procedure yielded a significant overall multivariate effect ($p < 0.01$). Follow up univariate tests revealed that the A group had a significantly higher total BMD ($p < 0.01$) and significantly lower body fat percentage for the DEXA ($p < 0.01$) and BIA procedures ($p = 0.05$). There was no significant difference between the groups for spinal BMD ($p = 0.06$). Paired t-tests revealed that DEXA body fat percentages were significantly higher than BIA body fat percentages for the A ($p < 0.01$) and NA ($p < 0.01$) groups. **Conclusions:** In this sample of college-aged females, those who participated in high school athletics had significantly higher total BMD and significantly lower body fat percentage as measured by DEXA and BIA. Although significant differences were not found for spinal BMD, the A group had more favorable values. These results suggest that participation in high school athletics may have a positive effect on spinal and total BMD and body fat percentage in college-aged females.

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