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Glycogen Utilization in Trained and Untrained Ischemic Rat Hearts

C.E. RIGGS, R.D. Kilgour, M. Cotten, and D.J. Johnson, Department of Movement Science and Physical Education, The Florida State University, Tallahassee, FL 32306

The effect of induced myocardial ischemia on cardiac glycogen utilization was investigated in trained and untrained male Sprague-Dawley rats. Following a twelve to fifteen week endurance training program (1 hr·day⁻¹, 5 days·wk⁻¹, 31.1 m·min⁻¹, 8% grade), myocardial ischemia was induced by ligation of the left coronary artery. Effected tissues of four trained and four untrained animals were removed, frozen in liquid nitrogen, and analyzed for glycogen at intervals of 0, 5, 10, 15, and 30 minutes of ischemia. The glycogen content for both groups declined significantly ($p < 0.05$) during the first five minutes, 33% and 27% for the trained and untrained hearts, respectively. In the sedentary hearts, the concentration rose back to the control level by the end of the fifteenth minute and then declined significantly ($p < 0.05$) during the final fifteen minutes. In the trained hearts, the glycogen concentration remained constant from minute five to fifteen and then rose to pre-ischemic levels during the final fifteen minutes. The differences between the trained and sedentary animals at fifteen and thirty minutes post-ligation were significant ($p < 0.05$). The results indicate that trained and untrained hearts utilize glycogen differently during acute ischemia. This difference may partially explain the apparent protective effect of training in regard to myocardial ischemia previously observed in experimental animals.

Supported by a grant from the Florida State University Committee on Faculty Research Support.

QUESTIONS TO BE ASKED/NOTES AND COMMENTS

Physical Work Capacity in Men and Women With Hemoglobin Concentration Experimentally Equated

P.A. BISHOP, K.J. Cureton, P.L. Hutchinson, S.R. Vickery, and L.D. Swiren, Human Performance Lab., Department of Physical Education, University of Georgia, Athens, GA 30602

Ten men and eleven women were studied to determine the extent to which the difference between men and women in hemoglobin concentration contributes to the sex difference in maximal oxygen uptake and physical work capacity. Males and females were matched on the basis of their habitual physical activity and had similar $\dot{V}O_{2\max}$ ($\text{ml}\cdot\text{kg FFW}^{-1}\cdot\text{min}^{-1}$), 53.4 and 53.1, respectively. $\dot{V}O_{2\max}$ and physical work capacity (ride time) of all subjects were measured on the bicycle ergometer using the same continuous, load-incremented protocol. The men were studied under two conditions: (1) with normal hemoglobin concentration ($\bar{Hb} = 15.3 \text{ gm}\cdot\text{dl}^{-1}$) and (2) two days following withdrawal of approximately 800 ml of blood, which reduced their mean hemoglobin concentration to exactly equal the mean of the women ($13.4 \text{ gm}\cdot\text{dl}^{-1}$). Equating hemoglobin concentration significantly ($p < .01$) reduced the mean $\dot{V}O_{2\max}$ (from 3.47 to $3.21 \text{ l}\cdot\text{min}^{-1}$, 7.5%) and ride time (from 14.7 to 14.0 min, 4.8%) of the men, but the final values remained significantly ($p < .01$) above the corresponding mean values for the women ($2.36 \text{ l}\cdot\text{min}^{-1}$ and 8.8 min, respectively). Equating hemoglobin concentration reduced the sex difference in $\dot{V}O_{2\max}$ and ride time by 23.4% and 11.9%, respectively. It was concluded that the typical sex difference in hemoglobin concentration of about $2 \text{ gm}\cdot\text{dl}^{-1}$ accounts for a significant, but relatively small proportion of the sex difference in $\dot{V}O_{2\max}$ and physical work capacity.

QUESTIONS TO BE ASKED/NOTES AND COMMENTS

The Effects of Higher or Lower Intensity Bicycle Ergometry Training On the Physical Work Capacity of Elders

D.T. BADENHOP and P.A. Cleary. Work Physiology Lab., The Ohio State University, Columbus, Ohio 43210

A conditioning program utilizing bicycle ergometers was developed to determine whether exercising at lower intensities (LI) improves physical work capacity (PWC₁₁₀, PWC₁₃₀, PWC₁₅₀) in people over 60 years of age. In addition, differences in physical work capacity elicited by training at LI as opposed to training at higher intensities (HI) were evaluated. Thirty-two volunteers over 60 years of age (\bar{x} =67.8) participated in an exercise program which lasted for 9 weeks. After initial determination of physical work capacities (PWC₁₁₀, PWC₁₃₀, PWC₁₅₀) on a bicycle ergometer, participants were randomly assigned to either the HI or LI training group. Physical conditioning of the LI and HI groups on bicycle ergometers was maintained at 30-45% and 60-75% of each subject's heart rate range (HRR), respectively. Subjects averaged 3 exercise sessions per week. A one-way ANOVA with repeated measures was utilized for comparisons of retest, groups and interaction. Both training groups exhibited significant increases ($P < .001$) in physical work capacity at a heart rate of 110 BPM. PWC₁₃₀ showed similar and significant gains ($P < .001$) of 36.2 and 35.3 percent in the LI and HI groups, respectively. The LI group had a 138 KPM increase and the HI group a 137 KPM increase. Significant increases ($P < .001$) of 33.0 (HI) and 23.4% (LI) in work capacity at 150 BPM were documented on the post-training evaluation. Although initial and post-training absolute workloads were slightly higher in the HI group, no significant differences in physical work capacities between groups were determined. Similar changes were documented by an increase in $\dot{V}O_2$ max and quicker declines in recovery heart rates. It was concluded that lower intensity exercise is an adequate stimulus for conditioning in elders and leads to increases in physical work capacity which are equivalent to those elicited by higher intensity training.

QUESTIONS TO BE ASKED/NOTES AND COMMENTS

The Oxygen Cost of Walking at Speeds in Excess of 100 m/min.

EDWARD T. HOWLEY, Wendy J. Bubb and Daniel Martin. Division of Physical Education/Department of Zoology. The University of Tennessee, Knoxville, TN 37996-2700

The American College of Sports Medicine has published formulas to estimate the energy cost of walking and running. Generally, the formulas give reasonable estimates for walking speeds between 50 and 100 m/min and for running speeds in excess of 130 m/min. It has been suggested that estimates of the energy cost for walking at speeds in excess of 100 m/min would be too variable, yet, little data exist in the literature characterizing this variation. We report some preliminary data bearing on this issue. Oxygen consumption was measured from minutes 6 to 8 in six walking tests at approximately 80, 90, 100, 120 and 130 m/min. Seven subjects (age 24-38) walked at three speeds on each of two days. There was a 10 minute rest period between tests. Data are presented in the following table.

	Walking Speed (m/min)					
	79	89	99	109	118	130
VO ₂ (ml/kg·min)	11.4 ± 1.0	13.1 ± 1.5	14.8 ± 1.8	17.3 ± 1.9	20.9 ± 2.2	26.1 ± 3.3
VO ₂ (ml/kg·meter)	.144 ±.014	.147 ±.015	.149 ±.018	.159 ±.016	.177 ±.019	.201 ±.025

Values are $\bar{X} \pm SD$; N = 7

The data indicate that the variability expressed as $SD \div \bar{X} \times 100\%$ is similar across all speeds. These data will be expanded to include 40-70 year old men and women, with and without coronary heart disease.

QUESTIONS TO BE ASKED/NOTES AND COMMENTS

Ultrastructure of Human Skeletal Muscle Among Olympic Style Weight Lifters

HAROLD O'BRYANT, graduate student HPRED Dept. L.S.U., Baton Rouge, LA 70803 and Michael H. Stone Ph.D., N.S.R.C. HPER Dept. Auburn University, Auburn, AL 36849

The purpose of this investigation was to examine muscle biopsies taken from olympic weight lifters to determine qualitative evidence of ultrastructure adaptation for anaerobic power.

Muscle biopsies from the m. vastus lateralis were taken from four anaerobically trained olympic style weight lifters and two aerobically trained volunteers. Tissue samples were prepared using standard fixation, dehydration, and embedding techniques for both cross-section and longitudinal sectioning on an ultramicrotome. These thin sections were post stained and viewed on a transmission electron microscope (TEM) with subsequent micrographs used for qualitative analysis. Additional measures were taken to ascertain each subject's body composition (body weight, % fat, & lean body weight), vertical jump (cm), and anaerobic power (kg-m/sec).

Observations indicate, anaerobic subjects exhibit greater anaerobic power, greater body weight & lean body weight, and lower percent fat than the aerobically trained volunteers. TEM analysis reveal distinctly different tissue characteristics with the aerobic subjects appearing to have larger myofibrils, larger and more abundant mitochondria with well developed cristae within the matrices. In contrast, tissues taken from the anaerobically trained weight lifters appear to exhibit extensive and well developed sarcoplasmic reticulum, small and less abundant mitochondria with less developed cristae in the mitochondrial matrices.

QUESTIONS TO BE ASKED/NOTES AND COMMENTS

The Effect of High Intensity Training on Max VO_2 and Anaerobic Threshold in Competitive Female Cross Country Runners

A.J. MAHURIN and T.P. Martin. Department of Physical Education, Springfield College, Springfield, MA 01109

Six competitive female cross country runners entered the study following a two to three month period of long slow distance running. During the six week course of the study the training regimen was altered to emphasize high intensity running, e.g., interval training, fartlek running, hill training and racing. Prior to beginning the high intensity phase of the training regimen, and again six weeks later, the runners VO_2 max and anaerobic threshold (AT) were measured via an open circuit gas collection method as they ran on a motor driven treadmill. The change in training emphasis had no significant influence on the VO_2 max of the subjects between the two testing periods, $55.8 \text{ Ml/Kg. min}^{-1} \pm 4.7$ and $54.9 \text{ Ml/Kg. min}^{-1} \pm 4.8$, respectively. Conversely, the AT increased significantly between the two testing periods, $66.9\% \text{ VO}_2 \text{ max} \pm 6.6$ and $75.1\% \text{ VO}_2 \text{ max} \pm 3.5$, respectively ($p < 0.05$). These findings suggest that the primary concern of highly trained endurance athletes should not be directed toward an increase in maximum aerobic capacity, but at the ability to utilize a higher percentage of that capacity for a prolonged period. Furthermore, it appears that high intensity training is an effective means of achieving this desired result.

QUESTIONS TO BE ASKED/NOTES AND COMMENTS

Effect of Prolonged Moderate Exercise on Sex Hormone Levels in Untrained Males

C.A. BOOKS, B.S. MT (ASCP), F.T. Murray, M.D., and C. W. Zauner, Ph.D. Center for Physical and Motor Fitness, University of Florida, Gainesville, FL 32611

The serum levels of testosterone, follicle-stimulating hormone (FSH), luteinizing hormone (LH), prolactin, and also of glucose in 10, untrained human males, (mean age 26: range 18-34) were studied during 45 min of submaximal activity. On experimental days One and Two, maximal oxygen uptake measurements ($\dot{V}O_2$ max) were determined for each subject utilizing continuous treadmill walking (Balke protocol). The mean $\dot{V}O_2$ max for the group was 44.5 ml/kg.min¹ with a range of from 31.8 to 63.9 ml/kg.min¹. On day Three, subjects were exercised on a bicycle ergometer at workloads sufficient to maintain 50% of $\dot{V}O_2$ max (mean 49.4%: range 45.0% to 51.8%). Blood samples were collected at rest and following 5, 15, 30, and 45 min of bicycle exercise. Testosterone was noted to increase during exercise but was not significant from resting values except at 15 min of exercise ($p < 0.010$). However, when subject 8 was omitted from statistical analysis the difference between pre-exercise and 45-minute exercise testosterone became statistically significant ($p < 0.025$). Subject 8 was unusual in his response in that he demonstrated decreases in testosterone during exercise. No significant mean differences were seen between resting levels and levels after 45 min of exercise for FSH, LH, prolactin or glucose. Subjects demonstrated peak testosterone levels at different time intervals (mean 24.5 min: range 5-45 min). The mean peak testosterone was significantly greater ($p < 0.005$) than that at rest. There was no significant relationship between peak testosterone and $\dot{V}O_2$ max ($r = -0.455$) nor between resting testosterone and $\dot{V}O_2$ max ($r = -0.276$). Overall means were as follows: peak testosterone = 603 ng/dl; peak testosterone (15 min) = 557 ng/dl; resting testosterone = 497 ng/dl; 45-min exercise testosterone = 546 ng/dl; resting glucose = 84 mg/dl; 45-min exercise glucose = 78 mg/dl; resting prolactin = 8.5 ng/ml; 45-min exercise prolactin = 9.0 ng/ml; resting LH = 8.08 mIU/ml; 45-min exercise LH = 7.37 mIU/ml; resting FSH = 5.45 mIU/ml; 45-min exercise FSH = 5.73 mIU/ml. In view of these findings we conclude: 1) serum testosterone increases significantly with moderate exercise, 2) this increase does not appear to be related to alterations of serum gonadotropins or prolactin, and 3) androgen levels during exercise do not correlate with fitness levels as indicated by $\dot{V}O_2$ max.

QUESTIONS TO BE ASKED/NOTES AND COMMENTS

Serum Creative Kinase and CK-MB Isoenzyme Responses to Acute and Prolonged Swimming in Trained Athletes

J.D. SYMANSKI, B.W. Smith, R.G. McMurray, L.M. Silverman and A.J. Siegel, M.D. Human Performance Lab., University of North Carolina at Chapel Hill, Chapel Hill, NC 27514

Previous research by these investigators has revealed significant elevations in total creatine kinase (CK) and CK-MB isoenzyme following endurance running (cross country, 10-kilometer, and marathon) or rowing. These results suggest that endurance activity transiently alters muscle cell membrane integrity. The responses of swimmers who are also engaged in endurance activity may be of particular interest because of the obvious differences in training medium and contractile forces generated during exercise. Six trained swimmers completed a maximum work capacity tethered swim and a one hour continuous tethered swim at $\sim 70\%$ $\dot{V}O_{2\max}$ in order to evaluate total serum CK and CK-MB changes. Venous blood obtained before, 5 minutes post, 6 hours post, and 24 hours post exercise, was analyzed for total serum CK (kinetic UV method; normal = < 100 U/l) and CK-MB isoenzyme (quantitative electrophoretic technique; normal = < 5 U/l). $\dot{V}O_{2\max}$ averaged (\pm S.E.) 4.59 ± 0.28 l/min, with a mean total work time of 24.5 minutes. Mean resting total CK was 100.5 ± 15.8 U/l. Compared to rest, neither swim bout produced any significant ($p > 0.05$) elevation in mean total CK. No CK-MB isoenzyme was observed in any post exercise blood sample. The data supports the hypothesis that the magnitude of forces applied within the musculature during swimming or the associated trauma is not sufficient to induce changes in the membrane permeability of muscle cells necessary for significant effluxes of CK or CK-MB into the serum.

QUESTIONS TO BE ASKED/NOTES AND COMMENTS

The Relevance of Computerized Information Retrieval Systems to Research in Biomechanics

POWELL D. McCLELLAN and Michael E. Rice, Human Performance Lab, Middle Tennessee State University, Murfreesboro, Tennessee 37132

The recent knowledge explosion coupled with the diversity of disciplines contributing knowledge have created a problem identifying and locating relevant literature in biomechanical research. Within recent years computerized information retrieval systems have become available whereby data from different disciplines can be more readily identified. The purpose of this investigation was to determine the degree research related to biomechanics has been indexed in computerized information data bases. Twenty-four data bases were searched using the key word descriptors: "biomechanic," "biomechanical," and related terms. The results of the computer searches are summarized in the following table:

BIOMECHANICAL CITATIONS

Data Base	No. Citations	Data Base	No. Citations
NTIS	392	DISSERTATION ABS	27
MEDLINE	304	PSYCH ABS	24
SCISEARCH	195	ISMEC	18
COMPENDEX	141	CHEM ABS	17
ERIC	40	OTHER	27

It was concluded that the majority of the biomechanical research literature was contained in four data bases which were indexed by medical and engineering societies. These data plus the nature of articles found in each data base should be taken into account when searching for completed research in biomechanics.

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QUESTIONS TO BE ASKED/NOTES AND COMMENTS

Bat Dynamics of Female Softball Batters

S.P. MESSIER and L.J. Ward. Department of Physical Education, Wake Forest University. Winston-Salem, NC 27109

The purposes of this study were: 1) to examine the relationships among the three dimensional components of the linear bat velocity of female softball batters, 2) to analyze the kinetic energy patterns of the bat during the swing and 3) to compare the results with previous research which utilized a male baseball batter (Shapiro, 1979). Seven females, who were currently playing amateur softball and were present or former intercollegiate softball players, batted against a belt driven pitching machine which propelled softballs at a mean velocity of 23.69 m/s. High speed photography employing direct linear transformation methodology was used to record the raw kinematic data. The results were digitized and computer processed to determine the three dimensional components of the linear bat velocity and the kinetic energy of the bat. A rapid increase in the bat velocity toward the pitched ball (V_x) began approximately .1 s prior to contact (PC). Maximum V_x values ($\bar{X} = 15.46$ m/s, SE = .992) occurred an average of 30 ms PC in 2 trials and at contact (C) in 5 trials. A rapid downward velocity (V_y) began .25 s PC and reached peak downward velocity .15 s later. This was followed by a rapid increase in the upward motion of the bat. Maximum downward V_y values ($\bar{X} = 4.28$ m/s, SE = .745) occurred an average of 87 ms PC. The upward V_y was increasing at the time of C in all trials. A rapid increase in the bat velocity toward home plate (V_z) occurred .15 s PC with maximum V_z values ($\bar{X} = 9.92$ m/s, SE = .935) occurring an average of 65 ms PC. The resultant maximum linear bat velocity [V], ($\bar{X} = 19.02$ m/s, SE = 1.2)] occurred an average of 28 ms PC. The patterns of the component velocities were similar to those established by the male intercollegiate baseball batter (Shapiro, 1979). However, the maximum V value of the male batter was an average of 11.27 m/s greater than those of the female softball batters. The maximum linear kinetic energy of the bat [(KE), ($\bar{X} = 135.10$ J, SE = 13.03)] occurred an average of 29 ms PC. The KE values were decreasing at C in 6 trials and increasing in the remaining trial. The maximum KE for the male baseball batter ($\bar{X} = 433.5$ J) was approximately 298.4 J greater than that of the seven female subjects. The disparity in the bat dynamics between the female and male batters raises the question of whether the batting techniques employed by baseball batters should be adopted in toto for use by female softball batters.

QUESTIONS TO BE ASKED/NOTES AND COMMENTS

Effect of Exercise Duration and Maximal Oxygen Uptake on Plasma Lipoprotein Cholesterol Levels

R. CARTER and J. Hataway. University of Texas at Tyler and University of Texas Health Center, Tyler, Texas and University of Alabama Medical School, Birmingham, Alabama.

Recent population studies have indicated an inverse relationship between plasma high density lipoprotein-cholesterol (HDL-C) and the incidence of coronary artery disease (CAD). Chronic physical activity has been reported to increase HDL-C levels and thus may reduce the risk of CAD. Therefore, the purpose of this investigation was to determine the response of plasma lipids to exercise duration and maximal oxygen uptake. Forty males between the ages of 24 and 38 years volunteered for the study. Blood samples were collected after a 12 to 14 hour fast and analyzed for total cholesterol (CHOL), HDL-C and Triglycerides (Trig). Body composition was determined by Hydrostatic weighing and maximal oxygen consumption via open circuit treadmill testing. Results indicate that when joggers were stratified by miles jogged per week (m/wk), a significant linear elevation in HDL-C was obtained ($p < .01$). No differences in CHOL and Triglycerides were noted $p > .05$. However Trig exhibited a gradual decreasing trend as m/wk increased. Max VO_2 increase significantly $p < .001$ as m/wk increased while %fat decreased $p < .005$. No significant relationship between Max VO_2 or %fat were noted when compared to HDL-C. Therefore, HDL-C appears to be a function of training mileage rather than maximal aerobic performance or body composition.

QUESTIONS TO BE ASKED/NOTES AND COMMENTS

An Analysis of Selected Physiological Traits and Differences of Three Female Mileage Running Groups.

G. RANKIN COOTER, Ph.D., FACSM and Carole Sloan, M.Ed., Kim Childs, B.Ed., Physical Fitness Center, Georgia State University, Atlanta, Georgia, U.S.A.

Three running mileage groups and a control group were analyzed for body weight, body composition (% fat), resting heart rate, maximum treadmill running time, maximum heart rate, MAX $\dot{V}O_2$, running duration/intensity coefficient, total cholesterol, HDL's and TC/HDL ratios. The experimental groups consisted of 15 subjects who ran 15-20 miles per week, 15 subjects who ran 21-30 miles per week, 15 subjects who ran from 31- 60 miles per week, while the control group consisted of 13 sedentary subjects. All subjects participated in a maximum treadmill test and a venous blood sample was taken for serum cholesterol analysis. All dependent variables were analyzed by ANOVA and group differences were determined by post hoc t-test analyses. Results revealed significant group differences in weight, % fat, resting HR, MAX TM time, MAX $\dot{V}O_2$, D/I and total cholesterol (TC). There were no significant differences in MAX HR, TC/HDL ratios and HDLs among the four groups.

QUESTIONS TO BE ASKED/NOTES AND COMMENTS

The Relationship Between Selected Physiological Parameters and Distance Running Performance in Trained Athletes

SCOTTY K. POWERS, Stephen L. Dodd, Richard Deason, Ronald Byrd, and Tipton McKnight. Louisiana State University and E. K. Long Hospital, Baton Rouge, LA 70803

The purpose of this study was to assess the relationship between anaerobic threshold, maximum oxygen uptake ($\dot{V}O_2$ max), running economy and distance running performance in a group (N = 9) of trained male runners with comparable experience and ability. Maximal oxygen uptake and submaximal steady state oxygen uptake were measured using open circuit spirometry during treadmill exercise. Anaerobic threshold (AT) was determined during graded treadmill exercise using non-invasive techniques while distance running performance was assessed by finish times in two 10-kilometer (km) road races. The subjects averaged 33.9 minutes on the 10-km runs, 68.6 ml.kg⁻¹.min⁻¹ for $\dot{V}O_2$ max, 47.88 ml.kg⁻¹.min⁻¹ for steady state $\dot{V}O_2$ running at 243 meters.min⁻¹. The AT (first deviation from linearity of V_E , $\dot{V}CO_2$) occurred at 61.4% of $\dot{V}O_2$ max. The relationship between running economy and performance was $r = .51$, the relationship between $\dot{V}O_2$ max and performance was $r = -.38$, and the relationship between AT and performance was $r = -.88$. Applying multiple linear regression, the combination of $\dot{V}O_2$ max, running economy, and AT was determined to be the best predictive model and accounted for 84% of the variance between performance and the three independent variables. These data suggest that among trained and experienced runners, a combination of running economy, $\dot{V}O_2$ max and AT can account for a large portion of the variance in performance during a 10-km race.

QUESTIONS TO BE ASKED/NOTES AND COMMENTS

Anaerobic Threshold of Trained Swimmers

B. W. SMITH, J.D. Symanski, and R.G. McMurray. Human Performance Lab., University of North Carolina at Chapel Hill, Chapel Hill, NC 27514

Studies have shown that endurance runners exhibit higher anaerobic thresholds (AT) in comparison to sprinters. Similar studies have not been conducted with swimmers. Therefore, the AT was evaluated in 12 competitive swimmers; six whose primary event was ≤ 200 yds and six whose primary event was ≥ 400 yds, utilizing a discontinuous tethered swimming $\dot{V}O_2$ max test consisting of 3 minute work stages. Blood lactate was determined to verify $\dot{V}O_2$ max ($\bar{X}_{12} = 12.86 \pm 0.90$ mmol/l). The AT, expressed as % $\dot{V}O_2$ max, was determined by nonlinear increases in \dot{V}_E and abrupt decreases in the $F_E CO_2$. The AT for sprinters averaged $65.89 \pm 0.40\%$, significantly lower ($p < 0.01$) than for the endurance swimmers, AT = $90.39 \pm 0.15\%$. $\dot{V}O_2$ max, max lactate, % body fat, total weight supported, total swimming time, height, and weight were not significantly different between groups. Weight supported after AT was reached was significantly greater for sprinters. There was a trend toward a lower $\dot{V}_E/\dot{V}O_2$ ($p < 0.10$) for the sprint group ($\bar{X} = 18.97 \pm 0.96$) when compared to the endurance group ($\bar{X} = 21.36 \pm 0.50$). The results indicate that trained sprint swimmers have a lower AT than trained endurance swimmers; similar to the relationship between sprint and endurance runners. The results also indicated no difference between groups in terms of maximal capacities.

QUESTIONS TO BE ASKED/NOTES AND COMMENTS

Optimal Pedal Frequencies at Varying Work Rates on the Bicycle Ergometer

J. RICHARD COAST, Department of Zoology, University of Tennessee, Knoxville, TN 37996-0910

This experiment was designed to give an estimate of the optimum pedalling rates under various loads on the bicycle ergometer. Five trained bicycle racers each performed a series of progressive maximal tests on the bicycle ergometer. The subjects rode at pedal frequencies of 40, 60, 80, 100, and 120 revolutions per minute (RPM). Each work load lasted three minutes in order to approximate a steady state. The tests were performed in random order. Energy cost and heart rate were determined from each test and plotted against pedal rate for work rates of 100, 150, 200, 250, and 300 watts (W). All curves fit a quadratic equation. The minimum point - where the slope of the curve equalled zero - was taken as the optimum pedal frequency. When the optimum pedal rate was plotted against work rate, the relationship was found to be linear; as work rate increased, so did the optimum pedal frequency. These results indicate that the optimum pedal rate on the bicycle ergometer varies with the absolute work rate. This suggests that pedal rate should vary with the type of cycling activity being undertaken; that is, a tourist carrying a heavy load, or a racer attempting to go very fast would have a higher optimum pedal rate than someone riding at a slow recreational pace with little or no load.

QUESTIONS TO BE ASKED/NOTES AND COMMENTS

Steady State Oxygen Consumption With Changes in Ambient Temperature

E.V. CLOUD, G. D. Wilson, D.L. Blessing, and M.H. Stone. Department of Health, Physical Education and Recreation, Auburn University, Alabama 36849

The purpose of this study was to determine whether steady-state V_{O_2} is increased, decreased, or unchanged in subjects exercising in the heat. There have been arguments for each case. Nine endurance trained, heat acclimatized subjects were exercised at approximately 40% V_{O_2} max for 30 minutes on a cycle ergometer. V_{O_2} at 18.8° C (60% rh) was compared with V_{O_2} at 32.4° C (64% rh). In these subjects, V_{O_2} was found to increase significantly ($P < 0.05$) in the hot environment as compared to the cool environment. Other variables which increased significantly ($P < 0.05$) were ventilation and heart rate. Core temperature and respiratory quotient did not change significantly. The results indicate that exercising in the heat is more stressful to the body and requires more energy to continue. These data have implications for training or performing in the heat.

QUESTIONS TO BE ASKED/NOTES AND COMMENTS

Coagulation and Fibrinolytic Responses to Cold, Exercise, and Cold Plus Exercise.

MICHAEL MANGUM and Emily Haymes, Exercise Physiology Laboratory, Florida State University, Tallahassee, Florida 32306

Twenty male student volunteers were randomly assigned to four groups to determine if coagulation and fibrinolysis could be affected differentially with common physiological stressors, exercise and cold. If so, then a potential for limited experimental control of these factors could be realized. Experimental conditions included 1. sitting in a cold environment (5°C, 20 min.) 2. exercise in a cold environment (900kgm/min, 20min.) 3. exercise in a neutral environment (23°C, 20min.) 4. rest, neutral (control). Euglobulin lysis times were utilized as a measure of fibrinolytic activity and the partial thromboplastin times as a measure of coagulation. Euglobulin lysis times were shortened 11, 75, and 54% for groups I, II, and III, respectively. The reductions noted were statistically significant for both exercise groups but not so for cold alone, although all subjects within that cell did experience a change. Partial thromboplastin times were reduced 1, 23, and 17%, respectively, with the change for group II being statistically significant. Significant hemoconcentration (5, 8, and 6%) occurred under the three experimental conditions. Although theoretical considerations would suggest that coagulation and fibrinolysis could be affected differentially under appropriate environmental stimuli, these data fail to provide support. A re-examination of the role that cold may play on these parameters is suggested.

QUESTIONS TO BE ASKED/NOTES AND COMMENTS

Effects of Various Levels of Hypoxia on Plasma Catecholamines at Rest and During Exercise

W. J. BUBB, E.T. Howley, and R.H. Cox. Departments of Physical Education and Zoology, University of Tennessee, Knoxville, TN 37996-2700

The purpose of this study was to investigate the relationship between hypoxia and heart rate (HR), ventilation (\dot{V}), lactate (HLA), plasma epinephrine (E) and norepinephrine (NE) at rest and during exercise at 40% of maximal oxygen uptake. Six subjects were exposed to inspired gas mixtures containing 21%, 19%, 17%, 15% and 13% O₂. The duration of exposure to each mixture was 10 continuous minutes at rest, followed by 10 continuous minutes during exercise. The order of the inspired gas mixtures was randomized. During the exercise test, HR was elevated with exposure to 15% and 13% O₂ ($p < .001$). \dot{V} and HLA were greater at 13% O₂ than at the higher O₂ percents ($p < .001$). There was no change in plasma E at rest or during exercise in response to the gas treatments ($p > .20$). Plasma NE was not affected by variable inspired O₂ during the resting test ($p > .20$) or the exercise test ($p > .10$). These results indicate that acute exposure to hypoxic gas mixtures at rest and during light work does not result in significant increases in sympathetic nervous system activity, as judged by the plasma E and NE response.

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QUESTIONS TO BE ASKED/NOTES AND COMMENTS

Effects of Exercise on Serum Enzymes in the Heat

T.E. TEMPLES, E.S. Garcia, and E.M. Haymes. Department of Movement Science and Physical Education Florida State University, Tallahassee, Florida 32306

The purpose of this study was to examine the effects of a moderately intense exercise bout for 45 minutes in a warm-humid (23°C, 100% RH) and hot-humid (30°C, 75% RH) environment on selected serum enzymes (SGOT, SGPT, and CPK). Four male volunteers, ages 23-29 years, were asked to run a predetermined distance on two separate occasions: early morning (23°C) and late afternoon (30°C). Data were collected before exercise, post-exercise, and 24 hours later. Exercise produced a significant ($p < 0.05$) rise in SGOT (23%) and SGPT (25%) from pretest to posttest. CPK levels increased by 11% with exercise but this increase was not significant ($p > 0.05$). With regard to temperature influences on pretest and posttest results, the percent increase in SGOT and SGPT levels was greater in the afternoon than in the morning condition (31% to 18% and 37% to 16% for SGOT and SGPT values, respectively). Analyses on 24-hour post-exercise serum samples revealed no significant ($p > 0.05$) differences in serum enzymes with the pretest levels. The data indicate that moderate exercise combined with thermal stress result in elevated serum enzymatic activity. However, these levels of serum enzyme activity were not above established normal upper values. Thus, the results tend to indicate that moderate exercise in the environmental conditions specified does not have a detrimental effect upon the body as indicated by serum enzymatic changes which have been used in many cases for diagnosing tissue damage.

QUESTIONS TO BE ASKED/NOTES AND COMMENTS

A Polynomial Regression Method for Estimation of Anaerobic Threshold From Exercise Ventilation

W. G. HERBERT, D.R. Sebolt, H.R. Bradley, A.D. Moore, and F.L. Robbins. Human Performance Laboratory, Virginia Tech, Blacksburg, VA 24061

Current literature reflects an incomplete understanding of the complex interactions among anaerobiosis, blood lactic acid (HLA) concentration, and the ventilatory response to progressive treadmill or cycling exercise. Many investigators have accepted that a non-linear rise in ventilation (\dot{V}_E) reflects the aerobic-anaerobic transition (Skinner, Res Q Exer Sport, 1980) or anaerobic threshold (AT), taking this point to indicate one's capacity for endurance activity or their prescriptive level for aerobic physical training. Such estimations have been confounded by intra- and inter-individual response variability in \dot{V}_E , leading to experimenter subjectivity in the AT determination. The purpose of this study was to apply a two-component polynomial regression technique to objectify AT estimation. Manipulations were performed on \dot{V}_E data collected from healthy subjects who exercised on the treadmill in a progressive protocol to maximal effort. A micro-computer (Apple II Plus-48K) facilitated rapid computation and graphic presentation of the data. A polynomial least square curve fitting software routine was selected to generate regression models of \dot{V}_E on exercise load. First, the bivariate distribution of \dot{V}_E vs load for the exercise test was submitted to several regression analyses to determine the lowest order polynomial to "best" predict the function (i.e., maximum r and minimum $s_{y \cdot x}$). Second a series of linear regressions were computed wherein each bivariate point uppermost in the distribution was successively deleted after computation of r and $s_{y \cdot x}$ until the linear model with the highest r and the lowest $s_{y \cdot x}$ was defined. Third, the regression models from steps one and two were overlaid graphically to objectively reveal the point of exponential rise in \dot{V}_E (AT). This technique yielded AT predictions consistent with values reported in the literature (40-75% $\dot{V}O_2$ max: Davis et al. J Appl Physiol, 1979). Discrimination was evident in data sets wherein \dot{V}_E observations were numerous, the hyperventilation phenomenon at exercise onset was disregarded, and the \dot{V}_E function was quadratic. Future studies will be directed toward assessing the reliability and validity of this technique.

QUESTIONS TO BE ASKED/NOTES AND COMMENTS

Responses of Older Adults to Cardiorespiratory Training

J.R. McINTOSH and D.E. Cundiff. Physical Fitness Institute, University of Southern Mississippi, Hattiesburg, MS 39406

Physiological, biochemical, body composition, and functional capacities of older adults (60 years and older), were studied while participating in a progressive exercise program of walking and jogging. Means and Standard deviations for the parameters studied are presented below. Only a subsample of this reported population (50-82 years), qualified as participants in the fifteen week training study.

	Females N=51		Males N=22	
Height (in.)	62.05	8.99	69.71	3.55
Weight (lb)	145.43	30.81	181.63	27.58
% Fat (Durnin)	36.15	6.88	23.91	6.65
SBP (mmHg)	141.58	15.74	136.59	19.79
DBP (mmHg)	80.11	7.43	79.72	7.72
Rest HR	72.09	11.19	72.63	12.66
Max HR	146.33	29.86	152.81	24.07
Glucose (mg%)	109.58	21.44	106.63	16.41
TC (mg%)	212.05	40.56	208.63	54.49
HDL-C (mg%)	44.84	16.22	34.77	8.18
HDL/TC	.21	.08	.15	.07
LDL-C (mg%)	134.54	40.91	150.81	58.54
TG (mg%)	164.37	141.18	164.95	91.28
VO ₂ (pred.)	19.31	8.08	25.97	10.02

Case examples of several individuals who demonstrated highly significant physiological, biochemical, and/or body composition improvements will be included in the presentation.

QUESTIONS TO BE ASKED/NOTES AND COMMENTS

Accuracy of Pulse Palpitation During Cardiac Exercise Programs

C.A. TAYLOR. Cardiac and Intervention Center, Virginia Polytechnic Institute and State University, Blacksburg, VA 24061

Eighteen men and two women with known coronary heart disease enrolled in the Cardiac Therapy Program were studied to determine accuracy of pulse palpation during exercise at the radial and carotid arteries for 6 and 10 seconds. Each subject was randomly assigned to one of four groups to decrease the systematic effect due to training. On four consecutive exercise days, each group palpated their pulses according to one of four randomly assigned methods, radial 6 seconds, radial 10 seconds, carotid 6 seconds, and carotid 10 seconds. Heart rate was simultaneously recorded on an ECG write-out. Subjects tended to palpate their pulses for more or less time than instructed. Difference scores were calculated to correct for the time error in subject palpation for 6 or 10 seconds. A MANOVA approach to the split-plot analysis of variance yielded a significant time main effect. There were significantly fewer errors for 10 seconds ($x = 7.562$) palpation than for 6 seconds ($x = 12.664$) palpation ($F [1, 16] = 7.452, p = .0148$). These data indicate that 10 seconds is the desired time of pulse palpation.

QUESTIONS TO BE ASKED/NOTES AND COMMENTS

A Computerized Data Storage and Retrieval System for Cardiac Rehabilitation Programs

F.L. GOSS, W. G. Herbert, D.L. Kuhn and V.L. Fredericks. Cardiac Therapy Center, Virginia Tech, Blacksburg, VA 24061

Cardiac rehabilitation personnel must address numerous problems directly related to data management and analysis. It is essential for the design and prescription of clinical interventions and for assessment of participant progress to have an efficacious reduction of information to include only the most critical data. In addition, it is desirable to have an expedient procedure for processing information into summary progress reports for presentation to primary care physicians. Perhaps most important is the concern with documenting the overall effectiveness of risk management strategies. Given these problems, a computer system was developed principally to maintain a research data base. Information pertaining to risk factor modification, recurrent cardiac events, hospitalizations and related cardiac care costs, occupational status and survivorship patterns can be examined in relation to salient demographic, diagnostic laboratory and treatment compliance data. This could provide a basis for the evaluation of the multiple intervention approach. All data can be entered on site, via a Hewlett Packard 2648A Graphics Terminal. Data entry forms and immediate graphic displays are generated by PL/I (Programming Language I) programs. Summary clinical reports and data base manipulations are produced with the Statistical Analysis System (SAS) operating under IBM VM/CMS (conversational monitor system). The ability to evaluate local programs as well as the potential to pool statewide or regional data makes this storage and retrieval system a valuable asset.

QUESTIONS TO BE ASKED/NOTES AND COMMENTS

A Survey Technique for Assessing Health-Fitness Status and Exercise Interests of University Personnel

B.J. WILLARD, G.J. Scanlon, W.G. Herbert, R.A. Winett Cardiac Therapy and Psychological Services Centers, Virginia Tech, Blacksburg, VA 24061

This investigation was undertaken preliminary to organizing an exercise program for University employees. Responses to questions regarding cardiovascular health history and associated health habits were used to generate a risk profile for the campus population. The survey was also constructed to assess the past and current exercise habits, contributing environmental factors that influence exercise behaviors, the various times for and types of exercise desired, and to obtain an idea of what people regarded as an acceptable cost for various exercise and screening programs. Surveys were randomly distributed to 400 (5% probability sample) of the 4666 member faculty and staff. The survey format and assembly was designed to facilitate completion and return. Initially, the return rate was 51.5%; however, phone calls designed to encourage survey participation (regardless of the person's interest in health and fitness) increased the final return to 76%. A sub-sample (12%) of those who still failed to return the survey forms were telephoned again to request a dichotomized response on three important characteristics queried in the survey, i.e., a CHD risk status variable (smoking), exercise behavior, and interest in participating in a structured exercise program. This information was used to ascertain the extent to which a selection bias might have been introduced in the sample as a result of the non-respondent subset. Preliminary results indicated that approximately 50% of the people surveyed did not engage in regular exercise (i.e., three times per week). Thirty percent of the respondents were interested in joining a formal exercise program and were willing to pay for health-fitness services. It was also possible to stratify the major subclasses of employees (faculty and administration, blue-collar workers, and clerical) on the items relating to CHD risk and exercise program interests, thereby providing occupation specific estimates for these characteristics. This survey procedure provides an economical and precise approach for estimating perceptions of health-fitness status and participatory interests in large employee groups.

QUESTIONS TO BE ASKED/NOTES AND COMMENTS

Coronary Heart Disease Risk Factors in 54 Corporate Executives.

MICHAEL LEPP, Thomas Soos. Human Performance Laboratory, Aerobic Performance Center, Charlotte, NC 28211

Fifty-four corporate executives were selected from a regional population to participate in this study. Select CHD risk factors were assessed, and a relative risk assigned to each factor. A standard Bruce treadmill protocol was used with standard 12-lead ECG monitoring and analysis of expiratory gases by use of a Beckman Metabolic Measurement Cart.

<u>Factor</u>	<u>X\pmSD</u>	<u>Relative Risk</u>
Age	43.3 \pm 8.1	Average
Height (cm)	154.9 \pm 61.6	NA
Weight (kg)	87.7 \pm 15.8	NA
%Fat	20.6 \pm 5.1	Average
Triglycerides (mg/dl)	172.0 \pm 114.5	Moderate
Cholesterol (mg/dl)	221.8 \pm 42.7	Moderate
HDL (mg/dl)	44.1 \pm 13.8	Moderate
LDL (mg/dl)	181.6 \pm 48.0	Moderate
Systolic BP (mmHg)	129.5 \pm 13.7	Average
Diastolic BP (mmHg)	84.0 \pm 10.2	Average
Max VO ₂ (ml/kg \cdot min ⁻¹)	27.6 \pm 6.9	High
Smoking %	32%	NA
Abnormal ECG%	2%	NA
Family History %	52%	NA
Resting Heart Rate	69.6 \pm 11.7	NA
Max Heart Rate	173.5 \pm 12.3	NA

From the data it would appear these corporate executives are of moderate risk for development of coronary heart disease.

The results indicate a need for risk factor intervention and education for this population. All subjects are now involved in a dietary modification and exercise program. Follow up testing will be performed to assess favorable changes in risk factors.

QUESTIONS TO BE ASKED/NOTES AND COMMENTS

Fitness and Risk Profiles of Police and Firemen in Hattiesburg, MS

D.E. CUNDIFF, C. Hester, A. Hinton and D. Read. Physical Fitness Institute, University of Southern Mississippi, Hattiesburg, MS 39406

One hundred and fifty seven men (66 police and 91 firemen) were studied in the Human Performance Laboratory to determine their cardiorespiratory fitness and coronary artery disease (CAD) risk profiles. Means and standard deviations for the parameters studied are presented below:

	Police (N = 66)		Firemen (N = 91)	
Age (yrs)	32.0	7.5	33.9	6.8
Height (cm)	178.4	6.4	173.0	27.9
Weight (kg)	86.7	16.2	87.5	19.4
% Fat (Durnin)	22.2	5.5	23.1	4.9
SBP (mmHg)	133.2	12.2	132.4	12.7
DBP (mmHg)	82.6	9.5	80.6	8.5
TC (mg%)	195.4	28.6	195.7	39.4
TG (mg%)	167.4	118.4	142.4	102.0
HDL-C (mg%)	37.5	10.8	38.4	10.8
HDL/TC	.197	.69	.202	.76
LDL-C (mg%)	120.3	37.9	128.0	39.1
Glucose (mg%)	103.9	21.9	104.7	22.6
RHR	73.8	12.8	77.4	11.9
Bruce TH Dur.	10.3	2.3	10.3	2.0
$\dot{V}O_2$ (Pred.)	39.5	9.3	39.7	8.5
Max. HR	184.7	15.7	184.9	23.0

Fifty five percent of police and 44% of firemen smoked. Two positive GXT's occurred (37 year old fireman and 42 year old policeman). Subsequent angiography confirmed that each had advanced CAD and both have undergone bypass surgery. Risk profiles revealed that police and firemen in Hattiesburg are at greater risk of CAD than men of similar age in the general population.

QUESTIONS TO BE ASKED/NOTES AND COMMENTS

Effects of Talking on Exercise Tolerance

B.C. MYERS and B.D. Franks. Center for Physical Activity and Health, Division of Physical Education, University of Tennessee, Knoxville, TN 37996-2700

Volunteer male (n = 8) and female (n = 8) college students, with no known health problems, were tested twice on a graded treadmill test. The test started at five METS and 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, number and dress of tester, and physical surrounding) were controlled. During one of the test sessions, the S was asked to indicate general reactions to the exercise during each stage (e.g., "how are you doing?"). During the other test session, the S was asked at least three questions about personal physical activity habits, as well as the reaction to the exercise, at each stage. Half of the S had each of the treatments on the first test. Differences between the "talking" and "no talking" tests were determined by a t-test for paired scores. Both females and males had significantly ($p < .10$) lower HR during the talking test on stage 1 and the mean of all the stages between the first and last stages. There were no significant differences in RPE or maximum performance.

QUESTIONS TO BE ASKED/NOTES AND COMMENTS

Prediction of Body Composition in University Swimmers

J. SMITH and E. Mansfield, University of Alabama, University, AL 35486

The purpose of this study was to develop body composition prediction equations for male and female intercollegiate swimmers. The subjects were 17 male and 18 female members of The University of Alabama swim team. Residual volume was determined by helium dilution, body density by underwater weighing (UWW), and percent fat according to Siri (1956). Twenty-six selected body diameters(D), circumferences(C), and skinfolds(SF) were also taken using wooden broad-blade anthropometers, cloth tape, and Harpenden calipers, respectively. Because the model was overdefined, a stepwise variable selection procedure was used. Residuals were analyzed for magnitude and pattern in order to isolate potential outliers and possible need for model modifications. The results were a set of candidate prediction equations with R^2 values and standard errors of $\approx .88$ and ≈ 1.7 for females and $\approx .81$ and ≈ 1.2 for males. Five variable equations for each sex are given below.

Males: Percent fat = $16.806 - .836 X_1 + .461 X_2 + .713 X_3 + .478 X_4 - 1.707 X_5$
(X_1 -chest SF, X_2 -mid-axillary SF, X_3 -abdominal SF, X_4 -biceps C, X_5 -wrist C)

Females: Percent fat = $30.320 + 1.114 X_1 - 4.576 X_2 + .548 X_3 - 1.106 X_4 - .980 X_5$
(X_1 -subscapula SF, X_2 -knee D, X_3 -shoulder C, X_4 -forearm C, X_5 - age)

QUESTIONS TO BE ASKED/NOTES AND COMMENTS

Female Collegiate Runners, Their Understanding of How Nutrition Affects Performance

P.A. GRANDIS, J.A. Axelson, G.I. Holtzman, C.J. Stevens, and F.W. Thye, Department of Human Nutrition and Foods, Virginia Tech, Blacksburg, VA 24061

Sixty-eight collegiate female distance runners in the state of Virginia responded to a questionnaire designed to assess their understanding of human nutrition as it relates to athletic performance. Sixty-four percent of the runners had been competing competitively for five or more years; ages ranged from 17 to 23. Questions concerning their understanding of the basic food groups, energy substrates, fluid replacement, vitamin supplements, and the pregame meal were answered by each athlete prior to the annual state or regional competition. The responses indicated that female distance runners had a poor understanding of nutrient energy sources, specifically in relation to the contribution that fats and proteins may play in energy metabolism. Thirty percent responded incorrectly to questions concerning carbohydrates, 40% answered questions about protein incorrectly and 60% answered the questions concerning fats incorrectly. Fifty percent of the athletes thought that proteins were the best source of muscular energy and believed that their protein requirements were greater than for the non-athlete. Forty percent felt that protein supplements were needed to increase muscle mass. Only 6-7% answered incorrectly questions concerning the replacement of body fluids during exercise, however, approximately one third of the females believed that commercial drinks such as Gatorade were more beneficial than water in replacing fluids lost during exercise. Vitamin and mineral supplements were believed to enhance performance by 86% of the females as their choice of the pregame meal. Overall, the runners had an average understanding of human nutrition especially as it relates to performance. This study indicates that female athletes need further information on sound nutritional practices as they relate to performance.

QUESTIONS TO BE ASKED/NOTES AND COMMENTS

The Effects of a High Intensity Short Duration Endurance Exercise Program on Serum Triglycerides and Body Composition in Police Cadets

C.J. STEVENS, C.S. Lynch and D. Sebolt, Human Performance Laboratory, Virginia Tech, Blacksburg, VA

The intent of this study was to evaluate the effects of a short duration, high intensity endurance exercise program on serum triglycerides and body composition in police cadets. Twenty-three police cadets from the Central Virginia Criminal Justice Training Center (ages 18-49) participated in an endurance exercise program consisting of running 12 miles/week for a total of six weeks. Police officers (N=8), 23-38) currently employed by the City of Lynchburg, Va., served as control subjects. Training intensity elicited 80-85% of their maximal aerobic capacity and was monitored throughout the exercise program by immediate post exercise heart rates, perceived exertion and maintenance of lap pace. Covariance analysis was used to compare post-test scores with the effect of pre-test differences removed. The exercise training program resulted in a significant ($p < .01$) reduction in serum triglycerides (\bar{x} pre 149.1 mg/dl, \bar{x} post 141.4 mg/dl) with a concomitant decrease ($p < .05$) in body fat (\bar{x} pre 22.6%, \bar{x} post 20.6%). Body weight was not significantly altered (\bar{x} pre 79.2 kg., \bar{x} post 78.6 kg.) during the six week training period. Serum triglycerides were not significantly different for the control subjects (\bar{x} pre 174.5 mg/dl, \bar{x} post 176.0 mg/dl). These results indicate that running at a high intensity (80-85% $\dot{V}O_2$ max) 12 miles/week for a total of six weeks will be of benefit in reducing serum triglycerides and body fat.

QUESTIONS TO BE ASKED/NOTES AND COMMENTS

Fitness Profile of the Professional Dancer

C.A. MANN, G.R. Cooter, C.S. Schane, Human Performance Laboratory, Georgia State University, Atlanta, Georgia 30303

Seven female professional dancers were studied during flexibility, strength and aerobic tests to determine their fitness levels. The average number of dance hours per week was 28.1 hours. The mean (m) age was 27 years, m height was 65 inches and m weight was 119.3 pounds (lbs.). Percent body (%) fat was calculated and the mean was 14.91%. Flexibility measurement included trunk and neck extension, mean 22.3 (ins) and bend and reach average was 9.7 (ins). Strength measurements included maximal sit ups with the m 58.7 times, bench press with the m press of 74 lbs. and the leg press mean (n=6) was 195 lbs. The m maximum oxygen consumption (max $\dot{V}O_2$) was 50.6 millileters (ml.)/kilogram (kg.)/minutes (min.) with the average time on the treadmill being 12.182 mins. Thus placing the subjects in the excellent category of aerobic fitness with the mean age.

QUESTIONS TO BE ASKED/NOTES AND COMMENTS

Extremely Large Exercise Cardiac Output in World Class Swimmers

CHRISTIAN W. ZAUNER, Center for Physical and Motor Fitness, University of Florida, Gainesville, FL 32611

Subjects of main interest in this study were readily identifiable as world class swimmers. At time of measurement, one was a two-time women's intercollegiate backstroke champion, a second, U.S. 100 meter women's breast stroke champion, a third, world champion in men's 400 meter freestyle and another the men's 200 meter butterfly world record holder. All other swimmers were at least finalists in NCAA, AIAW or AAU national championships and all but three had international competitive experience. Thirteen such subjects (six females; seven males) were measured for resting and exercise cardiac output (\dot{Q}_c) using a CO_2 rebreathing technique with downstream correction. The work task was bicycle ergometry. Exercise \dot{Q}_c ($\dot{Q}_{c \text{ ex}}$) was measured during steady state at a heart rate of approximately 170 bpm. The mean $\dot{Q}_{c \text{ ex}}$ for female swimmers was 38.76 ± 6.03 and for males 47.09 ± 8.33 l/min. The mean stroke volume at exercise for the females was 230.87 ± 36.75 and for the males 277.28 ± 48.58 ml. Resting values were not remarkable. Eight normally active subjects (four females; four males) were similarly assessed. The mean $\dot{Q}_{c \text{ ex}}$ for these females was 17.24 ± 2.85 and for the males 25.88 ± 4.11 l/min. The untrained female and male mean values for exercise stroke volume were 100.36 ± 17.73 and 152.29 ± 26.60 ml. respectively. These latter data suggest that the large mean $\dot{Q}_{c \text{ ex}}$ observed in swimmers was not artifact due to methodological error. World class swimmers possess $\dot{Q}_{c \text{ ex}}$ far in excess of that reported for lesser athletes and for normal untrained subjects.

QUESTIONS TO BE ASKED/NOTES AND COMMENTS

Weight Control Intervention With Prepubescents

D.S. WARD and R.R. Pate. Human Performance Lab., University of South Carolina, Columbia, South Carolina 29208

Childhood obesity is considered a serious health problem because: (a) obese children suffer from a number of physical and psychological problems, and (b) obesity tends to persist into adulthood. Behavioral weight control programs recently have gained attention as potentially effective in the treatment of overweight adults. The purpose of this study was to investigate the effectiveness of a behavioral weight control program on body composition and selected physiological responses to exercise in obese children. Subjects were fifteen 9-10 year old obese children who had enrolled in a community-based weight control project. In addition, age-matched obese (n=9) and nonobese (n=9) control groups were identified. All children were assessed for weight, body density, and physiological responses to submaximal and maximal exercise. Body density was measured via hydrostatic weighing; direct measurements of $\dot{V}O_2$ were performed during a graded, maximal treadmill test. Test children participated in a 10-week intervention program which involved twice-weekly after-school sessions focusing on nutrition education and aerobic exercise training. Parents attended bi-weekly educational programs. Results were as follows:

	Group 1(e)				Group 2(c/o)				Group 3(c/l)			
	Pre \bar{x}	σ	Post \bar{x}	σ	Pre \bar{x}	σ	Post \bar{x}	σ	Pre \bar{x}	σ	Post \bar{x}	σ
Weight	45.40	8.32	44.01	7.16	39.67	3.21	40.14	3.23	32.29	3.91	32.77	3.88
Density	1.032	.019	1.028	.013	1.033	.025	1.034	.011	1.051	.012	1.059	.011
$\dot{V}O_{2ml}O_2$	39.79	7.39	39.04	6.88	38.59	2.51	37.91	4.21	52.08	8.90	55.90	8.39

Covariant analysis of dependent variables found no significant differences between the responses of test and control groups. Although differences were not significant, the test group lost weight while the obese controls gained weight and the nonobese controls gained similarly. These data suggest that the prescribed intervention program was not of sufficient length to generate significant physiological adaptations. Future research should examine more extensive intervention programs.

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QUESTIONS TO BE ASKED/NOTES AND COMMENTS