

**Southeast  
Chapter of the**

**AMERICAN COLLEGE  
OF SPORTS MEDICINE**

**annual meeting**

**February 3-4, 1984  
Auburn University  
Auburn, Alabama**



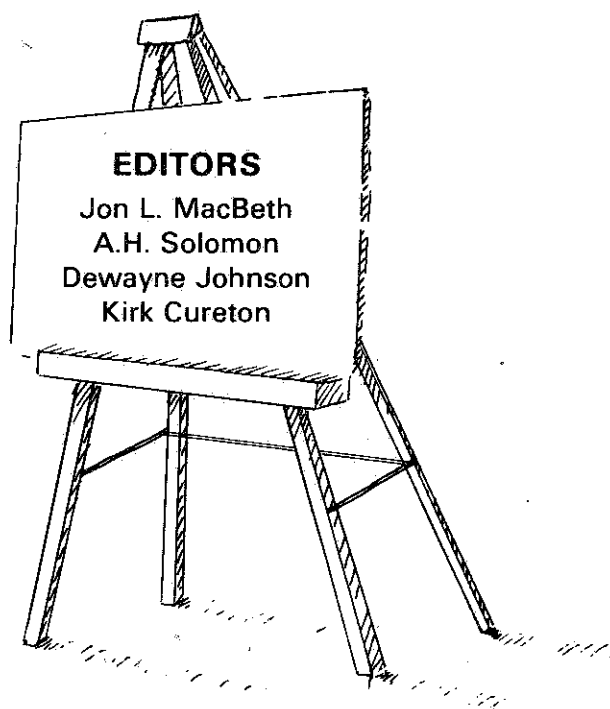
**CONFERENCE  
ABSTRACTS**

**Eleventh Annual Meeting**

**Southeastern Regional Chapter of the  
AMERICAN COLLEGE OF SPORTS MEDICINE**

**annual meeting**

**February 3-4, 1984  
Auburn University  
Auburn, Alabama**



**CONFERENCE ABSTRACTS**  
is published by the  
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**Free Communications  
Poster Presentations  
Lab Tours**

**Symposia  
Workshops  
Mini-Sessions**

**SEACSM OFFICERS**

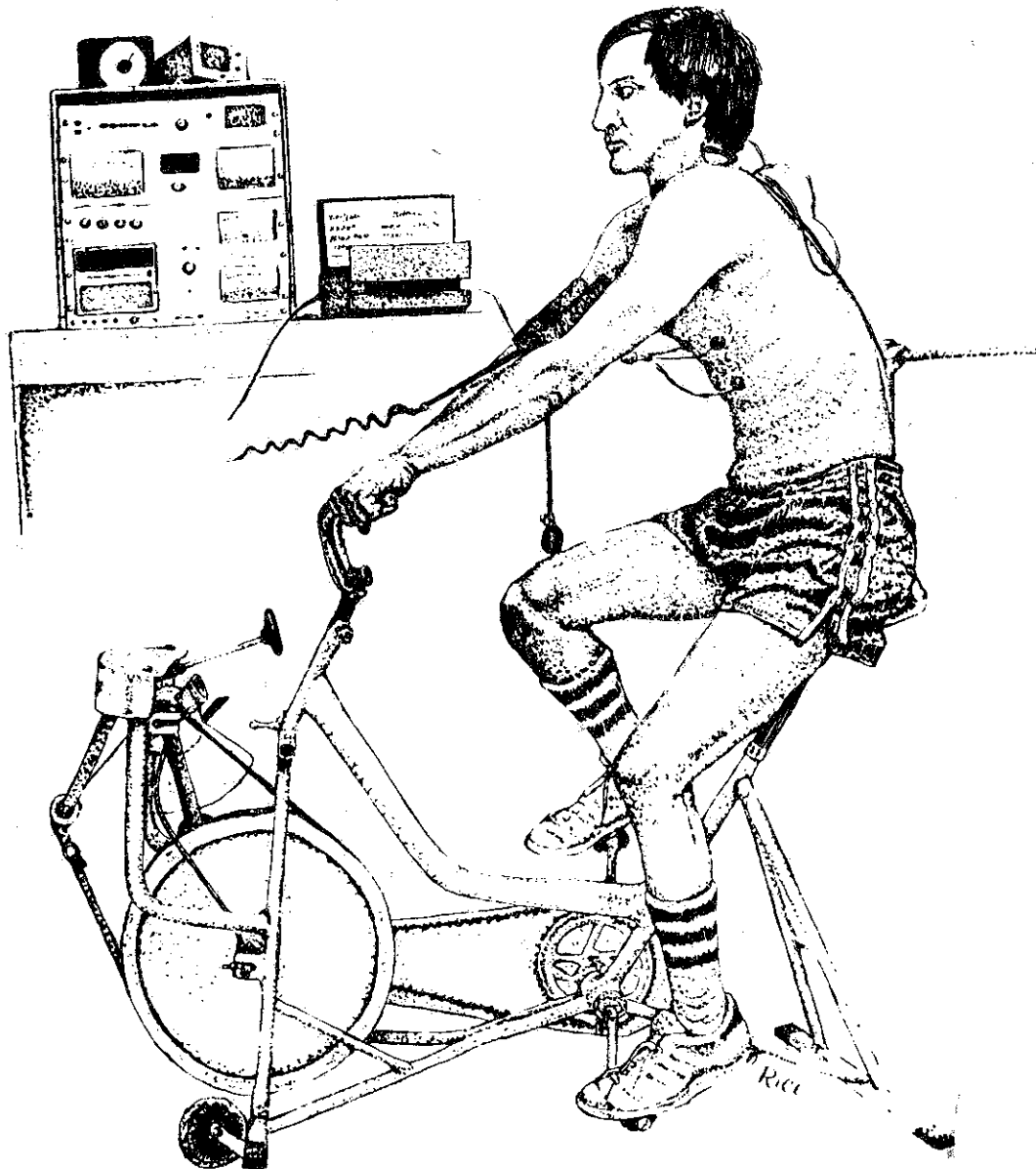
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Hosted by Auburn University of Auburn, Alabama  
At the Auburn Conference Center and Motor Lodge



**We have something good—Let's share it! (SEACSM Motto)**

# ANNUAL MEETING PROGRAM

## SOUTHEAST CHAPTER AMERICAN COLLEGE OF SPORTS MEDICINE

**FEBRUARY 3 AND 4, 1984  
AUBURN, ALABAMA**

**Thursday, February 2**  
7:00 - 9:00 p.m.

**REGISTRATION: FACILITY TOURS: RECREATIONAL ACTIVITIES...**Upper Lobby

**Friday, February 3**  
8:00 a.m. - 2:00 p.m.

**REGISTRATION**.....Upper Lobby

9:00 - 11:30 a.m.

**WORKSHOPS**

"Contemporary Biomechanical Techniques for Sport and Exercise Analysis." Thomas McLaughlin and Nels Madsen, Auburn University, William McLeod, Hughston Orthopaedic Clinic, Columbus, GA.....Biomechanics Research Lab, Memorial Coliseum 2129

"Causes and Prevention of Low Back Pain." David Cundiff, University of Southern Mississippi .....Ballroom A

"Weight Training as a Lifetime Physical Activity." Michael Stone and Dennis Wilson, Auburn University, Ron Byrd, Louisiana State University.....Ballroom CD

"Microcomputer Software You Can Use—Now!" Richard N. Godsen, College of Charleston, Powell McClellan, Middle Tennessee State University, Vaughn Christian, Appalachian State University.....Ballroom B

"Nutritional, Medical, Psychological and Physiological Aspects of Fatigue." Jack Mahurin, Steve Dodd, Robert Collins, Janet McNaughton, and Lochia Farrah, Mississippi State University.....Conference Room 3

"Questionable Flexibility and Strength Development Exercises." Tommy Boone, Steve Maples and Mannie Hall, University of Southern Mississippi.....Downstairs Mtg. Room

11:30 a.m. - 1:00 p.m.

**LUNCH** (on your own)

1:00 - 2:00 p.m.

**MINI SESSIONS, GROUP A**

"Dietary Pattern Review: A Practical Approach to Dietary Evaluation and Follow-up." Paul Ribisil, Wake Forest University.

"Corporate Fitness in Atlanta: An Overview of Three Programs - AT&T, Georgia-Pacific and Coca-Cola." Phillip Sparling, Linda DiCarlo, Janet Edmunson and Roger Moffat, Georgia Institute of Technology.

"Obesity in Children: Implications for Treatment." Diane Ward, University of South Carolina.

"A Multidisciplinary Approach to Pulmonary Rehabilitation." Carl King, Frye Regional Medical Center, Hickory, NC

2:15 - 3:15 p.m.

**MINI SESSIONS, GROUP B**

"Microcomputers in Exercise Science: Dispelling the Mystery." Deborah Morley, Wake Forest University.....Ballroom A

"Practical Aspects of Blood Glucose Control and Exercise in the Insulin-Dependent Diabetic." W. Guyton Hornsby, Delta State University.....Ballroom B

"Recent Progress in Understanding Athletic Amenorrhea." Mark Davis, University of South Carolina.....Ballroom CD

"Organization of Road Races." Roy Benson, Director, Atlanta Track Club  
.....Downtown Meeting Room

"Exercise Program for Patients One to Twelve Weeks after Coronary By-Pass Surgery: Kilocalorie Concept: William Webster, Ester Whitmore, Susan Lowry, Cardiac Rehabilitation Center, Greenville Memorial Hospital, Greenville, SC.....Conference Room 3

3:15 - 3:45 p.m.

**BREAK**

3:45 - 5:15 p.m. **SYMPOSIUM**.....Ballroom BCD  
"Drugs in Sport: Caffeine and Androgens." Michael H. Stone, Auburn University, and Scott Powers, Louisiana State University.

5:15 - 7:00 p.m. **DINNER** (on your own)

7:30 - 8:00 p.m. **BUSINESS MEETING**.....Ballroom BCD

8:00 - 9:00 p.m. **KEYNOTE ADDRESS**.....Ballroom BCD  
"Quantification of the Exercise Prescription." Dr. Michael Pollock, Past President ACSM, Professor, Department of Medicine, Mount Sinai Medical Center, Milwaukee, Wisconsin.

0:00 - 10:00 p.m. **SOCIAL**.....Downstairs Meeting Room

**Saturday, February 4**

8:00 - 9:00 a.m. **FREE COMMUNICATIONS**

**GROUP A**.....Ballroom B

"Glycogen Resynthesis in Muscle, Liver and Cardiac Tissue Following Exhaustive Exercise: Effect of Ovariectomy." Charles Riggs, Florida State University. 1

"Effects of Tryptophan Administration on Plasma Beta-Endorphin and Plasma Corticosterone Following Repeated Exhaustive Exercise in Rats." Mike Lambert and Mark Davis, University of South Carolina. 2

"Alteration of Plasma Lipoproteins in Previously Trained Women Subjected to a 9-Week Marathon Training Program." L.J. Goodyear, M.S. Fronsoe and J.L. Durstine, University of South Carolina. 3

"The Relationship of Stride Frequency and Ventilation." R.G. McMurray and L.G. Smith, UNC-Chapel Hill. 4

**GROUP B**.....Ballroom CD

"Demands of Moderate Exercise in Smokers Exposed to Carbon Monoxide." C.A. Jones, W.G. Herbert, D.S. Hinkle and D.R. Sebolt, Virginia Tech. 5

"The Mediation Role of Social Influence in the Perception of Exertion." C.J. Hardy, E.G. Hall and P.H. Prestholdt, UNC-Chapel Hill. 6

"Biological Determinants of the Sex Difference in Muscular Strength." P.A. Bishop, K.J. Cureton and M. Collins, University of Georgia. 7

"Comparison of Cardio-Respiratory Responses Between Normal and Paraplegic Males During Maximal Arm Ergometry." G.T. Hardison and R.G. Israel, East Carolina University. 8

9:15 - 9:45 a.m. **BREAK**

9:45 - 10:45 a.m. **SYMPOSIA**

"Assessment of Body Composition Using Skinfolts: Recent Research and Practical Consideration." Michael Pollock, University of Wisconsin, School of Medicine, Mount Sinai Medical Center.....Ballroom CD

"Carbohydrates and Physical Performance." Robert Keith, Auburn Univ....Ballroom A

"Methodological Considerations in Research Investigating the Biological Basis of Sex Differences in Physiological Responses to Exercise and Physical Performance." Phillip Bishop, University of Georgia and Phillip Sparling, Georgia Institute of Technology  
.....Ballroom B

10:45 - 12:15 p.m.

<b>POSTER PRESENTATIONS.....</b>	<b>Downstairs Meeting Room</b>
"Lipid and Lipoprotein Changes Resulting From Aerobic Training in Third Year Cadets." D.E. Cundiff and R.J. Vogel, University of Southern Mississippi	9
"Effects of Acute Thermal Dehydration on the Anaerobic Threshold." P. England, S.K. Powers, S.L. Dodd, E. Brooks and T. Callender, Louisiana State University.	10
"Alterations in Hemoglobin Saturation During Non-Steady State Incremental Arm and Leg Exercise." S.K. Powers, S. Dodd, J. Woodyard, R. Beadle, and G. Church, Louisiana State University.	11
"The Effects of an Acute Weight Training Bout on Plasma Testosterone Levels in Untrained College Age Males." E.M. Manno and J.M. Davis, University of South Carolina.	12
"Body Composition, Physical Working Capacity and Serum Lipids in Morbidly Obese Females Prior to Gastric-Bypass Surgery." M.G. DeLozier, R.G. Israel, R.A. Shaw, R.S. Burrell and H.D. Meelheim, East Carolina University.	13
"Changes in Serum Creatine Kinase Following Endurance Running." R.L. Breedlove, G.L. Dohm and R.G. Israel, East Carolina University.	14
"The Relationship of Cardiorespiratory Fitness and Coronary Heart Disease Risk to Self-Concept in Male Police Officers." R.G. Israel, M.R. McCammon and J.E. Cox, East Carolina University.	15
"The Oxygen Cost of Breathing During Exercise." A.J. Rouch and H.G. Welch, University of Tennessee.	16
"Carbohydrate-Loading and Its Effect on ECG Responses." C. Karam, F. Thye, M. Slayton and J. Walberg, Virginia Polytechnic Institute and State University.	17
"The Use of B-Mode Ultrasound in Measuring Subcutaneous Fat Thickness." Lawrence Weiss, Georgia Southern College.	18
"Effects of Forced Exercise on Food Intake and Body Weight in Intact and Ovariectomized Female Rats." C.A. Caldwell and J.M. Davis, University of South Carolina	19
"The Effects of a High Fat Diet and Exercise on Plasma Lipoproteins," D.R. Van Houten, L.J. Goodyear and J.L. Durstine, University of South Carolina.	20
"Current Exercise Beliefs and Habits in South Carolina: Implications for Exercise Programs." A. Kriska, S. Blair, D. Shepard, R. Pate and M. Weinrich, University of South Carolina and the S.C. Department of Health and Environmental Control.	21
"The Validity of Aerobic Points for Scientific and Clinical Use." N.N. Goodyear, D.A. Ludwig and S.N. Blair, University of South Carolina.	22
"Association Between Physical Activity, Physical Fitness and CHD Risk Factors." S.N. Blair and N.N. Goodyear, University of South Carolina.	23
"Effect of a Season of Competition on Performance-Related Fitness Components of Female Intercollegiate Volleyball Players." G. McKenzie Gillam and Jancie P. Creel, Jackson State University.	24
"Anthropometric and Physiological Comparisons of Male College Basketball Players and Nonparticipants." G. McKenzie Gillam, Jackson State University.	25
"Health Related Fitness of Police Officers: Effects of Age and Body Weight." Luke E. Thomas, Austin Peay State University.	26
"Validity of VO <sub>2</sub> Utilizing the R.E.P. 100 Data Acquisition System." S.J. Fleck, G. Reed, D.L. Olander, C. Schmidt and D. Campbell, University of Alabama.	27
"The Effects of Interval Aerobic Training on Lipid Fractions." A.C. Cohen, J.L. Tapp, L. Weeks and D. Cross, University of Miami.	28
"The Effect of Elastic Hose on Plasma Volume and Blood Lactate." D.M. Guinan, R.G. McMurray and D.C. Lawrence, University of North Carolina.	29

"A Re-Examination of Research Method: Application to Arm Crank Ergometry." M. Mangum and B. Harris, Louisiana State University.	30
"Effects of Training on the Sympathetic Response of Trained Runners." V. Ben-Ezra and P. Vaccaro, University of Maryland.	31
"The Actual Maximal Heart Rates of Adolescent Athletes and Predicted Values." T. Lightfood and K. Stuart, Northeast Louisiana University.	32
"Validation of Body Composition Prediction Equations for Alabama High School Wrestlers." H.N. Williford, Jr. and Joe E. Smith, Auburn University at Montgomery.	33
"Accounting for Respiratory Gas Phase Delay in Open-Circuit Systems for Exercise Oxygen Uptake Determinations." H.L. DeBoever, W.G. Herbert, B.E. Cline and R.C. Marchany, Virginia Tech.	34
"Effects of a Power Weight Training Circuit Program on Power Production and Performance." J.M. Manning, U.S. Sports Academy, Cathryn Dooly-Manning, University of Southern Mississippi, David Terrell and Earlee Salas, U.S. Sports Academy.	35
"Effects of Tester/Subject Relationship on Exercise Tolerance Testing." B.D. Franks and L. Watts, University of Tennessee.	36
"The Effects of Two Cardiovascular Endurance Training Intensities on Serum Lipoprotein Cholesterols in Middle-Aged Women." M.D. Senn, V.K. Christian, R.J. Johnson and H.S. O'Bryant, Appalachian State University.	37
"Prediction of Injury in Collegiate Athletes as a Function of Selected Personality Characteristics." Charles Hardy, University of North Carolina.	38
"How Well Do Road Racers Predict Their Own Performance?" R.N. Godsen, College of Charleston.	39
"The Effects of Acute Caffeine Ingestion on Muscle Endurance in Weight Trained Males and Females." K.S. Sansocie, M.H. Stone and C.C. Sansocie, Auburn University.	40
"Cross Validation of the Jackson & Pollock Generalized Equations for Predicting Body Density on Collegiate Football Players." S.R. Vickery, P.A. Bishop, M.A. Collins, G.E. Wilson and K.J. Cureton, University of Georgia.	41
"Time of Day as a Factor in Training for Strength Development." D.W. Hill and C.W. Zauner, University of Florida.	42
"The Effects on Exercise and Large Doses of Vitamin B-6 on Fatigue and Contractile Properties of Rat Muscle." Jim McMillan, Bob Keith, Dennis Wilson, Mike Stone, Auburn University.	43
"Comparison of the Wingate Anaerobic Test with Other Tests of Anaerobic Power." G.P. Griffith and P.M. Ribisl, Wake Forest University.	44
"The Practical Validation of the Wingate Test of Anaerobic Power." P.M. Ribisl and G.P. Griffith, Wake Forest University.	45
"Effects of Imagery on Exercise Tolerance of Experienced Test Takers." B.D. Franks and J. Soldano, University of Tennessee.	46

12:15 - 2:00 p.m.

**LUNCHEON**.....Ballroom ABCD

**Luncheon Speaker:**

"United States Olympic Sports Medicine Program." Dr. Peter Van Handle, Sports Physiologist, U.S. Olympic Training Center, Colorado Springs.

This program has been approved for 12 hours of Continuing Education Credit granted by the American College of Sports Medicine.

# GLYCOGEN RESYNTHESIS IN MUSCLE, LIVER, AND CARDIAC TISSUE FOLLOWING EXHAUSTIVE EXERCISE: EFFECT OF OVARIETOMY

CHARLES RIGGS, Exercise Physiology Lab., Florida State University, Tallahassee, FL 32306

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Glycogen resynthesis in muscle, liver, and cardiac tissue following exhaustive swimming was studied in intact and ovariectomized Sprague-Dawley rats. Rats swam unweighted for 30 min at which time tail weights equivalent to 2% of body weight were added. Subsequently, additional tail weights (2% bw) were added every 15 min until the rats were exhausted. Swim time to exhaustion was not different for the two groups. At exhaustion, the glycogen content of the red and white vastus lateralis muscles, the soleus and gastrocnemius muscles, the heart, and liver were significantly ( $p < 0.05$ ) reduced. The pattern of resynthesis for the two groups for all tissues was the same during the first hour following exercise with no differences between groups being significant. At 24 hr post-exercise, however, ovariectomized females had significantly ( $p < 0.05$ ) greater glycogen in both the red vastus lateralis and the liver. The glycogen content was 53% and 107% greater in the red vastus and liver, respectively, 24 hr after exercise. The results show that removal of the influence of the ovarian hormones alters the process of glycogen repletion following exercise heavily dependent on glycogen. Further, they show that the greatest effect of the hormones is on tissues most involved in endurance exercise, "redder" muscle and the liver.

NOTES AND COMMENTS

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# EFFECTS OF TRYPOTOPHAN ADMINISTRATION ON PLASMA BETA-ENDORPHIN AND PLASMA BETA-ENDORPHIN AND PLASMA CORTICOSTERONE FOLLOWING REPEATED EXHAUSTIVE EXERCISE IN RATS

M.I. LAMBERT and J.M. Davis. Exercise Biochemistry Lab., University of South Carolina, Columbia, SC 29208

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Since brain serotonin levels increase following a tryptophan injection and can influence pituitary-adrenal responses to stress we investigated the effects of a tryptophan injection (125 mg/kg, i.p.) on the analgesia and plasma beta-endorphin and corticosterone responses in rats exposed to repeated exhaustive exercise. Thirty-one male Sprague-Rawley rats ( $288.1 \pm 2.2$ ;  $\bar{x} \pm se$ ) were divided into a resting control (RC), exercising control (ES), resting tryptophan (RT) and exercising tryptophan (ET) groups. The exercising groups swam for 90 minutes, twice a day for 5 days with a weight equivalent to 2% of the body weight attached. The stressful effect of the exercise was indicated by the difference in body weight between the control and experimental groups ( $324.0 \pm 4.8$  vs  $293.2 \pm 6.3$  g) at the end of the 5 days ( $p < 0.01$ ). Prior to the exercising program, a hot-plate test ( $56^\circ C$ ) was used to determine the effect of an exhaustive 50 minute swim on pain tolerance. The exercised groups remained on the hot-plate significantly longer ( $p < 0.01$ ) than the rested groups. The tryptophan injection had no effect on pain tolerance. When the test was repeated following 5 days of exercise, similar responses were observed. Immunoreactive beta-endorphin (IR-B-ep) levels in plasma following an exhaustive bout of exercise were significantly higher ( $p < 0.01$ ) than the resting controls ( $1805 \pm 214$  vs  $387 \pm 46$  pg/ml). There was no difference between the tryptophan and control groups in either the resting or exercising treatments. The increase in plasma IR-B-ep may be related to increases in pain tolerance as shown by the results of the hot-plate test. The plasma corticosterone values were significantly higher ( $p < 0.01$ ) in the exercised rats compared to the resting controls ( $54.8 \pm 4.9$  vs  $6.6 \pm 1.2$  mg%). No difference occurred between the tryptophan treated and control groups. These data fail to support the hypothesis that tryptophan administration effects pituitary-adrenal reponsiveness to exercise stress.

## NOTES AND COMMENTS

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# ALTERATION OF PLASMA LIPOPROTEINS IN PREVIOUSLY TRAINED WOMEN SUBJECTED TO A 9-WEEK MARATHON TRAINING PROGRAM

L.J. GOODYEAR, M.S. Fronscoe, and J.L. Durstine. Exercise Biochemistry and Human Performance Laboratories, University of South Carolina, Columbia, SC 29208

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Physical training has been shown to favorably alter the lipid profiles of sedentary individuals. This study examined the effects of physical training on lipid levels of women already considered highly fit. Five women age  $24 \pm 2$  y,  $VO_2\max$   $50.9 \pm 1.3$   $ml \cdot (kg \cdot min)^{-1}$ , averaging 40-45 km of running per week, participated in a 9 week marathon training program that doubled training distance by the 7th week. Five sedentary women age  $22 \pm 5$  y,  $VO_2\max$   $36.0 \pm 6.4$   $ml \cdot (kg \cdot min)^{-1}$  served as controls. All subjects were nonsmoking university students who were not taking oral contraceptives. The training program produced a  $2.6$   $ml \cdot (kg \cdot min)^{-1}$  increase in  $VO_2\max$  ( $p < .05$ ). There was a 10% decrease in body fat with no change in body weight. Training produced no change in plasma glucose triacylglycerol, or total cholesterol concentrations, while HDL cholesterol rose significantly from 59 to 76 mg/dl ( $p < .01$ ). All variables remained unchanged in the sedentary controls. Surprisingly, HDL cholesterol levels in the fit women prior to the training program were not significantly greater than that of the sedentary women (59 vs 57 mg/dl). The results suggest that 40-45 km of running per week will not markedly elevate HDL levels of young female university students. This may be due to the already high HDL levels normally found in women, or the fact that "sedentary" students are actually somewhat active. The results also support the theory that a threshold point based on duration and/or intensity exists where HDL levels increase dramatically. In considering duration, this threshold point probably lies between 40 and 85 km of running per week.

NOTES AND COMMENTS

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# THE RELATIONSHIP OF STRIDE FREQUENCY AND VENTILATION

R.G. McMurray and L.G. Smith. Human Performance Lab., University of North Carolina, Chapel Hill, NC 27514

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Ten female subjects completed a slow walk (SW), fast walk (FW) and a run (R) on a motor driven treadmill to evaluate the effect of varying stride frequency on ventilatory responses. The treadmill grade was adjusted during walking such that the oxygen uptake was the same as during running at 0% grade. Ventilation (gasometer) and end-tidal CO<sub>2</sub> (Beckman LB-2) were monitored breath-by-breath. Blood pressure was obtained by sphygmomanometer after each ventilatory recording. Oxygen uptake was similar for the three trials ( $1.78 \pm 0.07$  l/min) as were heart rates ( $154.6 \pm 4.8$  beats/min). Stride frequencies averaged 58.8, 68.9, and 79.9 strides/min for the SW, FW, and R, respectively. Mean blood pressure was unaffected by altering stride frequency. Minute ventilation was similar for all three trials ( $47.3 \pm 3.2$  l/min) but significant differences in tidal volume and respiratory frequency were noted. (TV; SW = 1417, FW = 1348 & R = 1310 ml;  $f_R$ ; SW = 33.2, FW = 35.4 & R = 37.2 breaths/min). Respiratory frequency was significantly related to stride frequency ( $r = 0.508$ ;  $p < 0.05$ ) but the correlation of tidal volume to stride frequency was greater ( $r = .998$ ;  $p < 0.001$ ). R values were found to increase with stride frequency; SW = 0.869, FW = 0.879, R = 0.943. A trend toward decreasing  $P_{ET}CO_2$  with increasing stride frequency was also noted: SW = 38.6, FW = 36.3, R = 36.0 torr. The results further suggest that although variations in the respiratory control mechanisms during walking and running exist, they are not related to blood pressure. These results suggest the importance of neural feedback for the control of exercise hyperpnea.

NOTES AND COMMENTS

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# DEMANDS OF MODERATE EXERCISE IN SMOKERS EXPOSED TO CARBON MONOXIDE

C.A. JONES, W.G. Herbert, D.S. Hinkle and D.R. Sebolt, Human Performance Laboratory, Virginia Tech, Blacksburg, VA 24061

Six physically inactive young adult male smokers were studied to determine if experimentally-induced elevations in alveolar carbon monoxide ( $C_{ACO}$ ) would alter the perceptual and physiological demands of aerobic exercise. On separate days, subjects breathed atmospheric air from a 120 liter wet spirometer which contained either no CO ( $AA_t:CO < 5ppm$ ) or ( $CO_t:CO = 1500ppm$ ) to raise the  $C_{ACO}$  to 50 ppm. Mean breathing times for  $AA_t$  and  $CO_t$  were 18 and 15 min. The order of  $AA_t$  and  $CO_t$  was randomly assigned to subjects (single blind procedure). Breathing was interrupted periodically in each trial to measure end-tidal breath CO levels ( $CET_{CO}$ : assumed  $CET_{CO} \approx C_{ACO}$ ). Within 10 min after spirometer breathing, subjects performed a brief warm-up and then a 45 min bicycle ergometer exercise at a fixed load corresponding to the onset of non-linear increase in ventilation (anaerobic threshold). This intensity averaged 47% of  $VO_2$  max. Perceived exertion (Borg 10+ RPE scale), heart rate and blood lactate (HLA) responses were compared for the CO and control trials, as shown below:

Trial	Exercise @ 8 min			Exercise @ 45 min		
	RPE	HR ( $bt \cdot min^{-1}$ )	Blood HLa ( $mg \cdot dl^{-1}$ )	RPE	HR ( $bt \cdot min^{-1}$ )	Blood HLa <sup>a</sup> ( $mg \cdot dl^{-1}$ )
$AA_t$	3.1	132	18.8 <sup>b</sup>	7.8	132	12.9
$CO_t$	3.5	141	28.2 <sup>b</sup>	9.3	150	17.6

<sup>a</sup>Samples from 5 min post-exercise      <sup>b</sup>Values significantly different ( $P < 0.05$ )

These data suggest an elevated perceptual and physiological cost of moderate aerobic exercise associated with preliminary exposure to CO in amounts which characterize the moderate smoker's habit. Given these preliminary findings, further research seems indicated to determine the behavioral consequences of attempting to initiate exercise programs by those engaged in smoking cessation.

NOTES AND COMMENTS

# THE MEDIATIONAL ROLE OF SOCIAL INFLUENCE IN THE PERCEPTION OF EXERTION

C.J. HARDY, E.G. Hall, and P.H. Prestholdt. UNC-Chapel Hill, Chapel Hill, NC 27514 and LSU, Baton Rouge, LA 70803

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The mediational role of social influence in the self-perception of exertion was examined in two experiments. In Experiment 1, subjects (N=9) performed three, 15 min. trials on a cycle ergometer at 25%, 50%, and 75% of  $\dot{V}_{O_2}$  max, both in the mere presence of another performer (a coactor) and alone. Separate 2 (treatment) X 3 (intensity) X 5 (time) ANOVA procedures with a priori comparisons conducted on the alone versus the coaction condition within each intensity were used on the dependent variables: RPE,  $\dot{V}_{O_2}$ ,  $\dot{V}_E$ , and HR. The means at both 25% (alone = 9.0; coaction = 7.9) and 50% (alone = 14.1; coaction = 12.5) indicate that RPE was significantly ( $p < .05$ ) lower in the coaction condition than in the alone condition. The results of a priori orthogonal comparisons on the physiological parameters, however, revealed no significant findings. In Experiment 2, subjects (N=16) performed one 15 min. trial at 50% of  $\dot{V}_{O_2}$  max, both alone and in the presence of another performer (coactor) exhibiting nonverbal "cues" that the work was either extremely easy or extremely difficult. Separate 2 (group) X 2 (condition) X 5 (time) ANOVA procedures with a priori orthogonal comparisons were performed on RPE,  $\dot{V}_{O_2}$ ,  $\dot{V}_E$ , and HR to test for differences between the alone and coaction conditions within both the low and high "cue" groups. The results indicated that subjects exposed to the low intensity cue information reported significantly ( $p < .05$ ) lower RPE's than when performing alone (alone = 12.75; coaction = 10.97). No significant differences were noted for those subjects exposed to the high intensity cue information (alone = 12.50; coaction = 12.82). As in Experiment 1, no significant results emerged from the a priori orthogonal comparisons on the physiological parameters. The results of Experiment 1 and 2 indicate that RPE can be mediated by social influence, without physiological responses accompanying such changes. Such social influence effects are best viewed from a self-presentational analysis (the motive to "look good" in comparison to another performer).

NOTES AND COMMENTS

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# BIOLOGICAL DETERMINANTS OF THE SEX DIFFERENCE IN MUSCULAR STRENGTH

PHILLIP BISHOP, Kirk Cureton and Mitchell Collins. Human Performance Laboratory, University of Georgia, Athens, GA 30602

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Previous studies investigating the biological basis for the sex difference in muscular strength have not accounted for the influence of a sex difference in the habitual physical activity of their subjects nor attempted to quantify the importance of the sex difference in fat-free body size. In order to determine the extent to which sex differences in muscular strength are accounted for by sex differences in fat-free body size in subjects with similar physical activity histories, nine strength measures, fat-free weight (FFW) and limb fat-free cross-sectional area (LCSA) were measured in 118 subjects. The subjects were 13 male and 8 female gymnasts, 24 male and 25 female swimmers, and 23 male and 25 female nonathletes between 15 and 28 years of age. The percent mean difference between males and females averaged 23%, 27% and 56% for upper-body strength expressed relative to FFW and -8% (women higher), 11% and 17% for lower body strength expressed relative to FFW for the gymnasts, swimmers and nonathletes, respectively. The sex difference in strength was generally smaller for all three groups than that measured in previous studies. When strength was predicted from the two size measures, the linear combination of FFW and LCSA accounted for 94 percent or more of the sex-related variance (sex difference) in upper-body strength and 98 percent or more of the sex-related variance in lower-body strength for both the swimmers and nonathletes. Virtually all of the sex difference in strength was accounted for by the two size measures. For occupational and sport activities in which strength is important, fat-free body size may be a more valid qualification or classification criteria than gender.

NOTES AND COMMENTS

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# COMPARISON OF CARIO-RESPIRATORY RESPONSES BETWEEN NORMAL AND PARAPLEGIC MALES DURING MAXIMAL ARM ERGOMETRY

G.T. HARDISON, JR. and R.G. Israel. Human Performance Laboratory, East Carolina University, Greenville, NC 27834

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Recently, investigators have attempted to make recommendations about arm training regimens for paraplegics while studying cardio-respiratory responses of normals during maximal arm ergometry. To make generalizations that arm work findings in normals would be applicable to paraplegics would assume cardio-respiratory responses to be similar. The purpose of this study was to actually compare cardio-respiratory responses of normals and paraplegics during maximal arm ergometry. Fifteen healthy males (NA) and 13 healthy paraplegics (PA), with lesion levels ranging Th<sub>4</sub>-Th<sub>12</sub>, were recruited to serve as subjects. Each subject performed a maximal arm ergometry exercise test on a Schwinn Ergometric EX-2 Bicycle modified for arm work. The initial load was set at 150 kpm and sequentially increased by 150 kpm every two minutes until volitional fatigue or until the subject could no longer maintain a metronome paced 70 rpm cranking rate. HR was recorded during the last ten seconds of each minute from the ECG and  $\dot{V}O_2$ ,  $\dot{V}_E$ , and RQ were obtained using the Beckman Metabolic Measurement Cart. A Mann-Whitney U Test for independent sampling yielded significantly higher values for  $\dot{V}O_2$  max,  $O_2$  pulse max ( $p < .001$ ) and  $\dot{V}_E$  max ( $p < .05$ ) in NA. PA produced higher RQ values ( $p < .05$ ) than did NA. Since there were no significant differences in HR max, but large differences in  $\dot{V}O_2$  max, paraplegics apparently tend to work at a higher percentage of their  $\dot{V}O_2$  max than normals when working at similar submaximal heart rates. Difficulty in isolating leg and trunk muscles in normals during arm ergometry may explain the large difference in  $\dot{V}O_2$  max since  $\dot{V}O_2$  is dependent upon the amount of active muscle mass involved during exercise. Results from this study reflect the need for using paraplegic subjects when conducting research designed to elucidate specific exercise prescription standards for paraplegics.

\* Supported by a grant from the University Research Committee, East Carolina University.

## NOTES AND COMMENTS

# LIPID AND LIPOPROTEIN CHANGES RESULTING FROM AEROBIC TRAINING IN THIRD YEAR AROTC CADETS

D.E. CUNDIFF and R.J. Vogel. The University of Southern Mississippi, Hattiesburg, MS 39406

The purpose of this study was to determine the physiological effects of a model 28-week supervised aerobic training program on body composition, serum lipids and lipoproteins on 41 men and 10 women Military Science third year Army Reserve Officer Training Corps cadets. Six men and two women from the M.S. IV Class acted as controls. Subjects were given pre, intermediate (14 weeks), and post-tests to determine body composition (four skinfolds--Durnin and Wormsley) and blood serum was sampled to determine fasting triglycerides (TG), total cholesterol (TC), and low and high density lipoprotein cholesterol (LDL-C & HDL-C) and HDL-C/TC ratio. Experimental subjects performed supervised aerobic exercise (jogging) at least three days/week. Subjects were required to complete a minimum of 30 aerobic points per week the first ten weeks, and at least 40 pts/wk the final 18 weeks. Analysis of covariance, with the pre-test the covariate was used to determine the effects of the training program. The sum of four skinfolds significantly decreased ( $p < .05$ ) in the experimental group from pre to post-tests (48mm to 32mm) with no change in body weight. A small significant decrease occurred in TC, increase in TG, a non-significant increase in HDL-C, a significant decrease in LDL-C, and an increase in HDL-C/TC ratio (see table below for mean and standard deviation values).

	Lipid and Lipoprotein Values (mg/DL)				
	TC	TG	HDL-C	LDL-C	HDL-C/TC
Pre-	164.5 ± 32.2	83.2 ± 28	41.1 ± 7.6	107.3 ± 31.0	.25 ± .06
Post	163.2 ± 30.6	85.3 ± 30	45.2 ± 7.7	101.3 ± 27.8	.29 ± .08

Except for the slight increase in serum TG, all lipid and lipoprotein values moved in the direction that is considered to lower risk of coronary artery disease.

## NOTES AND COMMENTS



# EFFECTS OF ACUTE THERMAL DEHYDRATION ON THE ANAEROBIC THRESHOLD

P. ENGLAND, S.K. Powers, S.L. Dodd, E. Brooks, and T. Callender. Applied Physiology Laboratory, Louisiana State University, Baton Rouge, LA 70803

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Numerous investigators have suggested that dehydration may alter carbohydrate metabolism in muscle. Theoretically, altered glycolytic flux in exercising muscle could result in a change in the rate of blood lactate (La) accumulation, and thus alter the anaerobic threshold. The purpose of this study was to investigate the effects of acute dehydration on the anaerobic threshold. Six trained male subjects performed an incremental cycle ergometer test to exhaustion during which the work rate was increased by 30 watts every three minutes. Ventilation ( $\dot{V}_E$ ), gas exchange measures, and blood samples for La analysis were obtained every third minute during the test. Anaerobic threshold ( $AT_{La}$ ) was defined as the  $\dot{V}O_2$  at which there was a systematic rise in blood La concentration. Additionally,  $AT_{VE}$  was estimated from alterations in  $\dot{V}_E$  and defined as the exercise  $\dot{V}O_2$  at which a nonlinear increase in  $\dot{V}_E$  occurred ( $AT_{VE}$ ). Subjects were tested twice, once in euhydration condition (N) and a week later after acute thermal dehydration (D). The treatment was counter-balanced. Thermal dehydration (~5% body weight loss) was induced by intermittent sauna exposure (~65°C). The  $AT_{La}$  occurred at a significantly lower ( $p < 0.05$ )  $\dot{V}O_2$  during exercise in the D condition when compared to work in the N condition. The correlation between  $AT_{La}$  and  $AT_{VE}$  in condition N was  $r = -.51$  ( $p > 0.30$ ) while the relationship between  $AT_{La}$  and  $AT_{VE}$  in treatment D was  $r = .16$  ( $p > 0.70$ ). These findings demonstrate that acute dehydration may alter the  $AT_{La}$ . Further, these data suggest limitations in estimating  $AT_{La}$  from alterations in  $\dot{V}_E$  during incremental exercise.

NOTES AND COMMENTS

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# ALTERATIONS IN HEMOGLOBIN SATURATION DURING NON-STEADY STATE INCREMENTAL ARM AND LEG EXERCISE

S.K. POWERS, S. Dodd, J. Woodyard, R. Beadle, and G. Church. Applied Physiology Laboratory, School of HPERD, Louisiana State University, Baton Rouge, LA 70803

There are few reports concerning the alterations in the percent of hemoglobin saturated with oxygen (%SO<sub>2</sub>) during non-steady state incremental exercise. Further, no data exists to describe the %SO<sub>2</sub> changes during arm work. Therefore the purpose of this study was to assess the dynamic changes in %SO<sub>2</sub> during incremental arm and leg work. Nine trained subjects (male, N=7; female, N=2) performed incremental arm and leg exercise to exhaustion on an arm crank ergometer and a cycle ergometer, respectively. Ventilation and gas exchange measurements were obtained minute by minute by via open circuit spirometry and changes in %SO<sub>2</sub> were recorded via an ear oximeter. Results were as follows:

Work Rate	Arm Work			Leg Work		
	PET O <sub>2</sub>	PET CO <sub>2</sub>	%SO <sub>2</sub>	PET O <sub>2</sub>	PET CO <sub>2</sub>	%SO <sub>2</sub>
Rest	108	40	97.5	106	40	97.1
50%	112	39	96.5	109	41	96.3
70%	113	39	95.8	110	41	95.2
90%	118	34	93.8	114	34	93.1
100%	119	30	86.8	117	31	89.1

PET O<sub>2</sub>/CO<sub>2</sub> expressed in torr:

No significant difference ( $p > 0.05$ ) existed between arm and leg work in PET O<sub>2</sub>, PET CO<sub>2</sub>, or %SO<sub>2</sub> when compared as a function of percent VO<sub>2</sub> max. These data provide evidence that arterial O<sub>2</sub> desaturation occurs in a similar fashion in both incremental arm and leg work with the greatest changes in %SO<sub>2</sub> occurring at work rates greater than 70% VO<sub>2</sub> max.

NOTES AND COMMENTS

# THE EFFECTS OF AN ACUTE WEIGHT TRAINING BOUT ON PLASMA TESTOSTERONE LEVELS IN UNTRAINED COLLEGE AGE MALES

E.M. MANNO and J.M. Davis. Exercise Biochemistry Laboratory, University of South Carolina, Columbia, SC 29208

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Much research interest has been directed to the role testosterone plays in eliciting changes in muscle mass and strength and the possible effects of weight training on these levels. To evaluate these changes while accounting for plasma volume shifts, eight college age men (5-experimental, 3-control) underwent a weight training bout. Plasma volume shifts were estimated using hematocrit values. Plasma testosterone levels were measured using radio-immunoassay techniques prior to, immediately after and at 45 and 90 minute post exercise intervals. Subjects performed three sets of 8-12 repetitions to exhaustion at eight exercise stations at 75% of an individual's pre determined maximal isotonic strength. Mean testosterone levels increased immediately after exercise ( $.534 \pm .14$ ,  $.602 \pm .15 \bar{x} + 50 \text{ ug\%}$ ) however, these changes were insignificant ( $p > .05$ ). Mean plasma testosterone levels returned to normal in approximately 30 minutes and fell below normal resting values by 90 minutes after exercise ( $.469 \pm .24 \text{ ug\%}$ ). When plasma testosterone values were corrected for changes in plasma volume, no appreciable differences were noted. It appears that while there is a tendency for testosterone levels in plasma to increase following weight training, these changes could be accounted for by changes in fluid volume as determined by hematocrit values. Of interest was the contrast of individual response. It is possible that individuals vary in their response to weight training.

NOTES AND COMMENTS

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# BODY COMPOSITION, PHYSICAL WORKING CAPACITY AND SERUM LIPIDS IN MORBIDLY OBESE FEMALES PRIOR TO GASTRIC-BYPASS SURGERY

M.G. DeLOZIER, R.G. Israel, R.A. Shaw, R.S. Burrell and H.D. Meelheim. Human Performance Lab. and School of Medicine, East Carolina University, Greenville, NC 27834

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Morbid obesity refers to greater than 100% over ideal body weight and is associated with a 200% increase in mortality. In order to better understand the health risks and rehabilitative needs of these individuals body composition, physical working capacity and serum lipids were evaluated in 14 morbidly obese females undergoing gastric-bypass surgery with a Roux-en-Y anastomosis. Body composition (as determined by hydrostatic weighing) revealed body fat percentages which ranged from 50.4 to 70.6 with a mean of 56.4 for 10 subjects. Percentage body fat was not significantly ( $p > .05$ ) correlated with relative weight (actual weight/ideal weight), indicating that relative weight may be an unsatisfactory measure of obesity. Physical working capacity (as determined by peak  $\dot{V}O_2$  at termination of treadmill test) was measured in 12 subjects using a modified progressive exercise treadmill test. Mean absolute peak  $\dot{V}O_2$  (1.961 L/min) was similar to average values for normal weight, age-matched females. However, mean relative peak  $\dot{V}O_2$  (14.62 ml/kg/min) was significantly lower than even the lowest category for normal weight women of any age reported in the literature. Mean cholesterol, HDL and triglyceride values were similar to previously reported values for moderately obese females. However, the mean cholesterol/HDL ratio was higher than the majority of ratios previously reported, indicating an increase in coronary risk. Results from this study indicate that individuals at 50% or more body fat have a severely decreased physical working capacity and are at an increased coronary risk as compared to moderately obese females.

Supported by the United Way through the ECU School of Medicine Starter Research Program, #5-80272.

NOTES AND COMMENTS

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# CHANGES IN SERUM CREATINE KINASE FOLLOWING ENDURANCE RUNNING

R.L. BREEDLOVE, G.L. Dohm and R.G. Israel. Human Performance Lab. and School of Medicine, East Carolina University, Greenville, NC 27834

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This study investigated changes in serum creatine kinase (CK) following a single bout of strenuous endurance exercise. Sixteen highly trained runners (5 young males  $\bar{X}$  age 23, 5 older males  $\bar{X}$  age 41, and 6 females  $\bar{X}$  age 23) ran continuously on a treadmill for 90 minutes. Mean percent  $\dot{V}O_2$  max and HR during the run were 74.56 and 88 respectively. Daily dietary consumption and activity patterns were controlled throughout the experimental trial. Changes in pre and post exercise serum levels of CK were determined through the analysis of blood samples collected at 12 and 24 hrs. before exercise and 0,4,8,12,24, and 48 hrs. after exercise. Subjective sensations of muscle soreness, according to Henry's Pain Rating Scale, were assessed at 0,24, and 48 hrs. following the run. Serum CK levels were significantly increased ( $p < .05$ ), peaking at approximately 12 hrs. post exercise. There were no significant differences in serum CK levels between young and old males for any subgroup time. Female runners demonstrated significantly lower CK levels ( $p < .05$ ) than male runners for any given time period pre or post exercise. Resting serum CK levels were higher ( $p < .01$ ) in both male (53%) and female (43%) trained subjects when compared to sedentary controls. No significant correlations were found between changes in serum CK levels and muscle soreness, training intensity, or metabolic costs. This study has shown serum CK levels to increase following strenuous endurance exercise, with women having less marked enzymatic changes than men. All runners were shown to have higher resting serum CK levels than sedentary controls.

\*Supported in part by Ross Laboratories, Columbus, Ohio.

## NOTES AND COMMENTS

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# THE RELATIONSHIP OF CARDIORESPIRATORY FITNESS AND CORONARY HEART DISEASE RISK TO SELF—CONCEPT IN MALE POLICE OFFICERS

R.G. ISRAEL, M.R. McCammon and J.E. Cox. Human Performance Lab., East Carolina University and Personnel Office, City of Greenville, NC 27834

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Sixty male Greenville, NC police officers ( $\bar{X}$  age 32.3 years,  $SD=+6.4$ ) participated in a health/fitness evaluation program. The purpose of the study was to assess cardiorespiratory fitness and coronary heart disease (CHD) risk and relate these variables to self-concept. These officers were found to be at a greater risk of developing CHD than men of similar age in the general sedentary population. Aerobic capacity, predicted from treadmill (Bruce protocol) performance time, was 38.75 ml/kg/min with an average treadmill time of 9:48. Mean percent body fat was 25.8 ( $SD=+8.9$ ) with an average fat weight of 53.1 lbs. ( $SD=+24.9$ ). Pearson Product Moment Correlations were used to correlate selected physiological variables to self-concept. Significant inverse relationships were observed between self-concept and percent body fat, waist girth, fat weight, total treadmill time, METS, and CHD risk; all were significant at the .05 level of confidence. Numerous investigations have established relationships between fitness and self-concept. However, many of these studies have not related specific fitness variables to self-concept. This investigation establishes a strong relationship between aerobic capacity, body composition, and self-concept. One possible way to improve self-concept in police officers is to adopt physical training programs designed to increase aerobic fitness and decrease body fat. Strength training programs may not improve self-concept since in this study bench press and hand grip strength were not significantly correlated with self-concept.

This research was supported by a grant from the City of Greenville, NC.

NOTES AND COMMENTS

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# THE OXYGEN COST OF BREATHING DURING EXERCISE

A.J. ROUCH and H.C. Welch. University of Tennessee, Knoxville, TN 37996-0900

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The purpose of this study was to compare the oxygen cost of breathing during exercise when inspiring mixtures of either 80% N<sub>2</sub>/20% O<sub>2</sub> (N<sub>2</sub>-O<sub>2</sub>) or 80% helium/20% O<sub>2</sub> (He-O<sub>2</sub>). Four male subjects exercised on a bicycle ergometer for 20 minutes at a rate of approximately 60% of their VO<sub>2</sub>max. During the final 10 minutes of exercise, they hyper-ventilated voluntarily at a breathing rate of 60 breaths per minute. The minute ventilation achieved during hyper-ventilation with He-O<sub>2</sub> was significantly higher than that with N<sub>2</sub>-O<sub>2</sub> (p < 0.01), and we found no significant differences in the oxygen cost of breathing between the two gases. The average cost of breathing for He-O<sub>2</sub> was 3.8 ml/ℓ for an average ventilation of 81.8 ℓ/min; the average cost of breathing for air was 3.5 ml/ℓ for an average ventilation of 56.1 ℓ/min. This study suggests that one can sustain a higher ventilation with He-O<sub>2</sub> without increasing the O<sub>2</sub> cost of that ventilation.

This study was supported by NIH grant AM-29888.

NOTES AND COMMENTS

# CARBOHYDRATE-LOADING AND ITS EFFECT ON ECG RESPONSES

C. KARAM, F. Thye, M. Slaton, J. Walberg. Virginia Polytechnic Institute and State University, Blacksburg, VA 24061

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Six white-volunteer males less than 35 years old, who ran less than 35 miles per week completed a loading regimen. This consisted of a succession of mixed, high-fat and high-carbohydrate (CHO) diets for at least 72 hours each. Subjects ran to exhaustion after each diet stage. Mean times to exhaustion were 61, 63 and 95 minutes for the mixed, high-fat, and high-CHO diets, respectively. Heart rate and blood pressure were not significantly different for the first 30 minutes of each exercise bout but rate of perceived exertion indicated the mixed diet trial most demanding and the high-CHO trial least. Since questions have been raised concerning a detrimental effect of CHO-loading on heart function, subjects were closely examined for evidence of negative effects associated with this procedure. An incomplete right bundle branch block, sinus arrhythmia, and early repolarization after the mixed diet was noted in three of the six subjects. These changes were not observed during the high-fat nor high-CHO diets. Prior to the high-CHO exhaustive run, it was also found that the width of the QRS complex was significantly more narrow than the mixed and high-fat diets. The above electrocardiographic changes were noted as not being clinically significant by an internal medicine physician. No differences between diet treatments were noted for patterns of serum free fatty acids before and after the exhaustive runs. Serum glucose was significantly higher for the pre-run high-CHO diet when compared to the mixed and high-fat diets pre-run values, yet this serum metabolite was similar for all diet trials after the run. In summary, CHO-loading appeared to enhance endurance of the novice runner with no apparent detrimental effects on metabolism or cardiac function.

## NOTES AND COMMENTS

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# THE USE OF B-MODE ULTRASOUND IN MEASURING SUBCUTANEOUS FAT THICKNESS

LARENCE WEISS, Exercise Science Lab., Georgia Southern College, Statesboro, GA  
30460-8073

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Two experiments were conducted for the following purposes: (1) to determine at each of four separate extremity sites if a single measurement of subcutaneous fat taken in the middle of an 8mm cross-sectional sonogram was similar to the average of three fat measurements taken equidistantly across the same sonogram, (2) to assess the reliability of fat sonograms repeated within 30 min at the same extremity sites, and (3) to examine the association between B-mode sonograms and skinfold assessments of subcutaneous fat. A total of 64 college students, half male and half female, served as subjects in the two investigations. B-mode ultrasound (General Electric Datason DB) and skinfold calipers (Harpenden) were utilized for the fat thickness determinations. A high correlation was found between the middle fat-thickness measurement and the average-of-three fat thicknesses taken from B-mode sonograms at four extremity sites (biceps brachii,  $r=0.99$ ; triceps brachii,  $r=1.00$ ; quadriceps femoris,  $r=1.00$ ; hamstring,  $r=1.00$ ). Correlations were also high for repeated fat sonograms at the same sites (biceps brachii: males (M),  $r=1.00$ , females (F),  $r=1.00$ ; triceps brachii: M,  $r=0.81$ , F,  $r=0.97$ ; quadriceps femoris: M,  $r=0.99$ , F,  $r=0.99$ ; hamstring: M,  $r=0.99$ , F,  $r=1.00$ ). Correlations between fat sonograms and skinfolds were higher for females at the two arm sites (biceps brachii: M,  $r=0.55$ , F,  $r=0.84$ ; triceps brachii: M,  $r=0.63$ , F,  $r=0.81$ ) and were similar at the anterior leg site (quadriceps femoris: M,  $r=0.88$ , F,  $r=0.83$ ). Skinfolds at the hamstring area were unobtainable on most subjects. It was concluded for each of the four extremity sites that a single ultrasonically-determined measurement could be used to represent subcutaneous fat thickness. Further, reliable measurements of subcutaneous fat could be obtained ultrasonically for thicknesses repeated within 30 min. Finally, it was concluded that skinfolds and fat sonograms can produce highly related measurements for both college men and women at the quadriceps femoris site, for women at both arm sites, and only moderately related measurements for men at the arm sites.

Supported by Bulloch Memorial Hospital. Statesboro, GA 30458.

NOTES AND COMMENTS

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# EFFECTS OF FORCED EXERCISE ON FOOD INTAKE AND BODY WEIGHT IN INTACT AND OVARIECTOMIZED FEMALE RATS

C.A. CALDWELL and J.M. Davis, Department of Physical Education, University of South Carolina, Columbia, SC 29208

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Recent evidence suggests that female rats regulate energy balance more efficiently than male rats in response to exercise challenge; this response may be related to estrogen production by the ovaries. Therefore, the purpose of this study was to determine the effect of ovariectomy on the feeding behavior and body weight changes in female rats forced to exercise. Twenty Sprague-Dawley rats (44-45 days old; 130-160 gm) were randomly assigned to undergo bilateral ovariectomy or sham operations. Four days post-surgery ovariectomized (OV) and intact (I) animals were randomly divided into exercise (EX) and control (C) groups (n=5 animals/group). Following a 3-day exercise adaptation period (10 min. swim/day), the animals in the EX groups were forced to swim for 20 min.; exercise sessions were increased daily until all animals were swimming 60 min/day. This schedule was continued for 7 days. The C groups remained on the adaptation schedule throughout the 7-day period to control for the stress effect of immersion. Food intake and body weight data were collected daily. Analysis of data revealed that ovariectomy had a weak effect on food intake ( $p=.06$ ) and body weight ( $p=.15$ ); neither the main effect of exercise nor the exercise X ovariectomy interaction was significant. OV groups as a whole tended to consume more food ( $19.78 \pm 2.98$  vs  $18.39 \pm 2.70$ ; gm/day;  $\bar{x} \pm S.D.$ ) and gain more weight ( $183.36 \pm 14.31$  vs  $177.10 \pm 9.61$ ; gm) than I groups. There was a significant interaction between ovariectomy and time ( $p < .0001$ ) suggesting that weight gain in the OV groups increased at a faster rate than in the I groups. Overall, these data tend to confirm other studies which have shown that removal of the ovaries in female rats results in increased food intake and body weight gain; however, these data are in contrast to reports showing that strenuous exercise stimulates food intake in I but not in OV rats. Future studies should include larger sample size, longer exercise sessions and possibly estrogen replacement in an attempt to determine the mechanism involved in this observed response. supported by funds from NIH Biomedical Research Support Grant.

NOTES AND COMMENTS

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# THE EFFECTS OF A HIGH FAT DIET AND EXERCISE ON PLASMA LIPOPROTEINS

**D.R. VAN HOUTEN**, L.J. Goodyear and J.L. Durstine, Department of Physical Education, University of South Carolina, Columbia, South Carolina 29208

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High fat diets have been associated with increased cholesterol and triglyceride subfractions in very low density lipoprotein (VLDL) and low density lipoprotein (LDL) with decreases in these lipid subfractions in high density lipoprotein (HDL). Evidence suggests that a single prolonged bout of exercise will alter the lipid components of plasma lipoproteins. Thus, the purpose of this study was to determine the effects of a single bout of exercise on plasma lipoproteins from rats fed a diet high in fat content for seven days. 40 rats (mean weight = 252 gms) were divided into four groups; high fat control (HFC), high fat exercise (HFE), low fat control (LFC) and low fat exercise (LFE). The high fat diet consisted of 39.2% fat, 29.1% protein, 31.8% carbohydrates and the low fat diet consisted of 4.3% fat, 24.5% protein, 71.2% carbohydrates, with diets being isocaloric. Exercise consisted of a swim to exhaustion with the HFE group (110 min) having a longer swim time ( $p < 0.05$ ) than the LFC group (72 min). The results of a two-way ANOVA ( $p < 0.05$ ) indicates neither the high fat diet nor the swim to exhaustion affected the cholesterol, triglyceride and protein subfractions in VLDL, LDL and HDL. Plasma cholesterol levels were not different between high ( $48.4 \pm 2.8$ ) and low ( $49.7 \pm 3.3$ ) fat diets or exercise ( $49.2 \pm 3.3$ ) and control ( $48.4 \pm 2.8$ ) treatments. In addition, plasma triglyceride levels were not different between high ( $45.6 \pm 2.5$ ) and low ( $44.1 \pm 2.9$ ) fat diets or exercise ( $41.2 \pm 2.7$ ) and control ( $48.6 \pm 2.7$ ) treatments. Thus, a seven day high fat diet and a swim to exhaustion did not affect plasma cholesterol, triglyceride and lipoprotein subfraction. These data suggests that a diet higher in fat content maintained longer than seven days is necessary to affect blood lipid and lipoprotein profiles.

This study was supported by funds from NIH Biomedical Research Support Grant Award.

NOTES AND COMMENTS

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# CURRENT EXERCISE BELIEFS AND HABITS IN SOUTH CAROLINA: IMPLICATIONS FOR EXERCISE PROGRAMS

A. KRISKA, S. Blair, D. Shephard, R. Pate, and M. Weinrich. University of South Carolina and the S.C. Department of Health and Environmental Control, Columbia, South Carolina 29208

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Large population surveys identifying current lifestyle behaviors are crucial in public health for planning and evaluating health promotion efforts. One such survey, the Carolina Health Survey, was administered to a random sample of the South Carolina population and included questions on current exercise beliefs and habits. The survey showed that 98% believe that exercise is an important part of good health and that 83% claim to be as active or more active than others their age, although only 29% report following a regular program of physical exercise. Also, of the 54% that report that they are not getting enough exercise, the major reason cited was lack of time (56%) or laziness (36%), with lack of available facilities and equipment (3%) being the least cited reason. The value of the information gained from this survey lies in the fact that the sample utilized is representative of the entire state as compared to most other studies that utilized self selected populations in exercise settings. The random sample in this survey was comprised of 5053 adults, eighteen years and older, representing 3566 households in South Carolina. Information gained from this study has major implications for planning of future exercise programs in South Carolina.

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NOTES AND COMMENTS

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# THE VALIDITY OF AEROBIC POINTS FOR SCIENTIFIC AND CLINICAL USE

N.N. GOODYEAR, D.A. Ludwig, and S.N. Blair. School of Public Health, University of South Carolina, Columbia, SC 29208

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The aerobic point system developed by Cooper in the late 1960's has probably been the most highly publicized and most widely adopted physical fitness program in America. Although the program is being used by the general public, the point system has never been validated on a population other than that from which the system was derived (primarily male Air Force personnel under age 50). The purpose of this study is to establish predictive validity coefficients for aerobic points on males (M) and females (F) over and under age 50 and to determine whether the weekly point threshold suggested by Cooper actually reflects a "good" level of physical conditioning. Subjects were 107 female and 475 male participants of the Aerobics Activity Center in Dallas, TX, who had complete monthly aerobic point scores for at least 5 months directly preceding a maximal exercise treadmill test. Predictive validity coefficients were calculated by sex and age group using treadmill time as the criterion and aerobic points as the predictor variable. Eta coefficients were found to be high for all groups: ( $\eta = .78$  F < 50 yrs.,  $\eta = .83$  F > 50 yrs.,  $\eta = .66$  M < 50 yrs., and  $\eta = .71$  M > 50 yrs.). In addition, the average weekly point threshold suggested by Cooper (32 pts. for M, 20-24 pts. for F) coincided with a "good" level of fitness as measured by published sex and age specific Cooper Clinic tables. Since the primary mode of activity for this group was running, walking, or jogging, caution should be undertaken before generalizing these findings to other aerobic activities. However, for runners, walkers, and joggers the aerobic point system not only provides a valid measure of physical fitness but also allows researchers and clinicians a means for monitoring ongoing progress.

## NOTES AND COMMENTS

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# ASSOCIATION BETWEEN PHYSICAL ACTIVITY, PHYSICAL FITNESS AND CHD RISK FACTORS

S.N. BLAIR and N.N. Goodyear, School of Public Health, University of South Carolina, Columbia, SC 29208

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Epidemiologic studies have found physical activity (PA) to be inversely associated with coronary heart disease (CHD) and with CHD risk factors; however, the measures of PA in these studies have been varied and in some cases imprecise. No "gold standard" for measuring PA has been established and it is not clear whether the important factor in the exercise-CHD association is PA per se or physical fitness. This study examined whether PA or physical fitness was more highly related to the following CHD risk factors: systolic blood pressure (SBP), diastolic blood pressure (DBP), glucose (G), total cholesterol (TC), uric acid (UA), HDL-C, and body fat (BF). Subjects were 107 female and 475 male ( $\bar{X}$  age 44 yrs.) participants of the Aerobics Activity Center in Dallas, TX. PA was assessed by aggregate aerobic points recorded at a computer terminal after each exercise session. Physical fitness was defined as maximal test time from a graded treadmill exercise test to exhaustion. Subjects had complete monthly aerobic points scores for at least 5 out of 6 months directly preceding the maximal exercise stress test. Regression models were calculated with CHD risk factors as dependent variables. Age and sex were entered first, then either PA or physical fitness entered as the independent variable of interest. In general, the models yielded  $R^2$  values in the 20-25 range. Physical fitness (treadmill time) explained more of the variance than PA for all risk factors except HDL-C. The increase in  $R^2$  for physical fitness over PA was as follows: 01., C; .02, G; .02, UA; .03, RSBP; .03, RDBP; and .12, BF. The  $R^2$  for HDL-C was almost identical for PA and fitness. Although limited by its cross-sectional design, these results indicate that both PA and physical fitness are associated with CHD risk factors. The more objective measure of physical fitness is marginally a stronger predictor of risk factors.

NOTES AND COMMENTS

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# EFFECT OF A SEASON OF COMPETITION ON PERFORMANCE—RELATED FITNESS COMPONENTS OF FEMALE INTERCOLLEGIATE VOLLEYBALL PLAYERS

G. MCKENZIE GILLAM and Jancie P. Creel. Department of Health and Physical Education. Jacksonville State University, Jacksonville, AL 36265

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Nine members of a female intercollegiate volleyball team were evaluated on selected measures of performance-related fitness at the beginning and end of a competitive season. The 13 week season consisted of practicing skill acquisition type drills for two hours per day, four to five days per week and participating in the 38 match schedule. Muscular strength was improved as evidenced by an increase in the one repetition maximum for the supine press, squat, and dead lift. Although arm and shoulder girdle muscular endurance increased significantly, an increase of 31% in general muscular endurance was not significant at the .05 level of confidence. No significant change in predicted maximum oxygen consumption (33.8 to 35.7 ml/kg/min) was found. Power was observed to improve from 89.84 to 96.45 kg-m/sec. Participating in volleyball was found to decrease the time necessary for changes in body direction to occur. Time to accelerate 15 yards was unaffected. With the exception of an increase of 1.97 kg in lean body weight, body composition was not significantly affected by a season of volleyball competition. Based on the results of this study, it appears that increased muscular strength, muscular endurance of specific body areas, power, agility, and lean body weight would provide the intercollegiate player with those qualities of function beneficial to successful participation in a season of volleyball play.

NOTES AND COMMENTS

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# ANTHROPOMETRIC AND PHYSIOLOGICAL COMPARISONS OF MALE COLLEGE BASKETBALL PLAYERS AND NONPARTICIPANTS

G. MCKENZIE GILLAM. Department of Health and Physical Education. Jacksonville State University, Jacksonville, AL 36265

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Thirteen college basketball players, tested within two weeks after their last competitive game, were compared with 14 physical education majors not involved in varsity sports for purposes of identifying those physical and anthropometric qualities necessary for participating in college basketball. Four anthropometric characteristics were found as significantly contributing to participation. Basketball players were 10.53 cm taller and heavier in terms of both total body weight (7.52 kg) and lean body weight (9.39 kg) than the nonparticipants. No differences were found between percent body fat and fat weight of the two groups. The basketball players were found to have a lower endomorph (3.33) value. No other body type differences were identified from Heath-Carter somatotype evaluations. Physical qualities contributing to basketball ability were also identified. The collegiate athletes were found to be superior to the nonathletes in terms of both acceleration and maximum speed and agility. The power of basketball players (154.12 kg-m/sec) exceeded that of nonplayers (135.20 kg-m/sec). General muscular endurance of the players was 35% greater than the nonplayer. Isotonic measures of upper and lower extremity muscular strength did not differ significantly between the two groups. No significant difference in predicted maximum oxygen consumption was found between the basketball players (46.4 ml/kg. min) and the nonparticipants (42.7 ml/kg/min). Flexibility of the lower back and posterior thigh was also not found to be a factor contributing to basketball participation. Application of these findings could prove most useful in the recruitment of basketball personnel and in the establishment of training programs to optimize playing ability.

NOTES AND COMMENTS

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# HEALTH RELATED FITNESS OF POLICE OFFICERS: EFFECTS OF AGE AND BODY WEIGHT

**LUKE E. THOMAS.** Department of Health and Physical Education. Austin Peay State University, Clarksville, TN 37044

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Seventy-nine police officers volunteered to participate in fitness evaluation in order to determine age related norms. A modified version of the AAHPERD Health Related Physical Fitness Test was utilized to evaluate each officer for cardio-respiratory endurance, abdominal muscular strength-endurance, low-back flexibility, upper and lower body strength, and body composition. Increases in age significantly decreased scores for the sit-ups ( $p < .01$ ) and sit-reach ( $p < .05$ ) tests while mile run time ( $p < .01$ ) and % body fat ( $p < .05$ ) increased. Also, age in combination with body weight significantly ( $p < .01$ ) effected scores for the leg press and bench press with age decreasing test scores and greater body weight increasing test scores. These data indicate the influence age and body weight have on fitness test performance.

## NOTES AND COMMENTS

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# VALIDITY OF VO<sub>2</sub> UTILIZING THE R.E.P. 100 DATA ACQUISITION SYSTEM

S.J. FLECK, G. Reed, D.L. Olander, C. Schmidt and D. Campbell. University of Alabama in Birmingham, 35294

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VO<sub>2</sub> values calculated utilizing the R.E.P. 100 Data Acquisition System (Rayfield Equipment Co., Chicago, Il.) were compared to VO<sub>2</sub> values calculated utilizing a non-computerized method. The R.E.P. 100 was connected to a Parkinson Cowen gas meter, and Bechman OM-11 oxygen analyzer and LB-2 carbon dioxide analyzer as described by the manufacturer. The non-computerized method consisted of visually obtaining VIATPS and breaths per minute from the Parkinson Cowen gas meter, collecting all expired air in a spirometer and analyzing a gas sample from the spirometer for O<sub>2</sub>% and CO<sub>2</sub>%. VO<sub>2</sub> of 20 subjects was measured during a continuous loading bicycle ergometer test. Work loads were 5 minutes in duration and progressed from rest to 206 watts in 29.4 watt increments. During minutes 4 and 5 of each workload data collection utilizing one of the 2 methods was performed, alternately. Pearson product moment correlations performed between the data of both methods revealed correlation coefficients of .98 for VIATPS, VESTPA, VO<sub>2</sub> (l/min), VO<sub>2</sub> (ml/Kg-min-1) and VCO<sub>2</sub> (l/min), .97 for VISTPD and .94 for breaths per minute. It was concluded that the R.E.P. 100 Data Acquisition System is a valid system for determining the examined variables.

## NOTES AND COMMENTS

# THE EFFECTS OF INTERVAL AEROBIC TRAINING ON LIPID FRACTIONS

A.C. COHEN, J. L. Tapp, L. Weeks, and D. Cross, Human Performance Lab University of Miami, Miami, FL 33124

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The purpose of this study was to determine the effects of 10 weeks of bicycle ergometer training on plasma lipoproteins in fasting venous samples of 12 sedentary male and post-menopausal faculty members attending the University of Miami. A group of 5 male and post-menopausal faculty members served as the control group. All subjects trained between two and three days per week at 80-85% of their age-approximated heart rate for the duration of 45 minutes. Estimated maximum oxygen consumption ( $VO_2max$ ), using Astrand's nomogram was used to assess a conditioning effect. Cycling caused a significant increase in  $VO_2max$  ( $p < .05$ ) and a non-significant decrease in body weight and adiposity. None of these parameters changed in the control group. There was a large but non-significant decrease in plasma triglycerides, very low density lipoprotein cholesterol (V.L.D.L.-C), and low density lipoprotein cholesterol (L.D.L.-C), in the experimental group as well as a non-significant increase in high density lipoprotein cholesterol (H.D.L.-C) in this group. The Cardiac Risk Index which is a measure of L.D.L., H.D.L. cholesterol showed a significant decrease following training ( $p < .05$ ). None of the aforementioned lipid parameters showed significant changes in the control group. All lipid assays were determined enzymatically according to the procedures set forth by Worthington Diagnostic Laboratories. A closer look at the experimental group revealed that males made greater changes in their lipid profile than females in the same program. Males had initial lipid profiles associated with greater coronary risk. Although beneficial changes in lipid levels occurred following training, it appeared that those individuals with the least favorable lipid profile initially made the most beneficial changes following interval aerobic training.

Supported by a grant from the Educational Alumni Association, University of Miami.

## NOTES AND COMMENTS

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# THE EFFECT OF ELASTIC HOSE ON PLASMA VOLUME AND BLOOD LACTATE

D.M. GUINAN, R.G. McMurray, and D.C. Lawrence. Human Performance Lab., University of North Carolina, Chapel Hill, NC 27514

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Six male subjects exercised on a bicycle ergometer for twenty minutes at 150/watts followed by five minutes at 250/watts, with and without over-the-calf elastic hose(EH), to determine the effect of the hosiery on plasma volume shifts and blood lactate concentrations. Compared to controls (Cont), the use of elastic hose did not effect heart rate or metabolic rate. Changes in plasma volume (Dill & Costill, 1974) were found to be similar for Cont and EH trials during exercise ( $-20.5 \pm 1.2\%$ ), but the EH significantly reduced fifteen minute recovery fluid shift (EH =  $-10.0 \pm 1.0\%$ ; Cont =  $-15.4 \pm 0.7\%$ ). Compared to controls, EH significantly reduced blood lactate at the end of exercise (4.4 vs 6.9 mM/l), five minute post exercise (6.9 vs 10.3 mM/l), and fifteen minute post exercise (4.3 vs 6.1 mM/l). Recovery oxygen uptake (15 min) were similar. Follow-up study utilizing six new subjects running on a treadmill and monitoring recovery for one hour, revealed the EH caused less shift in plasma volume and lower blood lactate at 5, 15, 30, 45 & 60 minutes of recovery. Comparison of the %PV and % (lac) indicated that the lower lactate was not related to the fluid shift. Recovery oxygen uptake (60 min) were similar for controls ( $33.72 \pm 1.74$  l/m) and EH ( $32.27 \pm 1.69$  l/min) trials. The results of these investigations indicate that the use of elastic hose does not alter submaximal or maximal exercise performance but enhances recovery fluid shifts and reduces circulating lactate.

Supported by Rampon Products, Inc., Asheboro, NC

NOTES AND COMMENTS

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# A RE-EXAMINATION OF RESEARCH METHOD: APPLICATION TO ARM CRANK ERGOMETRY

M. MANGUM and B. Harris. Applied Physiology Lab., Louisiana State University, Baton Rouge, LA 70803

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Exercise, when used as a treatment condition in research, is routinely established at a given %  $\dot{V}O_2$  max for all subjects. This practice carries considerable cost when laboratory time, equipment, and personnel are considered. The purpose of this investigation was to examine alternate methods for reducing error variance and increasing the precision of statistical analyses. Arm cranking was chosen as the exercise mode due to its qualitative differences from traditional exercise modes and the fact that  $\dot{V}O_2$  max cannot be elicited. Twelve subjects cranked for six minutes at three power outputs (30, 60, and 90 Watts). Heart rate (HR), minute ventilation ( $\dot{V}_e$ , BTPS),  $\dot{V}O_2$ , and venous lactate were assessed. For statistical analysis, workload was expressed three ways: 1) as absolute power output (Watts), 2) as power output per unit mass ( $\text{Watt} \cdot \text{kg}^{-1}$ ), and 3) as  $\dot{V}O_2$  relative to peak (%  $\dot{V}O_2$  peak). Analysis revealed that %  $\dot{V}O_2$  peak explained a greater proportion of variance for HR and lactate, but not  $\dot{V}_e$ , than did the other expressions of workload. However, the alternate expressions for workload explained significant proportions of variance (e.g., made a unique contribution) in addition to that explained by %  $\dot{V}O_2$  peak. These data validate the practice of establishing workload at a given %  $\dot{V}O_2$  peak for arm crank ergometry and suggest that other expressions of workload could be used as statistical covariates to further reduce error variance.

NOTES AND COMMENTS

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# EFFECTS OF TRAINING ON THE SYMPATHETIC RESPONSE OF TRAINED RUNNERS

V. BEN-EZRA and P. Vaccaro, Human Performance Lab., University of Maryland, College Park, MD 20742 and Exercise Physiology Lab., University of North Carolina-Chapel Hill, Chapel Hill, NC 27514

The purpose of this study was to determine if competitive road race training resulted in a reduced sympathetic output in highly trained distance runners. Nine competitively trained long distance runners (avg. 8.1 yrs. competing) served as subjects. All subjects entered the study having run 40-90 miles/week of long slow distance for the two months prior to the study. They then began a 10 week training program which included two high intensity training days/week at approximately 85%  $\dot{V}_{O_2}$  max. During this training program their normal weekly mileage was maintained. Each subject ran to exhaustion using an incremental treadmill protocol before and after their training program. Respiratory gases were measured for  $\dot{V}_{O_2}$ ,  $\dot{V}_{CO_2}$ , R,  $F_{EO_2}$ , and  $F_{ECO_2}$  every 30 seconds during each three minute stage. Plasma norepinephrine (NE) and lactate (LA) were determined from blood samples drawn via an indwelling venous catheter at rest, during the final 30 seconds of each workload and after three minutes of active recovery. The results show that there were no significant differences at any workload for NE pre to post training ( $P > .05$ ). There was also no significant difference in  $\dot{V}_{O_2}$  max (4.41 vs 4.48 l/min.,  $P > .05$ ) but blood lactate was significantly lower at 80% and 90%  $\dot{V}_{O_2}$  max post training ( $P < .05$ )

	% $\dot{V}_{O_2}$ Max							
	60		70		80		90	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
NE (pg/ml)	1441	1555	2034	1935	3353	3866	5088	4621
LA (mM)	1.22	1.22	1.54	1.63	2.94 *	2.45	5.57 *	4.03

\* = ( $P < .05$ )

These data indicate that highly trained runners do not appear to undergo any reduction in sympathetic response or increase  $\dot{V}_{O_2}$  max as a result of competitive training. The data does support previous findings that show a reduction in blood lactate accumulation post training.

NOTES AND COMMENTS

# THE ACTUAL MAXIMAL HEART RATES OF ADOLESCENT ATHLETES AND PREDICTED VALUES

T. LIGHTFOOT and K. Stuart. Northeast Louisiana University, Monroe, Louisiana 71291

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The purpose of this study was to compare predicted maximal heart rate values of adolescent athletes derived from the age-related maximal heart rate formula with the actual maximal heart rates of adolescent athletes to check the applicability of this age-related prediction formula with regard to adolescent athletes. Sixteen junior high athlete's, (mean age: 13.4 years), heart rates were monitored during maximal exercise to measure maximal heart rate. The values monitored were compared to predicted maximal heart rate values derived from the age-related maximal heart rate prediction formula,  $(220 - \text{age of subject} = \text{maximal heart rate in beats per minute})$ , by using a correlation matrix. When analyzed, the correlation coefficient,  $(-.397)$ , was found to be lower than the  $p < .05$  level of significance,  $(+.400)$ . Therefore, it was concluded that no significant relationship, (inverse or direct), existed between the actual maximal heart rates and the values derived from the age-related maximal heart rate prediction formula. Use of the age-related maximal heart rate prediction formula was meant to give approximate values for general exercise evaluations. However, this study showed that this age-related formula may not be applicable with regard to adolescent athletes. This fact may be due to training in the athlete or to a general failure of the age-related formula to approximately predict maximal heart rate in the adolescent athlete. The results showed almost a negative correlation, whereas, for the age-related formula to be applicable in this study, a positive correlation would be favorable. This showed that the age-related formula was totally not acceptable in predicting maximal heart rate in adolescent athletes.

NOTES AND COMMENTS

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# VALIDATION OF BODY COMPOSITION PREDICTION EQUATIONS FOR HIGH SCHOOL WRESTLERS

HENRY N. WILLIFORD, JR. and Joe E. Smith. Auburn University at Montgomery/Physical Education Department, Montgomery, AL 36193

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The purpose of this study was to validate the prediction equations by Tcheng-Tipton (1973), Katch-Michael (1971), and Forsyth-Sinning (1973) and to develop a prediction equation specific to Alabama High School Wrestlers. A sample of 56 high school wrestlers were evaluated to determine body density (DB), percentage of body fat, and a minimum wrestling weight (MWW). True DB was determined by hydrostatic weighing, and anthropometric measurements were used to validate existing equations and to develop new equations which would predict DB. Equations tested with correlations and standard errors of estimate between estimated and true DB were: (A) Katch-Michael,  $\bar{r} = .83, \pm .0075$  g/cc; (B) Forsyth-Sinning: Forsyth-Sinning 1,  $\bar{r} = .77, \pm .0091$  g/cc; Forsyth-Sinning 2,  $\bar{r} = .77, \pm .0091$  g/cc; (C) Tcheng-Tipton equations for MWW; long form,  $\bar{r} = .90, \pm 9.58$  lbs; short form,  $\bar{r} = .91, \pm 9.34$  lbs. New regression equations were also derived on the basis of anthropometric measurements taken on the wrestlers. Multiple correlations between true DB and DB estimated from newly derived equations ranged from  $\bar{r} = .83$  to  $\bar{r} = .89$ . The highest multiple correlation was obtained from the equation  $DB = 1.0582 - .00240$  (chest skinfold) -  $.00242$  (iliac skinfold) +  $.00156$  (abdominal 2 skinfold) +  $.0005$  (chest girth). When established and newly derived equations were used to estimate DB and MWW, high correlation coefficients were found between true and predicted DB. The prediction of the individual values of DB were variable enough to cause concern in predicting absolute individual values of DB and MWW.

## NOTES AND COMMENTS

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# ACCOUNTING FOR RESPIRATORY GAS PHASE DELAY IN OPEN-CIRCUIT SYSTEMS FOR EXERCISE OXYGEN UPTAKE DETERMINATIONS

H.L. DeBOEVER, B.E. Cline, and R.C. Marchany. Human Performance Laboratory, Virginia Tech, Blacksburg, VA 24061

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The purpose was to assess the phase delay between the time of ventilatory ( $\dot{V}$ ) response and expired air analysis in a continuous sampling system for open-circuit measurement of exercise oxygen uptake ( $\dot{V}O_2$ ). A gas with known concentrations of  $O_2$  and  $CO_2$  (16.35 and 4.80%) was pumped through the breathing system using a volumetric syringe attached to the mouthpiece port of a Warren Collins Triple-J breathing valve. Before the start of each pumping trial, the reference gas was cleared from the system and replaced with atmospheric air.  $\dot{V}$  levels of 30, 60, 90, 120, and 150  $L \cdot \text{min}^{-1}$  were generated manually to simulate conditions of human exercise ventilation. First,  $\dot{V}$  was measured with a digital pneumotach located in-line on the expired side ( $\dot{V}_E$ ) and, second, on the inspired side ( $\dot{V}_I$ ) using separate apparatus configurations. Gases were sampled from a mixing chamber (via dessicant, Aquasorb  $\text{®}$ ) using fast-response  $O_2$  and  $CO_2$  analyzers (Applied Electrochemistry, Inc.) interfaced with a MINC computer system (Digital Electronics Corp.) which provided response curves based on rapid data sampling (10 pts  $\cdot \text{sec}^{-1}$ ). The curves were then evaluated to determine the delay time before  $O_2$  and  $CO_2$  values stabilized at levels corresponding to the known  $O_2$  and  $CO_2$  concentrations. For the  $\dot{V}_I$  configuration, this delay was inversely related to  $\dot{V}$  such that the  $O_2$  phase delay between flow rates of 30 and 90  $L \cdot \text{min}^{-1}$  were 26 and 12 sec, respectively. Above 90  $L \cdot \text{min}^{-1}$  this delay was not less than 9 sec for either gas. For the  $\dot{V}_E$  configuration, a similar relation was observed for the  $O_2$  response but this tended to be linear through the entire  $\dot{V}_E$  range and was 10-25% faster than with the  $\dot{V}_I$  configuration.  $CO_2$  response patterns appear to follow those of  $O_2$ , with the exception of increased delay time at each  $\dot{V}$  rate. For the  $\dot{V}_E$  configuration at flow rates of 30 and 120  $L \cdot \text{min}^{-1}$  the  $CO_2$  phase delays were 34 and 12 sec. For computer supported  $\dot{V}O_2$  systems, these data suggest a basis for software programming corrections of phase delays to yield accurate  $\dot{V}O_2$  calculations predicated on the time required for approximately 10 respiratory cycles.

## NOTES AND COMMENTS

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# EFFECTS OF A POWER WEIGHT TRAINING CIRCUIT PROGRAM ON POWER PRODUCTION AND PERFORMANCE

**J.M. MANNING.** U.S. Sports Academy, Mobile, AL. Cathryn Dooly-Manning. University of Southern Mississippi, Hattiesburg, MS. David Terrell and Earlee Salas. U.S. Sports Academy, Mobile, AL 36608

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Seven male swimmers between the ages of 16-18 from the City of Mobile Swim Assoc. were placed on a nine week weight training program to observe changes in power production and freestyle swimming times. All swimmers had previously qualified for the Junior or Senior National and had granted consent. The circuit training program involved lifting either 30, 40 or 50% of their 1 RM as fast as possible for one minute followed by a 30 sec. rest. Measures were obtained nine weeks prior to weight training, just prior to weight training, and nine weeks post weight training. Swim training continued during the entire study. Specific power measures were obtained from: the Cybex FI isokinetic unit for the ankles, knees, shoulders, and the one minute Monark ergometer test. Functional power was obtained from the standing long jump. Swim times for the 50 & 100 yd. freestyle were also obtained. Significant differences ( $p < .05$ ) were found for the variables: ankles, knees, shoulders, and the number of revolutions. No significant differences ( $p > .05$ ) existed for the standing long jump and swim times. Scheffe post hoc procedures found that no significant differences existed between the nine weeks prior to weight training and the period just prior to weight training, but significant ( $p < .05$ ) differences did exist between the period just prior to weight training and nine weeks post weight training. Significant differences also existed between the period nine weeks prior to weight training and nine weeks post weight training. The swim times for the 50 & 100 yds. did not show significant differences although improvements were observed; a mean of .7 sec. and 2.4 sec. respectively. These were not statistically significant but when considering the short distances and the caliber of swimmers involved, the improvements were substantial. The authors concluded that the weight training program significantly increased the swimmers power production and improved their swim times for the 50 & 100 yd. freestyle.

NOTES AND COMMENTS

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# EFFECTS OF TESTER / SUBJECT RELATIONSHIP ON EXERCISE TOLERANCE TESTING

B.D. FRANKS and L. Watts. Center for Physical Activity and Health, 136 HPER Building, University of Tennessee, Knoxville, TN 37996-2700

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An earlier study (Myers, et al., SEACSM, 1983) found that the interaction of the race and gender of the tester and S affected resting heart rate, perceived exertion during exercise, and time to exhaustion, in Ss not well acquainted with the testers. This study tested friends of the tester, Watts, (N = 10) and 10 Ss who did not know him. All of the Ss were relatively naive to exercise testing. The treadmill test started at 5 METS and was increased 2-3 METS each 2 minute stage until voluntary exhaustion. Heart rate (HR) and rating of perceived exertion (RPE) were measured prior to, during each stage, and following the walk/run. The testing environment (i.e., temperature, tester, interaction with the S, and physical surrounding) were controlled. Differences on each dependent variable between the Ss who knew and didn't know the tester were determined by a t-test for independent groups ( $p < .10$ ). The only significant differences were that the resting HR (both sitting and standing) were higher in the friends, whereas, the RPE to stage 3 (6 mph, 1.75 % grade) and peak RPE were lower in the friends. There were no differences ( $p < .33$  to  $.99$ ) in time to exhaustion or any other HR or RPE response to walking, running, or maximum work. It is concluded that: (1) resting HR, and RPE during moderate work and at exhaustion appear to be sensitive to the tester/S relationship; and, (2) knowing the tester has little effect on HR response to exercise or time to exhaustion in Ss naive to exercise testing.

NOTES AND COMMENTS

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# THE EFFECTS OF TWO CARDIOVASCULAR ENDURANCE TRAINING INTENSITIES ON SERUM LIPOPROTEIN CHOLESTEROLS IN MIDDLE-AGED WOMEN

M.D. SENN, V.K. Christian, R.L. Johnson, H.S. O'Bryant, Human Performance Laboratory, Appalachian State University Boone, NC 28608

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The purpose of this study was to determine the effects of training intensities of 50 and 65 percent of the heart rate reserve (HRR) on changes in lipoprotein cholesterol fractions. The subjects consisted of 15 females between the age of 27 and 45 years. Blood samples were drawn prior to the training period, during the fifth week of training and at the conclusion of the training period. The training program consisted of walking and/or running on a motor driven treadmill three non-consecutive days per week. Group 1 trained at an intensity which was equal to 50 percent of the HRR added to the resting heart rate. Group 2 trained at an intensity which was equal to 65 percent of the HRR added to the resting heart rate. Exercise was terminated when 1,200 heart beats above the resting heart rate were cumulated. The data revealed no significant changes in triglyceride, low density lipoprotein cholesterol, or the ratio of high density lipoprotein cholesterol to total cholesterol for either training intensity. Although high density lipoprotein cholesterol was elevated between week five and week eight of training for both groups, the values for both groups remained significantly lower than the pre-training values.

## NOTES AND COMMENTS

# PREDICTION OF INJURY IN COLLEGIATE ATHLETES AS A FUNCTION OF SELECTED PERSONALITY CHARACTERISTICS

M.E. CAVANAUGH, J.M. Silva, C.J. Hardy, Department of Physical Education, Fetzer Gym, University of North Carolina-Chapel Hill, North Carolina 27514

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There has always been considerable speculation that injury frequency in athletes could be related to psychological variables. Rosenblum (1979) has suggested that guilt and underlying emotional conflicts often characterize the "accident prone" athlete. Research by Bramwell, Masuda, Wagner & Holmes (1975) & McClelland & Jemmott (1980) has indicated that stress and stressful life events are significantly related to injury proneness. The purpose of this study was to further probe the potential relationship between psychological traits and injury frequency. The subjects were 68 female & male intercollegiate athletes representing five varsity teams. Subjects were administered the IPAT Clinical Analysis Questionnaire (CAQ) in small team groups following a standardized instructional set each subject was requested to sign an informed consent form. A stepwise discriminant function analysis was conducted with injury frequency as the dependent variable and scores from the CAQ and gender as the predictor variables. A hierarchial cluster analysis was employed to establish group membership (low injury frequency through high injury frequency). The results indicated a significant canonical correlation (.699,  $p < .004$ ) which accounted for 44.89% of the variance in group membership. The primary variables contributing to the separation of the groups were: (1) guilt & resentment, (2) anxious depression, (3) schizophrenia, (4) suicidal depression, (5) expedient-conscientious, (6) trusting-suspicious. The results suggested that athletes with lower injury frequency exhibited slightly elevated withdrawal tendencies (schizophrenia & guilt & resentment) while frequently injured athletes manifested anxious depression, suicidal depression, expedience & suspiciousness.

NOTES AND COMMENTS

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# HOW WELL DO ROAD RACERS PREDICT THEIR OWN PERFORMANCE?

R.N. GODSEN, College of Charleston, Charleston, SC 29424

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The purpose of this study was to determine whether road racers are good predictors of their own race performance. Data were taken from the 1983 Cooper River Bridge Run (Charleston, SC, N=2331). Runners were asked beforehand to predict their race time; this value was then correlated with their actual race time. Overall, the field's predictive power was not very good. The correlation (R) between predicted and actual time was .79 with a standard error of estimate (SEE) of 7.64 minutes. Females were slightly better predictors than males (R=.83 & SEE of 6.48 versus an R of .76 and an SEE of 8.10). As might be expected, however, elite runners (first 50 male and female finishers) were significantly better predictors of their performance. The elite male group produced an R of .83 and an SEE of .88 minutes. Comparable figures for the elite female group were .80 and 1.71 minutes. The runners were also partitioned into arbitrary age groups to determine whether age was a factor. For these data, runners in their 20's and runners over 40 were significantly better predictors than young runners (19 and under). It is concluded that road racers as a group are not very good predictors of their own running performance, especially if they are young. Experience and wisdom appear to sharpen their prognosticative skills, however.

## NOTES AND COMMENTS

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# THE EFFECT OF ACUTE CAFFEINE INGESTION ON MUSCLE ENDURANCE IN WEIGHT TRAINED MALES AND FEMALES

K.S. SANSOCIE, M.H. Stone, and C.C. Sansocie. Human Physiology Lab., Auburn University, Auburn, AL 36849

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Six male and five female weight trained athletes volunteered for research testing the effects of caffeine on muscle endurance. Although aerobically trained athletes may gain increased muscle endurance through improved substrate utilization other factors such as motoneuron excitability and "volitional drive" may account for improved performance when competitive weight lifters take caffeine. Subjects were required to sign an informed consent developed according to ACSM and Auburn University guidelines. Then they received either caffeine or placebo in capsule form thirty minutes prior to a cycle ergometer ride to exhaustion. Maximum oxygen uptake  $\dot{V}O_2$  ( $L \cdot \text{min}^{-1}$ ) and  $\dot{V}O$  ( $ml \cdot \text{min}^{-1} \cdot \text{kg}^{-1}$ ), perceived exertion (PE), and time to exhaustion (T) were measured during both the caffeine and placebo trials. The Beckman Metabolic Cart was used for gas analysis. Experimentation was double blind and an attempt was made to counterbalance caffeine and placebo trials. Response to questions indicated that only three out of eleven subjects realized when they received caffeine. Data were analyzed using the  $P=0.05$  level of significance by Analysis of Variance (ANOVA). The most critical variable was time to exhaustion. Maximum heart rate was recorded to insure that subjects made a maximum effort during both trials. No statistically significant results were found between caffeine and placebo trials for any of the dependent variables ( $\dot{V}O_2$ ,  $\dot{V}O$ , PE, and T). Individual subjects differed greatly in their response. Maximum oxygen uptake was significantly different [ $F(1,7)=28.15$ ] between males and females. These data illustrated that the caffeine had no influence on muscle endurance in weight trained males and females.

## NOTES AND COMMENTS

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# CROSS-VALIDATION OF THE JACKSON AND POLLOCK GENERALIZED EQUATIONS FOR PREDICTING BODY DENSITY ON COLLEGIATE FOOTBALL PLAYERS

S.R. VICKERY, P.A. Bishop, M.A. Collins, G.E. Wilson and K.J. Cureton. Human Performance Laboratory, University of Georgia, Athens, GA 30602

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Generalized regression equations developed by Jackson and Pollock (J & P) for predicting body density (BD) from the sum of 7 or 3 skinfolds, the skinfold sum squared, and age were cross-validated on a group of 43 varsity collegiate football players. The correlations between BD measured using underwater weighing and BD predicted from the J & P equations with 7 and 3 skinfolds (.93 and .91., respectively) were similar to those reported on the original large sample of men; standard errors of estimate were somewhat lower (.0050 and .0054 gm/cc, respectively). The mean BD predicted from the J & P equations based on the sum of 7 and 3 skinfolds (1.0712 and 1.0747) were higher than the mean measured density (1.0693), which would result in mean errors in % fat estimates of 0.8 and 2.3 % fat. New equations developed on the 43 football players predicting measured BD from the same independent variables as the J & P equations were almost identical in accuracy ( $R^2$ 's = .93 and .92 and SEest's = .0050 and .0053 gm/cc) to their equations. However, BD predicted using their equation including the sum of 3 skinfolds resulted in noticeably higher BD estimates, particularly for fatter individuals. The data indicate that the J & P equation using the sum of 7 skinfolds is applicable to collegiate football players and provides quite accurate estimates of body density for this atypical group.

NOTES AND COMMENTS

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# TIME OF DAY AS A FACTOR IN TRAINING FOR STRENGTH DEVELOPMENT

D.W. HILL and C.W. Zauner, Center for Physical and Motor Fitness, University of Florida, Gainesville, FL 32611

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This study was designed to determine if training regularly with heavy resistance exercise at a given time of day results in greater strength development at that particular time of day than at other times. Nine women were tested for grip strength (GS) on two consecutive days at 8:00 a.m., 11:00 a.m., 2:00 p.m. and 5:00 p.m. Following testing, four of the women (Group 1) trained at 11:00 a.m. and the remaining five (Group 2) trained at 5:00 p.m. Subjects trained three to five times weekly for eight weeks. Then, they were retested as before. Initially, there were no differences in GS across time for either group. The mean initial GS for Group 1 was 30.7 kg and for Group 2 was 28.7 kg. After training, the mean GS for Group 1 increased 25.4% to 38.5 kg and for Group 2: 20.2% to 34.5 kg. The improvement in GS at different times of day was different for the two groups ( $F_{3,21} = 3.09, p < .05$ ). Group 1, which had trained at 11:00 a.m., showed highest post-training values at 11:00 a.m. and improved 10.4% more at this time than did Group 2. Group 2, which trained at 5:00 p.m., showed highest post-training values at 5:00 p.m. and improved 5.6% more at this time than did Group 1. The results suggest that it would be advantageous for athletes or individuals involved in activities where strength is a factor to carry out training at the same time of day that they will perform.

## NOTES AND COMMENTS

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# THE EFFECTS ON EXERCISE AND LARGE DOSES OF VITAMIN B-6 ON FATIGUE AND CONTRACTILE PROPERTIES OF RAT MUSCLES

**JIM McMILLAN**, Bob Keith, Dennis Wilson, Mike Stone, Dept. HPR, Auburn University; Dept. of Nutrition and Foods, Auburn University, Auburn Alabama

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Thirty-six male Sprague-Dawley rats (70-80) days old) were randomly placed in an exercise (Ex.) group or a no exercise (No Ex.) group. The two groups received identical diets but were sub-divided according to the level of Vitamin B-6 (B-6) added to their diet; minimum daily requirement (MDR), 10 times MDR (10MDR), 100 times MDR (100 MDR). The rats were exercised for 4 weeks, 4 days per week, on a Rotomex treadmill. Intensity was increased by raising the RPM's (1st week) and adding weight to the rats tails (2nd week  $\approx$  5% B.W., 3rd week  $\approx$  10% B.W., 4th week  $\approx$  15%). Results indicated the Ex. group produced a significantly higher ( $P < .05$ ) developed force per gram of muscle wet weight. The 10 MDR group had a significantly lower ( $P < .01$ ) one-half time to fatigue than either the MDR or the 100 MDR group. These results suggest that short-term high intensity exercise will increase muscle contractile properties, but that supplemented B-6 (above MDR) will not enhance performance as measured by increased time to fatigue or increased contractile properties of plantor flexors.

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# COMPARISON OF THE WINGATE ANAEROBIC TEST WITH OTHER TESTS OF ANAEROBIC POWER

G.P. GRIFFITH and P.M. Ribisl. Human Performance Lab., Wake Forest Univ., Winston-Salem, NC 27109

Due to current shortcomings (i.e. invasive nature, insufficient test duration, and failure to adhere to the definition of mechanical power), there exists no single test of anaerobic power which has gained the support or popularity characteristic of methods for determination of aerobic capacity ( $\dot{V}O_2$  max.). In response to these shortcomings, Ayalon, Inbar and others (1975) of the Wingate Institute, have developed a 30sec supramaximal cycle task to measure anaerobic power output ( $\text{kgm}\cdot\text{sec}^{-1}$ ). The purpose of the present study was to compare the Wingate Anaerobic Test (WANT) with similar, accepted tests of anaerobic capacity. A sample of 55 university students (athletes and non-athletes) performed the following tests in sequence: 40yd dash, Margaria stair run, vertical jump and the WANT. While performing the WANT, subjects cycle at a maximum pedal frequency for 30sec, at a workload equal to  $0.092-0.10 \text{ kg}\cdot\text{kg}^{-1}$  of body weight. Power output for each subject is determined in 5sec periods, by expressing the external work performed in  $\text{kgm}\cdot\text{sec}^{-1}$ . Three indices of anaerobic power are reported for the WANT; mean power, peak power, and power decline.

Results: Table 1. Correlation coefficients (r) and explained variance ( $r^2$ ) for the indices of the WANT and the other tests of anaerobic power. (n=55)

WANT indices	Margaria	40yd dash	vertical jump
Mean Power	$r=0.75^*$ ( $r^2=0.56$ )	$r=0.27$ ( $r^2=0.07$ )	$r=0.18$ ( $r^2=0.03$ )
Peak Power	$r=0.72^*$ ( $r^2=0.52$ )	$r=0.28$ ( $r^2=0.08$ )	$r=0.19$ ( $r^2=0.04$ )
Power Decline	$r=0.35^*$ ( $r^2=0.12$ )	$r=0.07$ ( $r^2=0.005$ )	$r=0.08$ ( $r^2=0.006$ )

(\*significant  $\geq 0.01$ ) The data indicate a relatively strong relationship ( $r=0.75$ ) between the WANT and the Margaria test; the latter being a purportedly valid measure of mechanical power. Non-significant relationships were found between the WANT and the two other tests utilized in the study. The Margaria, which measures true mechanical power (W/t), showed a similarly weak relationship with the other two tests. It can be concluded that the relatively strong relationship ( $r=0.75$ ) between the WANT and Margaria test suggests that they are measuring similar capacities, and that both can be used as valid measures of human leg power.

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# THE PRACTICAL VALIDATION OF THE WINGATE TEST OF ANAEROBIC POWER

P.M. RIBISL and G.P. Griffith. Human Performance Laboratory, Wake Forest University, Winston-Salem, North Carolina 27109

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At the present time, there is no universally accepted test of anaerobic power. In response to the deficiencies of several commonly used tests, Inbar and others (1975) at the Wingate Institute have developed a 30-sec supra-maximal test of anaerobic power using cycle ergometry; this test has compared favorably with the Margaria test of anaerobic power. The purpose of this study was to compare the anaerobic power (Wingate test) of four separate groups of individuals who ranged from low to high "expected" anaerobic power. The sample consisted of normals (n=13), cross country runners (n=16), soccer players (n=25) and football players (n=17). The results of the Wingate test are presented below with mean power output listed in both absolute ( $\text{kgm}\cdot\text{sec}^{-1}$ ) and relative ( $\text{kgm}/\text{kg}\cdot\text{sec}^{-1}$ ) units where the relative values represent an effort to correct for the influence of body size. The data were analyzed with one-way ANOVA.

	<u>Absolute</u> ( $\text{kgm}\cdot\text{sec}^{-1}$ )	<u>Relative</u> ( $\text{kgm}/\text{kg}\cdot\text{sec}^{-1}$ )
Football	103.5 $\pm$ 12.8	1.126 $\pm$ 0.112
Soccer	87.5 $\pm$ 13.7	1.209 $\pm$ 0.153
Normals	79.6 $\pm$ 15.4	1.044 $\pm$ 0.153
Cross country	75.1 $\pm$ 14.2	1.154 $\pm$ 0.149
ANOVA:	F=13.09 ( $p\leq 0.001$ )	F=3.95 ( $p\leq 0.05$ )

It is concluded that the Wingate test can effectively discriminate among athletic groups requiring different levels of absolute and relative power in order to be successful in their respective sports. The absolute expression reflects a combined influence of body size and muscular power with the largest individuals (football) having the highest absolute values and the smallest individuals (cross country) having the lowest values. In contrast, when the effect of body size is eliminated, then the athlete's ability to move his body mass with combined strength and speed (ie, power) is being measured and the soccer players exhibit the highest scores. Therefore, the application of the results will dictate the units to be used in the expression of human power.

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# EFFECTS OF IMAGERY ON EXERCISE TOLERANCE OF EXPERIENCED TEST TAKERS

B.D. FRANKS and J. Soldano. Center for Physical Activity and Health, 136 HPER Building, University of Tennessee, Knoxville, TN 37996-2700

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This study determined the effects of imagery of events that produced anger, happiness, or sadness on heart rate (HR), and ratings of emotional states and perceived exertion during rest and exercise. Four active Ss, who knew the tester well and were accustomed to being tested on a treadmill, were tested four times on a graded treadmill test (starting at 5 METS and increasing 2-3 METS every two minutes) to voluntary exhaustion while thinking about an event that would cause an anger, happiness, sadness, or neutral emotional state (clock face). The order of the testing was systematically assigned to minimize order effects. Differences among the imagery conditions at rest and during different intensities of exercise were determined by a one-way ANOVA, repeated measures. There were no significant differences ( $p < .10$ ) on HR, RPE, or time to exhaustion. There was no trend within these Ss for increased HR response to different emotional states at rest or during exercise. The only difference was on the self-reported emotional state corresponding to the treatment (i.e., Ss had higher anger when thinking about something that made them angry). It is concluded that there is no need to try to control for emotional state during exercise tolerance testing in these types of Ss. It is not known whether the lack of response to emotional states in this study was due to the Ss' regular activity, experience with exercise testing, knowing the tester, or an interaction of these and/or other factors.

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