Southeastern Chapter of the AMERICAN COLLEGE OF SPORTS MEDICINE winter meeting

FEBRUARY 16 - 17, 1979
GEORGIA STATE UNIVERSITY
ATLANTA, GEORGIA

ABSTRACTS of poster presentations
Southeastern Regional Chapter of the American College of Sports Medicine

Winter Meeting

Hosted by
Department of Health, Physical Education, Recreation and Safety
Georgia State University, Atlanta, Georgia

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POSTER PRESENTATIONS
WINTER MEETING 1979 OF THE SOUTHEAST CHAPTER
OF THE AMERICAN COLLEGE OF SPORTS MEDICINE
ATLANTA, GEORGIA

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"Intervention": A Community Approach to Cardiorespiratory Fitness and Health

Jerald D. Hawkins
University of South Carolina at Aiken

"Intervention" is a multiphased cooperative program of the University of South Carolina at Aiken and Aiken Community Hospital designed to prevent the occurrence and recurrence of cardiorespiratory disease among Aiken area residents through risk factor screening, stress electrocardiography, exercise prescription, and lifestyle modification. "Intervention" is somewhat unique in that it represents a community effort involving not only the University and hospital, but in the future will utilize public and industrial facilities. The program is presently in the developmental stage with only Phase I (in-hospital cardiac rehabilitation) currently functioning. However, plans have been finalized to systematically implement the above program phases as outlined below:

Phase II: Physician referral of high-risk subjects
Phase III: Direct program to high-risk subjects
Phase IV: Community education
Phase V: Follow-up care

POSTER PRESENTATIONS

The posters will be placed on a stand for display in the Centennial Room adjacent to the main conference area. The posters will be available for all participants to view individually during the conference. An informal presentation of all posters will take place on Saturday morning, February 17, from 8:00-8:40 a.m. At this time the authors of the poster presentations will be available in the display room to speak informally with interested individuals about the subject matter of their posters.
"INTERVENTION": A COMMUNITY APPROACH TO CARDIORESPIRATORY FITNESS AND HEALTH
Jerald D. Hawkins
University of South Carolina at Aiken

"Intervention" is a multiphasic cooperative program of the University of South Carolina at Aiken and Aiken Community Hospital designed to prevent the occurrence and reoccurrence of cardiorespiratory disease among Aiken area residents through risk factor screening, stress electrocardiography, exercise prescription, and life-style modification. "Intervention" is somewhat unique in that it represents a community effort involving not only the University and hospital, but in the future will utilize public and industrial facilities. The program is presently in the developmental stage with only Phase I (in-hospital cardiac rehabilitation) currently functioning. However, plans have been finalized to systematically implement the advanced program phases as outlined below:

Phase II: Physician referral of high-risk subjects
Phase III: Direct program access for asymptomatic subjects
Phase IV: Program accessibility to athletes and other highly-trained subjects
Phase V: Availability of program services for special-interest groups, i.e., industrial groups and athletic teams

NOTES AND COMMENTS:
PHYSIOLOGIC CHARACTERISTICS OF FIRE FIGHTERS
Ronald Byrd and Michael Collins
Louisiana State University

The purpose of this study was to develop a physiological profile of fire fighters in Homewood, Alabama, concentrating primarily on those factors more closely associated with heart disease.

Pulmonary function measures were taken by standard closed circuit spirometry. Blood pressures, heart rates, and electrocardiograms were examined at rest and during multi-stage exercise. Percentage body fat, hand grip, and bench press strength were also measured.

The predicted aerobic capacity of this sample of 53 fire fighters was slightly below average, with predicted maximum oxygen consumption being significantly correlated with age. Eleven of the 53 subjects (21%) had either diastolic blood pressures ≥ 90 mm Hg or systolic pressures ≥ 160. The low work capacity and incidence of hypertension, coupled with other risk factors noted, make this population's fitness for the demands of their profession questionable.

Percent body fat and pulmonary function were within normal limits. Grip strength was well above average. No meaningful correlations with age were observed for any of these measures.

Individual perception by these individuals of the adequacy of their habitual activity was judged to be faulty. While exercise was officially encouraged by the officers, no structured program was in operation. Much community criticism of on-duty physical activity by fire fighters had limited supervised exercise. Information from this study was used to counsel those judged to be at high risk for coronary artery disease, to recommend a general activity program, to prescribe for individuals, and to provide a data base for presentation of an educational approach to those members of the local community who disagreed with the concept of on-duty exercise for fire fighters.

This population of fire fighters, thus, is in need of focusing on correction of cardiovascular risk factors. Primary attention should be given to improvement of poor work capacity by aerobic conditioning and medical attention to hypertension.

NOTES AND COMMENTS:
A BODY DENSITY TANK—CAN WE BUILD ONE FOR YOU?
W. L. Hills, Jr., and Richard N. Godsen
College of Charleston

The purpose of this presentation is to provide plans and guidelines for the construction and utilization of an inexpensive body density tank which is suitable for use in a wide range of situations.

The tank is constructed of three-quarter-inch reinforced plywood; the water surface is covered with a waterproof synthetic vinyl. The walls are reinforced with "2 X 6" wooden braces which also serve as work platforms. The tank measures 84" X 32" X 48"; for normal use, it requires about 460 gallons. The immersion seat is constructed of simple conduit and is attached in series to a simple pulley device via an accurate detecto scale (in this case, a forty-five-dollar Detecto). The scale should be accurate to within one-half ounce.

The entire system described can be built/purchased for less than $250. Our preliminary results show that the system is extremely reliable. For inanimate objects, test-retest correlation coefficients approach unity. For human subjects, a correlation coefficient of .99 has been achieved (N = 20) with a standard error of measurement of less than .5% and a 95% confidence interval of about ± 1% of the body fat determination. Weighing protocols are discussed; slides are shown.

It is possible to build an inexpensive and reliable body density tank for use in your program.

NOTES AND COMMENTS:
RATINGS OF PERCEIVED EXERTION AT ANAEROBIC THRESHOLD
Jamie W. Purvis
University of Georgia

The purpose of this investigation was to determine ratings of perceived exertion at anaerobic threshold. It was hypothesized that the rating of perceived exertion (RPE) at anaerobic threshold (AT) would not be significantly different from 15, which corresponds to the verbal anchor "hard." 

\[ V_{\text{e}}, V_{O_2}, \]
HR and RPE were measured during submaximal and maximal bicycle ergometer exercise. Ratings of perceived exertion were measured using Borg's 15-point rating scale. AT occurred at 73.0 ± 8.1% and 75.7 ± 10.4% of \( V_{O_2\text{max}} \) for males and females, respectively. The RPE at AT was 16.2 ± 1.5 for males and 15.4 ± 1.9 for females. These values were not significantly different (p < .05). The RPE at AT was not significantly different from the perceptual rating of 15 (p < .05) for males and females. These results suggest that individuals can accurately perceive the point of AT. The metabolic changes occurring at AT appear to provide cues to the subject that the work he is performing is "hard." Being able to perceive the point of AT may be useful in the prescription of exercise.

NOTES AND COMMENTS:
ENERGY EXPENDITURE IN ROPE SKIPPING
Harold Z. Holmes, Jr., and James W. Fisher
Eastern Kentucky University

The purpose of this study was to estimate the energy expenditure during rope skipping using the open circuit system of indirect calorimetry.

Fourteen male students (X wt = 77.4 kg) skipped rope for 2 minutes, on two consecutive days, at 95-105 turns per minute while wearing a Kofranyi-Michaelis respirometer. Gas samples were analyzed in a Gallenkamp-Lloyd gas analyzer. Weir's formula was used to estimate energy expenditure. Values were adjusted for the weight of the K-M meter and to 65 kg reference man. The K-M meter was validated using a 2 liter syringe and a 120 liter Tissot tank. A regression line, determined by the method of least squares, gave specific correction factors for the expired gas volumes.

The unadjusted mean caloric cost of rope jumping was 10.8 kcal/min (SD = 1.1 kcal/min). Adjusting for the weight of the K-M meter and to 65 kg reference man reduced the mean caloric cost to 8.7 kcal/min/65 kg. As per Cooper's "Aerobics" program one would need to skip rope 100 minutes per week to attain the 30 points per week goal. Using the findings of this study there would be an energy expenditure of 870 kcal/week/65 kg.

It is concluded that at 8.7 kcal/min/65 kg rope skipping is a "heavy" exercise (7.5 kcal/min/65 kg and higher) according to the standard of Durnin and Passmore.

NOTES AND COMMENTS:
TEN YEAR FOLLOW-UP OF CHD EXERCISE PROGRAM. EFFECTS OF DIFFERENT AMOUNTS OF PHYSICAL ACTIVITY ON CARDIORESPIRATORY FUNCTION.
D. Franks, H. Hellerstein, C. Yoran, P. Fardy, A. Bram
University of Tennessee-Knoxville

This study determined the differences in CRF of men having clinical or ECG evidence of CHD who had selected different activity life styles over an eight year period following their participation in a two year fitness program (Hellerstein, Cleveland Jewish Community Center).

Forty-six males who had engaged in high (mean annual MET-HOURS = 2735, N = 13), moderate (X = 1025, N = 14), and low (X = 275, N = 19) levels of physical activity were retested on an intermittent PWC\textsubscript{150} on a bicycle ergometer. Ss continued to ride at increased work loads until HR = 150, SBP = 250, voluntary exhaustion, or they were stopped by the physical educator or cardiologist because of physical or ECG reasons. Differences among the three activity groups were determined by ANOVA (.10 level) on variables not different initially. Analysis of covariance was used to partial out initial differences.

The HA group was significantly better than MA and LA in physical work capacity as evidenced by higher workload attained before being stopped and higher PWC\textsubscript{150} and predicted max VO\textsubscript{2}. HA had better CR efficiency than LA as evidenced by lower resting HR and DBP. MA was better than LA on highest workload attained and resting HR.

Regular, vigorous physical activity is beneficial for CRF in post-cardiac persons. The advantages of moderate levels of activity are less certain.

NOTES AND COMMENTS:
EFFECTS OF HYPOXIA ON THE ONSET OF METABOLIC ACIDOSIS (ANAEROBIC THRESHOLD)
Arthur Weltman, Bryant A. Stamford, L. Bruce Gladden
University of Louisville

In order to test the effects of hyperoxia on the onset of metabolic acidosis (anaerobic threshold), 9 male subjects completed three criterion tests to determine the onset of metabolic acidosis (via blood lactate responses) while breathing room air, 100% oxygen with equilibration, and 100% oxygen without equilibration. It was hypothesized that if oxygen availability is a limiting factor in submaximal exercise, then the onset of metabolic acidosis (a criterion measure of submaximal fitness) should be delayed in the hyperoxic conditions. Results of the present study indicate that the onset of metabolic acidosis is delayed during hyperoxic conditions. Blood lactate concentrations were significantly lower (p < .05) at all work loads and the work load associated with the onset of metabolic acidosis was significantly higher during the hyperoxic conditions (144 watts during 100% O₂ with equilibration, 136 watts during 100% O₂ without equilibration, 105 watts during room air (p < .05).

It was suggested that the findings of reduced blood lactate during hyperoxia may not necessarily be due to a decrease in muscle tissue hypoxia. Furthermore, it was demonstrated that the onset of metabolic acidosis may not be as easily determined as suggested by Wasserman and associates (1973). It was concluded that (1) hyperoxic conditions result in significantly lower blood lactate concentrations at any submaximal work rate and (2) the work rate associated with the onset of metabolic acidosis is significantly delayed in hyperoxia.

NOTES AND COMMENTS:

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A LONGITUDINAL STUDY OF THE EFFECTS OF JOGGING 6-8 MILES A WEEK ON PREDICTED VO₂, BODY COMPOSITION, AND BODY WEIGHT
Guy Penny
Middle Tennessee State University

To investigate the long term effects of jogging 6-8 miles a week on predicted VO₂, body composition, and body weight was the purpose of this study. The Ss (10) average age 38.7 were given a Balke Treadmill Test prior to starting a supervised 3 day a week jogging class. The BTT was given again at 4 months, 16 months, and 28 months. After the 4 months test, the subjects continued jogging but unsupervised.

Analysis of variance for repeated measures revealed significant F's for predicted VO₂, body composition, and body weight. Duncan's Multiple Range Test disclosed significant differences in means at 4 months, 16 months, but not 28 months for predicted VO₂ and body weight. For body composition significant mean differences were revealed for 4 months and 28 months but not 16 months.

Jogging 6-8 miles a week seems to have an additive effect in relation to fitness for 16 months. Thereafter, jogging 6-8 miles a week maintains previous achieved levels of fitness. Significant reduction in body fat occurs with long-term jogging.

NOTES AND COMMENTS:
A CASE STUDY OF AN ATHLETE EXPERIENCING SECONDARY AMENORRHEA
Corrie J. Odom
Florida State University

The purpose of this study was to attempt to predict the menstrual cycle of an athlete experiencing secondary amenorrhea by comparing the physiological response to exercise of the amenorrheic subject to that of the control subject who was experiencing what the literature would consider a normal menstrual cycle.

Subjects were two female intercollegiate basketball players at Florida State University, one a control subject experiencing a normal menstrual cycle, one the experimental subject experiencing secondary amenorrhea. The experimental subject, in addition to the exercise required of all members of the varsity team, ran an average of 100-125 miles per week. The literature indicated that the most consistent and predictable physiological change that occurs during the menstrual cycle is the fluctuation of heart rate. Therefore, this study used heart rate as the dependent variable. Both subjects were administered the Harvard Step Test each day, at approximately the same time of day for 60 consecutive days. Recovery heart rates were recorded and performance scores were determined according to accepted procedures.

Scores for each subject were plotted on separate graphs. The fluctuations in the scores of the control subject were identified according to the day of the menstrual cycle. These fluctuations corresponded to expected variations based on available literature. The experimental subject's plotted scores were then super-imposed on the control subject's graph so that the high and low variations matched the high and low points on the graph of the control subject's scores. Using this approach, the investigator identified the approximate days of the menstrual cycle for the subject with secondary amenorrhea.

Based on the data comparisons above, it may be concluded that specific time periods of the menstrual cycle may be identified for those individuals experiencing secondary amenorrhea by using recovery heart rate. Also, it would have to be concluded that individuals, although experiencing secondary amenorrhea, still experience the same physiological changes during the menstrual cycle and therefore are affected in the same manner as athletes with normal menstrual cycles. This information can be an aid to the athletic trainer or coach of an athlete who is experiencing secondary amenorrhea if discomfort or illness occurring at regular intervals causes an athlete to have subpar performances or to be absent at practices or events.

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of
RESEARCH PAPERS

WINTER MEETING
of
SOUTHEAST CHAPTER

AMERICAN COLLEGE
of
SPORTS MEDICINE

GEORGIA STATE UNIVERSITY
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FEBRUARY 16-17, 1979
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This publication of the Abstracts of Research Papers presented at the Winter Meeting 1979 of the Southeast Chapter of the American College of Sports Medicine was edited and published by the Department of Health, Physical Education, Recreation, and Safety at Middle Tennessee State University, Murfreesboro, Tennessee.

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PHYSIOLOGICAL RESPONSES TO DIFFERENT BREATHING PATTERNS DURING TETHERED SPRINT FREESTYLE SWIMMING

George H. Bell and W. G. Herbert
Virginia Polytechnic Institute and State University

The purpose of this study was to determine the effects in male swimmers of two breathing patterns on selected respiratory-metabolic responses to sprint freestyle swimming.

Ten competitive male swimmers, aged 15-22 years, were observed during tethered swimming to compare levels of oxygen uptake, blood lactic acid, ventilation, and the respiratory exchange ratio in four 110 sec sprint swims. Subjects breathed during each arm stroke cycle (relative tachypnea) in two of the sprint swims and in the remaining two swims, they breathed on alternate cycles only (relative hypopnea).

Multivariate statistical analysis indicated that there was a significant difference \( p < .01 \) in the linear combination of physiological responses between the tachypnic and hypopnic swimming conditions. Through subsequent calculations of simultaneous confidence intervals, it was found that \( \dot{V}O_2, \dot{VE} \), and blood lactic acid were the dependent measures which caused the significant difference: responses for all three variables were elevated significantly \( p < .05 \) in the tachypnic condition. These results indicated that breathing during every arm cycle in sprint swimming was associated with a greater metabolic cost than when subjects breathed during alternate cycles. Apparently, relative hypopnea may enable swimmers to perform at higher work levels, or to maintain a constant swimming pace with less effort than during hypopnic conditions. Implications for freestyle swim training and competition were discussed.

Sprint freestyle swimming may be performed with greater metabolic efficiency by breathing only on alternate arm cycles, as opposed to breathing every arm cycle.

REPRODUCIBILITY OF SYMPTOM-LIMITED MAXIMUM HEART RATE AND OXYGEN UPTAKE OF POST-MYOCARDIAL INFARCTION PATIENTS WHILE TETHERED SWIMMING

W. T. Boone, A. D. Lee, P. M. Ribisl, and H. S. Miller
Wake Forest University

Ten male swimming patients of the WFU Cardiac Rehabilitation Program engaged in one practice session prior to the first maximum tethered swim test. Retests were administered within 3 to 4 weeks. Expired gases were directed into a system of five 120 liter meteorological balloons, with each balloon containing expired gas for 1 minute of work. Oxygen and \( CO_2 \) content were analyzed via Bechman OM-11 and LB-2 medical gas analyzers. A Parkinson Cowen CD-4 gas meter was used to determine gas volume.
Supine and standing EKG tracings were taken on the deck, followed by a warm-up of 3 minutes with a workload of 2.5 pounds. The protocol of the first test was duplicated during the second test. The attending physician monitored HR and EKG responses the last 10 seconds of each minute of warm-up, at the 30-second mark and the last 10 seconds of each subsequent work load. Abnormal EKGs, chest pain, and exhaustion were used as criteria for termination of testing.

The VO₂ for the first test was 1.52 L/min., while the second was 1.50 L/min. While there was no statistically significant difference by paired t-test, the correlation coefficient was only r=.63. Costill (1966) reported a correlation coefficient of r=.92 for oxygen uptake in a reproducibility study with tethered swimming using normal males. The lower correlation in this study could be due to subject selection and the time between the two tests. One might expect the physical potential of cardiac patients to vary more than that of healthy males, especially from day to day and following 3 to 4 weeks. The mean max HR for the first test was 156 bpm and 149 bpm for the second test. There was no significant difference between the two mean max HR values for the two tests. The correlation coefficient was r=.84, which was consistent with Costill’s r=.87 for HR. In addition, oxygen pulse, RQ, pulmonary ventilation, ventilation equivalent and max mets between the two tests were not significant.

The tethered swim test is a reproducible method of determining the symptom-limited max HR and VO₂ of post-MI patients.

PHYSICAL ACTIVITY MODE AND WORK SELECTION IN THE CARDIOVASCULAR RESPONSES OF PARTICIPANTS IN A CARDIAC REHABILITATION PROGRAM
M. C. Camp, W. G. Herbert
Virginia Polytechnic Institute and State University

The purpose of this study was to examine the ability of a group of post-coronary patients to exercise within individually prescribed target heart rate zones in a mode familiar to them (walking) and in two novel modes (arm-cranking and load-carrying) using subjective feedback as guides for work selection.

Twelve patients were told to exercise continuously for 5 min at levels which they expected would elicit their target heart rates using subjective feedback as selection criteria. Tasks were performed on three separate days; 5th min exercise heart rates and early (≤ 1 min) post-exercise blood pressure responses were measured using an ECG and sphygmomanometer, respectively.

Subjects exercised at 84, 83, and 76% of their target heart rates in walking, arm-cranking, and load-carrying, respectively. Although these levels were below prescribed intensities, they were sustained at a level judged sufficient to provide a
training stimulus in all modes, i.e., 77, 74, and 68% of maximum heart rates as previously determined on graded exercise tests. Variations in blood pressure responses across modes suggested that a static component may have affected work level selected by the patients in the arm-cranking and load-carrying tasks. Individual patient differences across modes in the ability to attain target heart rates clearly illustrated the need for frequent heart rate monitoring in therapeutic exercise programs in order to assure that training goals are realized. The importance of recognizing the specificity of cardiovascular responses to different dynamic exercise tasks was also illustrated by these data.

Statistical analysis indicated that the heart rate levels which patients exhibited, although less than those medically prescribed, were judged sufficient to produce training effects on all three tasks.

**COMPARISON OF ENERGY COST AND LEVELS OF INTENSITY OF TENNIS PLAYED ON TWO DIFFERENT COURT SURFACES**

M. Czarnecki, T. Boone, P. Ribisl, and H. Miller
Wake Forest University

The purpose of this study is to measure and compare the energy cost and levels of intensity of playing a singles match in tennis between opponents of equal ability on two different court surfaces.

Ten male subjects were chosen from the Wake Forest University tennis team. The subjects were then matched by skill level in order to produce the normal game situation. Each pair of subjects then played a one hour singles match on hard courts and clay courts with oxygen uptake being measured by a Kofranyi-Michaelis Respirometer. The level of intensity was determined from heart rate measured by use of a Parks radio telemetry unit.

The mean, SD, sx, and range were computed to determine the energy cost and heart rate measured during play on both surfaces. The energy cost of play on clay courts ranged from 9.20 to 10.45 Kcal/min (mean=9.77) and was found to be significantly ($p < .005$) higher than the energy cost on hard courts which ranged from 6.40 to 9.91 Kcal/min (mean=8.61). In addition, the heart rate attained during play on clay courts (mean=160 b/min; range=154-164 b/min) was significantly ($p < .005$) higher than the heart rate attained on hard courts (mean=142 b/min; range=132-148 b/min). With regard to level of intensity, play on clay courts produced a level of 71.0% versus 58.3% for play on hard courts as determined from the percentage of the range between the resting and maximum heart rate founded by Karvonen. Thus, the threshold level of intensity (60%) was only surpassed for play on clay courts.

It was concluded that tennis played on clay courts between
high caliber players of equal ability requires a greater use of energy than play on hard courts, and play on clay courts may result in greater aerobic benefits due to the increased intensity of play.

THE 1977-78 NORTH CAROLINA HIGH SCHOOL WRESTLING SURVEY
J. Estwanik and G. Rovere
Hawthorne Orthopedic Clinic, Charlotte, North Carolina

The documentation of injuries will aid in their prevention, detection, and treatment. Preseason questionnaires, injury log sheets, introductory letters, and letters of approval, along with midseason followup reminders and supportive letters, were sent to programs in the state. Thirty-two teams responded. Information was gathered regarding methods of weight loss, coaching experience, cauliflower ear, adequacy of medical coverage, favorite injury-prevention techniques, holds considered dangerous, and a record of all injuries sustained. The average number of participants per team was 23, and injury rate of 24% was calculated. The main areas of injury, in decreasing order, were: head and neck, shoulder, knee, hand. Injuries pertinent to each anatomical area were discussed. Suggestions are also included with the survey results.

THE PHOSPHOFRUCTOKINASE-FRUCTOSE DIPHOSPHATE GLYCOLYTIC CONTROL CYCLE: RELATIVE DISTRIBUTION OF CONSTITUENTS, TISSUE GLYCOLYTIC POTENTIAL, AND ADAPTABILITY TO SPRINT TRAINING
Gene McKenzie Gillam
Jacksonville State University

Those questions specifically addressed in this study were: (1) the relative distribution of FPK and FDPase as it relates to the necessity of substrate cycling; (2) a comparison of red and white muscle tissue FPK and FDPase activity in assessing that tissues potential for glycolytic energy production; and (3) determining FPK, FDPase, and FPK/FDPase cycling rate adaptability to training as it might relate to an increase in the glycolytic flux capacity, rapid reconversion of lactate and pyruvate into carbohydrate sources, and an enhanced amplification mechanism for turning the glycolytic pathway "on" and "off" in response to the energy demands of the cell. The soleus muscle and white and red portions of the gastrocnemius and quadriceps muscle of 64 Sprague Dawley rats were assayed for FPK and FDPase activity through a modification of the methods previously described by Mansour (1963) and Newsholme and Crabtree (1970), respectively, after 3, 6, 9, and 12 weeks of sprint training.
Pretraining FDPase values were found to be less than 10% of the PFK activity observed in the white and red gastrocnemius and quadriceps and soleus muscle. The presence of FDPase in the muscle cell seems to necessitate substrate cycling, although PFK appears to be dominant in terms of regulatory capabilities. PFK activity in the red gastrocnemius and quadriceps was found to be only 79 and 77% of that observed in the white portions of those muscles, respectively. White portions of the gastrocnemius and quadriceps also contained significantly higher levels of FDPase than the red portions of the same muscles. The white tissue thus appears to have an advantage over red tissue as a result of an enhanced responsiveness of the F6P–FDP conversion to changes in AMP concentrations through the possession of higher enzyme activity levels. PFK activity decreased in the white gastrocnemius and quadriceps and increased in the red portions of those muscles after six weeks of sprint training. As a result of these PFK adaptations, the PFK/FDPase activity ratio increased in the white tissue and decreased in the red tissue. The former adaptation would appear to greatly enhance the white tissues glycolytic flux potential for energy production during rapid, forceful contractions. The apparent lack of response of the glycolytic enzymes in the white and red gastrocnemius and quadriceps after 9 and 12 weeks of training seems to imply that the glycolytic regulatory mechanism is efficient. In essence, this innate mechanism allows for optional substrate control in response to the metabolic needs of the cell. The possibility of muscle gluconeogenesis was not enhanced since FDPase activity was not affected by sprint training with the exception of an increase in the soleus muscle after 9 and 12 weeks.

THE EFFECT OF SHORT-TERM ENDURANCE WORK UPON ADIPOSE TISSUE LOSS
Richard N. Godsen and W. L. Hills, Jr.
College of Charleston

This study was conducted to determine if heavy and prolonged exercise results in a significant "spot reduction" of adipose tissue in the region of the exercised musculature.

Eleven volunteers (6 male, 5 female) served as subjects in this investigation. They trained on bicycle ergometers for approximately 110 minutes per day until their accumulated work amounted to about 620,000 KpM, which is the approximate caloric equivalent of two pounds of adipose tissue. Both local (via skin-fold measurement of 6 sites) and whole-body (via hydrostatic weighing) fat changes were monitored in a simple pre-post design. It was hypothesized (null) that the training would not significantly reduce the ratio of the leg skin-fold value to the total skin-fold value.

The training resulted in significant reductions in both
whole-body fat (mean reduction of 2.6 pounds) and local fat deposits (mean reduction in the total fat-pad value of 10.4%). The leg fat to whole-body fat ratio was unchanged, however (pre = .35; post = .36); thus, the null hypothesis was accepted. These results support the contention of Brehmke and Wilmore that adipose tissue loss follows genetic rather than exercise patterns. It was concluded that "spot reduction" of adipose tissue does not occur in short-term endurance programs.

A BIOMECHANICAL ANALYSIS OF OLYMPIC FLATWATER CANOE PADDLERS
J. T. Kearney, R. V. Mann, and S. Plagenhoef
University of Kentucky

Six American, Canadian, and European paddlers, who were competing on international level, were filmed at speeds ranging from 80 to 100 percent of race pace. Filming was done at 64 fps and displacement data extracted using a Grad-Pen system. Results indicated that highly skilled performers generated smooth velocity and acceleration curves for the body segments, the body center of gravity, and the canoe. It was noted that the velocity of the canoe followed a sinusoidal pattern, whereas the velocity of the center of gravity was virtually constant. Analysis of these velocity patterns revealed that the early portion of the stroke, the catch, was most critical for producing acceleration. As a result of the relative velocities between the canoe and the body segments, it was concluded that the dominant segments in producing the propulsive forces are the draw segments. The action of the thrust segments varied among the paddlers but was essentially one of stabilization—providing a fixed point about which the shaft could be rotated.

The Olympic-style flatwater canoe stroke can be characterized as activity in which the craft is propelled in a sinusoidal manner under a constant velocity performer. Dominant forces are produced during the early phase of water contact by the draw segments, using the thrust segments for stabilization.

ALTERATIONS IN HIGH AND LOW DENSITY LIPOPROTEINS AS A RESULT OF A SUPERVISED EXERCISE PROGRAM
Powell McClellan, Roger Alteri, and Crawford Adams
Middle Tennessee State University

The purpose of this study was to determine the effects of a 12 week supervised exercise program upon the serum concentrations of HDL and LDL.

Fifteen male banking executives (X age = 46.6 years) served as subjects. The intensity of the exercise program was 60-70% of maximal oxygen consumption and 70-80% of age-predicted maximal
heart rate; duration was at least 30 minutes and frequency was 5 times weekly. The training stimuli were satisfied utilizing a progressive program of indoor and out-of-door walking and jogging. Bicycle ergometers and motor-driven treadmills were used as indoor modalities.

Although no significant changes were noted in HDL, the total cholesterol LDL and HDL/LDL ratio significantly changed. The shift in the HDL/LDL ratio toward unity suggests a condition which has been noted among young children in primitive populations where atherosclerosis almost never occurs. High HDL/LDL ratios have also been noted among long distance runners in the Stanford heart disease prevention programs.

Within the limitations of this study, it is concluded that a supervised exercise program will cause certain positive alterations in the serum concentrations of HDL and LDL.

PREDICTION OF INITIAL JOGGING PACES IN THE TRAINING OF YOUNG, HEALTHY SUBJECTS
Chris A. Mileisis and Benjamin Smith
Furman University

The purpose of this study was to develop an equation to predict the 110-yard training pace at which one should jog in order to elicit a heart rate of 85% of the maximal heart rate range.

Thirty-nine healthy university students (17 males, 22 females) were given the Cooper 12-min run test, which was then correlated with the jogging pace (in sec) required to produce an 85% intensity level in a walk 110-yard, jog 110-yard aerobics training program. A regression equation to predict jogging pace was generated from this correlation.

An r of -0.853 was observed between 12-min run distance (miles) and 85% intensity jogging pace (seconds). The $X \pm S.D.$ for training heart rate, 12-min run, and 110-yard jogging pace was $174 \pm 7.2$ b/min, $1.41 \pm 0.26$ mi, and $27.1 \pm 6.0$ sec, respectively. A linear regression nomogram (least squares method) was developed for rapid estimation of 110-yard pace from 12-min run distance. The regression equation for predicting jogging pace was:

$$ Y = 54.9 - 19.7X, $$

where

- $Y$ = 110-yard jogging pace at 85% intensity (sec)
- $X$ = 12-min run (miles)

Use of the above regression was tried in approximately 90 students drawn from the same population, with results satisfactory to instructor and students alike. In a cross validation on three subjects, the observed 110-yard jogging pace differed by only 0.8-1.9 seconds compared to the predicted pace. Since the initial jogging pace is predicted from a maximal test (i.e., 12-min run)
before any training is performed, it is evident that this tech-
nique must be limited to young, healthy subjects.

In conclusion, initial training pace for the beginning jogger
can be estimated from 12-min run performance.

STRENGTH CHANGES IN THE CONTRALATERAL CALF MUSCLES DURING AND
FOLLOWING A LOCALIZED COLD TREATMENT TO THE DOMINANT LEG
Robert A. Oliver, Dewayne J. Johnson, Sarah Moore, and John Moore
Newberry College

The purpose of this study was to investigate the effect of
a 30 minute, 10.0 degree centigrade water bath on the plantar
flexion strength of the contralateral leg during a three hour
post treatment period.

Subjects were 10 male and female volunteers. Each subject
was tested twice, on the same day of the week, at the same time
of the day, for two consecutive weeks. Treatment involved the
submersion of the dominant leg into 10.0 degree centigrade water
for 30 minutes. The leg was submerged to two inches above the
patella. During one test period, the subject received the cold
treatment and during the other test period the subject served as
a control subject. The order of treatments was randomly
assigned. Measurements of plantar flexion strength of the contra-
lateral leg were taken eight times during the three and one half
hour testing period. Plantar flexion strength was measured with
a cable tensiometer. The tensiometer was used with the regulation
testing table and the strap was placed on the metatarsal-phalangeal
joint and regulated for each test occasion by making a mark on the
bottom of the shoe to assure consistent placement of the strap.

Results indicated no significant gain in plantar flexion
strength of the contralateral limb over normal (pre
 treatment) measurements. However, there was a significant gain in plantar
flexion strength from immediately post treatment on the treat-
ment day, to all test occasions during the three hour post treat-
ment period. This indicates that the cold treatment affected
strength of the contralateral limb enough to cause a reduction in
strength immediately post treatment to allow a significant increase
in strength following. Previous research indicated that plantar
flexion strength of the treated leg, during the experimental ses-
sion, had significant gains in strength, above normal measure-
ments, during the recovery period from reduced intramuscular
temperature. This study indicates that contralateral strength
is not affected by reduction of intramuscular temperature of one
limb.
PHYSIOLOGICAL CHARACTERISTICS AND CORRELATES TO PERFORMANCE IN ADULT FEMALE DISTANCE RUNNERS
Russell R. Pate, Jon Van Wyk, Austin Okocha, and Gwen Hagenbuch
University of South Carolina

This study was designed to: (1) develop a physiological profile of the adult female who participates in competitive road races, and (2) to examine the extent to which physiological parameters can account for the variance in distance running performance in trained adult females.

Sixteen female distance runners, aged 21 to 37 years ($\bar{x} = 26.5$), completed submaximal and maximal treadmill runs during which $V_{O_2}$, ventilation ($V_E$), heart rate (HR), respiratory quotient (RQ), and relative perceived exertion (RPE) were measured. Submaximal running was conducted at 6 mph and at 80% $V_{O_2}\text{max}$. Venous blood lactate (HLa) was assessed after submaximal and maximal runs. Body composition (% fat) was estimated from skinfolds. In addition, 13 of the Ss competed in a 10 km road race, performance in which was correlated with the observed physiological parameters.

It was concluded that: (1) adult female distance runners exhibit a level of cardiorespiratory fitness which exceeds that of most younger female athletes, and (2) in this group, interindividual variance in competitive performance is explained largely by metabolic and anthropometric characteristics.

THE DEVELOPMENT AND VALIDATION OF A CORONARY DISEASE CONTROL SCALE
W. Rejeski and W. McCook
Wake Forest University

To investigate the psychometric properties of a situationally specific Coronary Disease Control Scale (CPCS) was the purpose of this study.

Items for the CPCS were based on existing instrumentation relating to locus of control and were written specifically for the parameters relating to CHD. These parameters emerged from an analysis of the Wake Forest multi-interventional rehabilitation program. A random sample of 245 college students served as subjects for the initial analyses. These analyses included: (1) an item analysis, (2) generation of internal consistency reliabilities, and (3) a factor analysis of the CPCS.

Item analysis of the CPCS demonstrated that 14 items correlated significantly with total score. Principal components analysis in conjunction with an oblique rotation yielded four factors which explained 54% of the total variance. Interestingly, the four factors were relatively independent and supported the multi-interventional approach to cardiac rehabilitation. While an
internal consistency reliability of .72 was generated and deemed acceptable, a linear combination model which was based on a summation of individual factor reliabilities yielded an alpha coefficient of .77. Discriminant validity for the CDCS was provided by the direction and magnitude of the correlation between Marlowe-Crowne's Social Desirability Scale and the CDCS (-.18). Additionally, cardiac patients (n = 25) scored significantly more external on the CDCS than a random sample of college students (n = 50; t (73) = 2.66, p < .01).

Preliminary data suggest that the CDCS is both reliable and valid. The practical and empirical value of the CDCS emerges from its theoretical integration with a Social Learning Approach to Personality.

ANALYSIS OF HEART RATE PATTERNS DURING EXERCISE TRAINING OF PATIENTS IN A CARDIAC REHABILITATION PROGRAM
Paul M. Ribisl, W. T. Boone, Henry S. Miller, Jr., and Robert S. Mazzeo
Wake Forest University

The purpose of the present study was to evaluate the heart rate patterns of cardiac patients during a typical training session to determine whether their heart rates are in fact maintained within the prescribed heart rate zone.

Dynamic electrocardiography (Holter monitor) recordings were made on 16 cardiac patients during a 45 minute exercise session consisting of warmup (10 min), walk/jog (20 min), and volleyball as cooldown (15 min). Results were compared to the prescribed training zone for heart rate that was established during the graded exercise test.

Although an exercise intensity of 60 to 85 percent of the functional range was prescribed for each patient, the mean intensity during the 20 minute endurance phase (walk/jog) of the training session was only 62.3 percent. It was noted that several distinct heart rate patterns were observed during exercise ranging from a steady-state heart rate pattern to an oscillating pattern commonly observed during interval training. As expected, the intensities for warmup (19.8%) and cooldown (27.5%) were lower than during the walk/jog. The average intensity for the entire 45 minute exercise period was only 54.2 percent. Even though this intensity is somewhat lower than recommended, a significant (p < .05) improvement in functional capacity was nevertheless observed in these patients. After approximately 20 weeks of participation in training these patients had an increase in their functional capacity from 7.18 to 8.18 METs.

It appears that regular exercise training in the range of 40 to 60 percent of the functional capacity is sufficient to elicit significant improvement in the functional aerobic capacity of ischemic heart disease patients.
THE EFFECTS OF MUSCULAR FATIGUE ON SPRINT RUNNING MECHANICS
P. Sprague and R. Mann
University of Kentucky

The purpose of this study was to analyze the mechanics of sprint running in a non-fatigued and fatigued condition. Since the cause of the biomechanical alterations is directly related to the muscle force (moment) generated around the body joints, these results were utilized to determine significant changes in the sprinting mechanics.

Fifteen highly skilled runners performed a maximum exertion 400 meter sprint. Film records, shot at 150 fps, were obtained at 40 meters (non-fatigue) and 370 meters (fatigue) in the subjects' sagittal plane. The film records were digitized and processed utilizing computer techniques.

The expected decrease in stride length and body center of gravity horizontal velocity, coupled with an increase in the time for the ground phase which increased the time for the full stride completion, were evident with the onset of fatigue. Since the proper application of muscle moment is the direct determinant of the quality of the movement, any decrease in magnitude or alteration in pattern of moment application would lead to these effects. Although the patterns of muscle moment application did not alter significantly around any joint, the magnitudes did significantly decrease in the fatigue state. This leads to the speculation that, as fatigue sets in, the sprinter slows to the velocity where the available muscle moment is sufficient to maintain the established movement pattern.

The effects to the onset of fatigue in the sprint run can be attributed to a decrease in the overall muscle moment generated around the body joints.

PHYSIOLOGICAL RESPONSES TO A SHORT TERM WEIGHT TRAINING PROGRAM
Michael Stone, Jack K. Nelson, Sam Nader, Robert L. Johnson, and David R. Carter
Louisiana State University

Male university students (n = 39) participated in a 6 week free weight exercise program using 3-5 sets of 3-6 RM's. Dynamic and static strength, power, and cardiovascular fitness, skinfolds, circumferences, and body weight were measured initially, after 3 weeks, and at the end of the 6th week. Repeated measures ANOVA and product moment correlations were utilized in analyzing the data.

Significant increases were shown in the following dynamic strength (IRM) measures: squat, 1/4 squat, bench press, and incline press. Significant gains in static strength were realized in the arm press, but not the back lift. Significant improvement was evidenced in a modified Margaria Anaerobic Power Test;
however, no changes were shown in the vertical jump, scored by
the Lewis formula for power. Improvement in cardiovascular fit-
ness was indicated by significant reductions in the 5 pulse
counts of the LSU Step Test: taken before exercise, 5 seconds
after exercise, and 1, 2 and 3 minutes during recovery. Skin-
fold measures taken at the triceps, pectoral, abdominal, and
thigh decreased significantly. Thigh circumference decreased
significantly. No changes were found in arm or waist circum-
ference or body weight. Significant relationships were found
between all strength measures and cardiovascular fitness (as
reflected by lower pulse rates), the correlations increased over
the training period. Inverse relationships were found between
cardiovascular fitness and skinfold measures, indicating decreased
cardiovascular efficiency with higher amounts of subcutaneous fat.

In summary, the 6 week free weight program brought about
increases in strength, cardiovascular fitness and power, and
resulted in decreases in body fat.

RELATIONSHIPS AMONG MAXIMAL OXYGEN UPTAKE, MAXIMAL HEART RATE
AND SUBMAXIMAL EXERCISE HEART RATE IN MIDDLE-AGED MALE JOGGERS
C. Zauner, N. Benson, E. Lenoir, and D. Hill
University of Florida

This study was designed to determine whether or not middle-
aged male joggers demonstrate relationships among \( \dot{V}O_{2\text{max}} \), HRmax,
and HRsubmax that are evident in young athletes. In addition, an
effort was made to assess the relative effects of age and of
training magnitude upon \( \dot{V}O_{2\text{max}} \).

The Balke treadmill protocol and modified Douglas Bag tech-
nique with paramagnetic oxygen and infrared carbon dioxide anal-
yses were applied to 36 male joggers (mean age = 43.3 years) in
order to elicit, measure and calculate \( \dot{V}O_{2\text{max}} \). During the tread-
mill exercise, heart rate at 5% grade and 3.5 mph was recorded as
HRsubmax. The HRmax was the greatest heart rate measured during
serial sampling of expired air while at 4 levels of work at or
approaching full effort. Pearson zero-order coefficients were
computed to express relationships between \( \dot{V}O_{2\text{max}} \) and HRmax,
HRsubmax, age in years (age), and weekly distance jogged (dis-
tance).

The relationship between \( \dot{V}O_{2\text{max}} \) and HRmax \( (r = 0.457) \) was
statistically significant \( (p < 0.01) \) as was the relationship
between \( \dot{V}O_{2\text{max}} \) and HRsubmax \( (r = -0.561; p < 0.001) \). The age
versus \( \dot{V}O_{2\text{max}} \) relationship \( (r = -0.075) \) was not significant
\( (p > 0.05) \), but distance was significantly \( (p < 0.001) \) related
to \( \dot{V}O_{2\text{max}} \) \( (r = 0.751) \). Of these relationships, only that between
\( \dot{V}O_{2\text{max}} \) and distance was sufficiently strong to be considered as
somewhat predictive. All relationships demonstrated direction
of association typical of younger subjects. The failure of age
to be significantly related to $\dot{V}O_2\text{max}$ is contrary to evidence in
the literature acquired from sedentary subjects. When considered
concurrently with the strong positive relationship observed
between weekly distance jogged and $V_0_2\text{max}$, our lack of association
of age with $\dot{V}_O_2\text{max}$ appears to suggest that regularly taken exer-
cise inhibits age-related depreciation of $\dot{V}_O_2\text{max}$.

It is concluded that as with younger, more intensely trained
individuals, middle-aged joggers achieve higher $\dot{V}_O_2\text{max}$ when HRmax
is high and HRsubmax is low. Furthermore, our data indicate that
training by jogging may slow the deterioration of cardiorespiratory
function associated with aging.
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