

# **ABSTRACTS of RESEARCH PAPERS**



## **THIRD ANNUAL MEETING of SOUTHEAST CHAPTER AMERICAN COLLEGE of SPORTS MEDICINE**

**MIDDLE TENNESSEE STATE UNIVERSITY  
MURFREESBORO, TENNESSEE  
OCTOBER 22 - 23, 1976**

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Jon L. MacBeth, Ed. D.  
Department of Health, Physical Education, Recreation, and Safety  
Middle Tennessee State University  
Murfreesboro, Tennessee

Dewayne J. Johnson, Ph. D.  
Faculty of Health and Physical Education  
George Peabody College for Teachers  
Nashville, Tennessee

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Department of Physical Education  
Georgia State University  
Atlanta, Ga. 30303

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Knoxville, Tennessee 37916

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910 Madison Ave., #712  
Memphis, Tennessee 38103

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Dept. of Health and Physical Education  
The University of North Carolina at  
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UNCC Station  
Charlotte, N. C. 28223

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School of Health and Physical  
Education  
University of South Carolina  
Columbia, S. C. 29208

Paul M. Ribisl, Ph. D.  
Director,  
Human Performance Laboratory  
Wake Forest University  
Box 7234 Reynolds Station  
Winston-Salem, N. C. 27109

G. Dennis Wilson, Ph. D.  
HPER Department  
Auburn University  
Auburn, Alabama

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COMMITTEE MEMBERS: Powell McClellan  
Jon L. MacBeth

## SMOKING HABITS, ALCOHOL CONSUMPTION AND MAXIMAL OXYGEN UPTAKE

Henry J. Montoye, Richard Gayle, and Millicent W. Higgins.

Data on smoking and drinking habits and maximal oxygen uptake were available on 597 males, age 16-69. For subjects below the age 40 (about half of the subjects)  $\dot{V}O_2$  max. was measured; for those above age 40,  $\dot{V}O_2$  max. was estimated from submaximal  $\dot{V}O_2$  and heart rate. After correcting  $\dot{V}O_2$  max. for body weight, age and sum of 4 skinfolds, analyses of co-variance indicated smokers had significantly lower  $\dot{V}O_2$  max. Alcohol consumption was also related to  $\dot{V}O_2$  max. with the non-drinkers and heaviest drinkers having the lowest  $\dot{V}O_2$  max.

Presented by:  
Henry J. Montoye  
School of HPER  
The University of Tennessee  
Knoxville, Tn. 37916

## A NON-INVASIVE TEST OF ANAEROBIC CAPACITY

Russell R. Pate, Steven

N. Blair, and David Hughes.

Our aim was to devise a test of anaerobic capacity which would not require measurement of respiratory gases or blood metabolites. Twenty-one adult male subjects pedaled as rapidly as possible for 90 sec. on a mechanically braked bicycle ergometer while the flywheel resistance was maintained at 4.5 kg. Pedal revolutions were recorded at 30, 45, 60, 75, and 90 sec. Other measures obtained were  $\dot{V}O_2$  max (graded treadmill run to exhaustion), peak blood lactate (after  $\dot{V}O_2$  max test), anaerobic power (Margaria Test), 440 yard run time, body weight, height and leg girths. Peak lactate was found to correlate most highly with pedal revolutions at 45 sec. ( $r=0.57$ ). The following regression equation was constructed to predict peak lactate (multiple  $r=0.65$ ): Peak lactate (mg%) = 1.55414 (Pedal revolutions in 45 sec) - 1.34982 (Height in cm) - 0.10709 (Right calf girth in mm) + 287.707. It was concluded that an estimate of anaerobic capacity can be obtained using the proposed bicycle ergometer test and simple anthropometric measures.

Presented by:  
Russell R. Pate  
College of HPE  
University of South Carolina  
Columbia, S. C. 29208

## AN INEXPENSIVE ANALYZER FOR MEASURING OXYGEN UPTAKE G. Dennis Wilson, L. Bruce Gladden, and Hugh G. Welch.

This study was undertaken to evaluate the Beckman Fieldlab 100800 O<sub>2</sub> analyzer (which was not designed for respiratory gas studies) to see if it could be used to satisfactorily measure FEO<sub>2</sub> in VO<sub>2</sub> testing situations. Besides its rather low cost, its portability and ease of use add to its attractiveness as an evaluative tool. Ten male subjects in various states of physical conditioning rode a Monark Bicycle ergometer for 5-6 minutes at workloads varying from moderate to maximal exercise. Samples from the collection bags were analyzed using the Beckman E-2 O<sub>2</sub> analyzer and the Beckman LB-1 CO<sub>2</sub> analyzer. The accuracy of the analyzers was checked periodically against the Scholander chemical gas analyzer, and they were in excellent agreement. Another sample from each bag was passed by the electrode attached to the Fieldlab O<sub>2</sub> analyzer. The degree to which the measurements made with the Fieldlab were identical to the Beckman E-2 and LB-1 was tested using the coefficient of agreement, A, and the significance of A was tested using a Z transformation of the intraclass correlation coefficient. The coefficient of agreement (A = .9874) was highly significant (P < .001) for FEO<sub>2</sub>, and also for VO<sub>2</sub> (A = .9888). It appears from the data in this study that the Beckman Fieldlab 100800 has many practical applications for researchers in VO<sub>2</sub> determination studies. The low cost, ease of use, and the level of accuracy makes this instrument an important evaluative tool for any lab.

Presented by:  
G. Dennis Wilson  
Dept. of HPER  
Auburn University  
Auburn, Ala. 36830

## CARDIOVASCULAR AND RESPIRATORY CHANGES IN EXERCISE INDUCED HYPERTHERMIA J. M. Liles, and Richard Adams.

Two male subjects (28 and 45 years of age) exercised (bicycle ergometer and treadmill) continuously at high work loads in a room 19-20° C with no convective cooling. Working at 76-80% of maximum aerobic capacity, it took about 30 minutes for the rectal temperature to reach 38.6-38.8°C, and an additional 30 minutes for the temperature to reach 39.9-40.1°C. With work loads even slightly less than 76% of the maximum aerobic capacity, a body temperature of 40°C was not reached even after 90 minutes of continuous work, unless heavy winter clothing was worn. Only small increases in respiration, oxygen consumption, and heart rate resulted until the body temperature exceeded about 38.8°C. Between 38.8°C and 40°C, heart rate rose about 14%, oxygen consumption 11%, ventilation 33%, and breathing frequency 50-100%, and there was a drop in systolic blood pressure of about 10-14%. The greatest amount of these changes occurred between 39.5-40°C. In one experiment, circulating plasma levels of epinephrine, norepinephrine, cyclic AMP and cyclic GMP were measured. All of these materials increased as the body temperature increased except cyclic GMP, which rose only after the body temperature reached or exceeded 39.5°C.

Presented by:  
J. M. Liles  
Dept. of Zoology  
The University of Tennessee  
Knoxville, Tn. 37916

## PHYSIOLOGICAL EFFECTS OF CHRONIC HEAVY PHYSICAL TRAINING ON FEMALE AGE-GROUP SWIMMERS

Pamela K. Robinson, Robert L. Bartels, Garrett P. Caffrey, and Thomas E. Shaffer.

Twelve female age-group swimmers and 12 female controls, 10-16 years of age, performed a pre-training discontinuous maximal bicycle ergometer test in the fall to determine the capacities of their anaerobic (alactacid and lactacid) and aerobic energy systems. Heart rate was monitored and oxygen uptake was measured during rest, exercise and recovery. Blood samples were collected before and after the exercise for determination of blood lactic acid concentrations. The tests were administered again in the spring, immediately following the completion of the swimmer's competitive training season. The mean maximum oxygen consumption ( $\text{max } \dot{V}O_2$  l/min) for the control group was  $1.93 \pm 0.26$  before the training period and  $1.99 \pm 0.34$  after the training period. The mean value for the experimental group increased significantly ( $P < 0.01$ ) from  $2.16 \pm 0.41$  before the training program to  $2.30 \pm 0.40$  after the training program. Expressed in terms of ml/kg/min, the before and after training mean  $\text{max } \dot{V}O_2$ 's for the control group were  $43.8 \pm 6.2$  and  $43.3 \pm 4.8$ . The corresponding values for the experimental group were  $47.7 \pm 5.2$  and  $48.8 \pm 3.4$ . It was concluded that the female age-group swimmers possess a significantly superior oxygen transport system as compared to the untrained controls. In addition, due to the chronic heavy physical training program engaged in by female age-group swimmers, this high level of aerobic fitness is maintained throughout the year.

Presented by:

Pamela K. Robinson  
Laboratory of Applied Phys.  
University of North Carolina  
Chapel Hill, N. C. 27514

## LOW INTENSITY CONTINUOUS AND HIGH INTENSITY INTERVAL TRAINING REGIMENS ON THE BICYCLE ERGOMETER

Steven N. Blair, Joe V. Chandler, David B. Ellisor, and Thomas D. Langley.

Nineteen male students aged 18-26 years were subjects for this study. They trained five days per week for ten weeks on bicycle ergometers. Total work was held constant for both groups (20,000 KPM/session initially to 30,000 KPM/session at the termination of the study.) Subjects were randomized into a low intensity continuous (LIC) group and a high intensity interval (HII) group. the LIC group trained at 50%  $MVO_2$  ( $\bar{X}$  HR = 134 BPM), and the HII group trained at 65%  $MVO_2$  ( $\bar{X}$  HR = 172 BPM), in two minute work-rest intervals. Both groups significantly improved  $MVO_2$  and a standardized bicycle ergometer test. Body weight and percent body fat were unchanged. There were no statistically significant differences between LIC and HII groups on any of the variables studied.

Presented by:

Steven N. Blair  
Human Performance Laboratory  
College of HPE  
University of South Carolina  
Columbia, S. C. 29208

# EFFECTS OF SUBMAXIMAL EXERCISE ON CATECHOLAMINE PLASMA LEVELS AND EXCRETION RATES IN YOUNG ADULT MEN OF AVERAGE AEROBIC CAPACITIES\*

Donald A. Olewine, Michael T. Simpson, Frank R. Ramsey, Georgelle Thomas, and Curtis G. Hames.

The Balke submaximal treadmill test was administered to 50 males age  $25 \pm 0.4$  yrs. (mean  $\pm$  S.E.). The estimated maximal oxygen consumption for the group was  $36.5 \pm 0.6$  ml/kg/min. In the total group the plasma epinephrine was not significantly elevated following exercise (Rest -  $0.54 \pm 0.08$  v.s. Exer. -  $0.81 \pm 0.13$  ug./l). However the epinephrine excretion rate after exercise was significantly increased (Rest  $0.73 \pm 0.09$  v.s. Exer. -  $1.18 \pm 0.10$  ug./hr.). Exercise significantly increased both the plasma level and excretion rate of norepinephrine (Plasma -  $0.28 \pm 0.03$  v.s.  $0.83 \pm 0.08$  ug./l.; Urine -  $1.2 \pm 0.09$  v.s. Exer.  $2.46 \pm 0.12$  ug./hr.). On the basis of work load achieved during exercise the group was subdivided into three groups which had significantly different estimated maximal oxygen consumptions ( $32.3 \pm 0.4$ ,  $37.5 \pm 0.5$ , &  $41.1 \pm 0.6$ ). In the group that achieved a work load of 11-12 mets during exercise the plasma norepinephrine level was strikingly elevated above that found in the other two groups which achieved lower work loads.

\* Supported by USPA Grant # HE 03341 to Evans County Health Department.

Presented by:  
Donald A. Olewine  
Dept. of Biology  
Georgia Southern College  
Statesboro, Georgia 30458

# OXYGEN UPTAKE AND HEART RATE RESPONSES MEASURED DURING ROPE SKIPPING

Edward T. Howley, and Daniel Martin.

Heart rate and oxygen uptake were measured on three male and four female athletes during two types of skipping; A stepping motion in which one foot leads the other at slow rates of skipping (50-85 skips per minute) and during a "run" in which both feet leave the ground simultaneously at higher rates of skipping (118-147 skips per minute). Subjects skipped for four minutes before data were collected. In addition, maximum heart rate maximum aerobic power ( $VO_2$  max) were measured with a treadmill test. The heart rate was ( $\bar{X} \pm SE$ )  $155 \pm$  beats/min and  $168 \pm 3$  beats/min at the slow (69 skips/min) and fast (132 skips/min) rates of skipping, respectively. The oxygen uptake was  $31.7 \pm 0.8$  ml/kg/min and  $38.9 \pm 1.2$  ml/kg/min at the slow and fast rates of skipping, respectively. The oxygen uptake values represented 62% and 74% of  $VO_2$  max for these subjects. It is suggested that these values probably represent "low" estimates of the energy requirement for skipping when dealing with unskilled subjects. These latter subjects tend to jump closer to a "maximum" rather than a "minimum" height off the floor.

Presented by:  
Edward T. Howley  
Division of Physical Ed.  
The University of Tennessee  
Knoxville, Tn. 37916

# THE RELATIONSHIP OF PAIN THRESHOLD AND PAIN TOLERANCE TO THE CARDIOVASCULAR ENDURANCE PERFORMANCE IN FEMALES

Jay T. Kearney,  
and A. J. Frye.

Measures of max  $\dot{V}O_2$ , cardiovascular endurance capacity, pain threshold, and pain tolerance were obtained on 30 college age females. Max  $\dot{V}O_2$  was evaluated by an intermittent graded open-circuit procedure. Cardiovascular endurance was taken as a timed performance on a bicycle ergometer. The measure used to quantify pain was an ischemic grip-flexion task. Initially, 50 percent of maximum grip-flexion strength was maintained for 90 seconds. Ischemia was produced by inflating a blood pressure cuff around the upper arm immediately prior to activity and maintaining inflation until the subject indicated her limit of pain tolerance. Pain threshold was evaluated during this procedure by asking the subject to indicate when she first perceived the ischemic sensation to be painful. The results indicated that significant relationships existed between max  $\dot{V}O_2$  and both cardiovascular endurance performance and pain tolerance as well as between the measures of pain threshold and pain tolerance. Calculation of multiple regression coefficients including either pain index with max  $\dot{V}O_2$  increased the percentage of variance explained by approximately 10 percent. Incorporation of both pain indexes improved the percentage of explained variance by 16 percent. It was concluded that utilization of pain index data in conjunction with oxygen uptake data may result in a more adequate prediction of cardiovascular endurance performance among college age females.

Presented by:

Jay T. Kearney  
Seaton Building Room 215  
University of Kentucky  
Lexington, Kentucky 40506

# SERUM LIPID RESPONSES TO EXERCISE TRAINING IN WOMEN AGED 25-39 YEARS AND POSSIBLE INTERVENING EFFECTS FROM ORAL CONTRACEPTIVE USE

Elizabeth A. Ritchey, and William G. Herbert.

Seventeen women, aged 25-39 years, were measured for serum lipids and functional capacity before and after exercise training consisting of 30 minutes of running on a treadmill, 3 days/week for 6 weeks, at 75% of their  $\dot{V}O_2$  max. Additionally, data for 9 subjects using oral contraceptives were examined to determine if the lipid response to training was influenced by this drug therapy. Periodic measurement of total skinfold thickness, body weight, and dietary patterns during training suggested that these factors did not influence pre- to post-training serum lipid changes. Although statistically significant changes (ANOVA;  $p < 0.05$ ) were not seen in any of the lipid variables, a trend toward reduced serum triglyceride and/or cholesterol levels was noticed in women whose initial values were in the upper ranges of clinical normality. Exercise did not seem to affect the lipid levels of subjects who initially had lower values. There was statistically significant improvement in  $\dot{V}O_2$  max and  $\dot{V}e$  max with this training program. Changes in serum lipid levels and functional capacity of the oral contraceptive subjects were similar to that observed in subjects not using the pill.

Presented by:

Elizabeth A. Ritchey  
Division of HPER  
Virginia Polytechnic Inst.  
Blacksburg, Virginia 24061

## LACTATE TOLERANCE AND PHYSICAL FITNESS

George V. Mann, Leon

Garrett, and Jon L. MacBeth.

Seeking an explanation for the immunity to hypercholesteremia and coronary heart disease of the milk and meat eating Masai has led to studies of the role in this of their high intake of fermented milk. Masai men consume 20 to 30 grams of lactic acid daily. When equivalent amounts of either L-lactate or citrate were fed to U. S. subjects a measureable increase of both physical fitness and lactate clearance from blood was observed. In studies of adult persons with a wide range of physical fitness a significant correlation between fitness and lactate clearance was observed. It is postulated that either training, dietary lactate or citrate induce enzyme systems which facilitate the clearance of metabolic acids. Thus fitness has biochemical parameter influenced by both diet and training.

Presented by:  
Jon L. MacBeth  
Box 527  
Middle Tennessee State U.  
Murfreesboro, Tn. 37132

## EXERCISE VALUE OF TWO "GET-INTO-SHAPE DEVICES"

Richard N. Godsen

The cardiovascular responses of sixteen volunteers were used to assess the exercise value of two highly-advertised "get-into-shape devices". Participation in recommended exercises effected minimal cardiovascular responses in the subjects. Methods of enjoining fallacious and/or misleading advertising are discussed.

Presented by:  
Richard N. Godsen  
College of Charleston  
Charleston, S. C.

## THE RESPONSE DURING REST OF MUSCLE TEMPERATURE UNDER TWO DIFFERENT CONDITIONS

Robert A. Oliver, Dewayne J. Johnson, Walter W. Wheelhouse, and Paul P. Griffin.

The purpose of this study was to investigate the response during rest of muscle temperature under two different conditions. Under the first condition, subjects remained at rest in a prone position for 210 minutes. With condition two, subjects received a thirty minute,  $10^{\circ}$  C, cold water bath of the lower portion of one leg, then remained at rest in a prone position for 180 minutes, for a total treatment time of 210 minutes. During the rest period, the subject made one maximal contraction of the gastrocnemius every thirty minutes. Twenty subjects participated in a repeated measures design with the two treatment conditions being randomly assigned. The tests were performed on the same day of the week, at the same time of the day, for two consecutive weeks. All parameters were monitored prior to the rest period and then every thirty minutes during the 180 minute rest period. Intramuscular temperature was recorded with a hypodermic thermistor probe, inserted into the lateral head of the gastrocnemius. Cutaneous temperature was recorded with a surface temperature probe. Data were analyzed with ANOVA for repeated measures. The Tukey method was used when a significant F was obtained. Results indicated heart rate, blood pressure, and oral temperature were not effected by localized cooling. This contradicts some of the literature. Intramuscular and cutaneous temperatures decreased significantly during the non-bath treatment. Intramuscular temperature significantly decrease from pre-cold bath to post-cold bath treatment measures during the cold water bath treatment. Significant increases occurred in all measures of intramuscular temperature during the 180 minute rest period, but never reached pre-cold bath values or the lowest temperature recorded during the non-bath treatment, which contradicts the literature. Cutaneous temperature had a significant decrease from pre-cold bath to immediately post-cold bath. Significant increases occurred during the rest period but never attained the pre-cold bath value or the lowest temperature recorded during the non-bath treatment, which contradicts some of the literature. Based on the results of the study, the authors conclude: (1) heart rate, blood pressure, and oral temperature are not effected by localized cooling, and (2) intramuscular and cutaneous temperatures, when lowered to a mean temperature of  $25.39^{\circ}$  C. and  $20.90^{\circ}$  C. respectively, will not return to normal temperatures within a three hour period.

Presented by:  
Robert A. Oliver  
Dept. of Physical Education  
Newberry College  
Newberry, S. C. 29108

## CINEMATOGRAPHICAL ANALYSIS OF THE WATER JUMP SKILL IN STEEPLE- CHASING David A. Kaufmann.

The purpose of this study was to determine linear and angular displacements of the body parts in the frontal plane of steeplechasers at take-off, top of the barrier and landing while competing in the 1975 Florida Relays Steeplechase event. Five subjects were filmed by a 16mm high speed (59.5 frames per second) camera at a right angle to the frontal plane of action while clearing the water jump barrier. A Recordak Film Analyzer was used to determine contourograms from which the measurements were taken. The data indicated: 1) the width of the feet at take-off, top of the barrier and landing remained rather constant with mean values ranging from 24.5 cm to 35.8 cm; 2) the champion performer leaned both his trunk and head inward at take-off, top of the barrier and landing; 3) the champion, who was the tallest, had a relatively low squat height to standing height ratio (61%) at the top of the barrier and the best crotch height to squat height ratio (38%) at the top of the barrier was obtained by the smallest performer.

Presented by:  
David A. Kaufmann  
19 Florida Gym  
University of Florida  
Gainesville, Florida 32611

## A COMPARISON OF SEVERAL PHYSIOLOGICAL PARAMETERS WITH STATE OF CONDITIONING Stephen A. Ames, and Ben R. Londeree.

The purpose of this study was to determine the relationships between state of conditioning and each of the following parameters: 1) maximal oxygen consumption, 2) heart rate response during a standard work load, 3) rate of heart rate recovery from a standard work load, 4) the threshold of anaerobic metabolism, and 5) heart rate response to a standard work load after previous heavier exercise (40-70-40 test as described by Hartley and Saltin, Scand. J. Clin. Lab. Invest. 22:217-224, 1968). Twenty-six male volunteers were classified as low-fit, medium-fit, or high-fit according to the amount of recent physical activity. The Cooper Aerobic Point System was used to define the fitness groups. Each subject was given a treadmill test to measure the previously listed physiological responses. Correlation ratios were determined with one-way analyses of variance with activity groups serving as the independent variables. Rate of heart rate recovery data were analyzed with a two-way analysis of variance with repeated measures test. Each of the parameters was significantly ( $P < .01$ ) related to state of conditioning except the rate of heart rate recovery from a standard work load. The correlation ratios (absolute values) ranged from 0.33 for the rate of heart rate recovery to 0.93 for maximal oxygen consumption when expressed as ml/kg.

Presented by:  
Stephen A. Ames  
Dept. of HPE  
Radford College  
Radford, Va. 24141

## ASSESSMENT OF MAXIMAL OXYGEN CONSUMPTION BY STEP BENCH AND TREADMILL PROCEDURES

Jimmie L. Cal, Robert L. Bartels, and Edward L. Fox.

The purpose of this study was to compare maximal oxygen consumption by step bench and treadmill procedures. Eight male subjects were tested over two periods of 6 and 7 days. Each subject performed two maximal oxygen consumption test (on separate days) before and after a 7-week training period. Maximal oxygen consumption was determined by open circuit spirometry. The pre-test values using the step bench ranged from 34.5 to 47.2 with a mean of 41.3 ml/kg-min, and for the treadmill, ranged from 33.4 to 64.2 with a mean of 43.3 ml/kg-min. A mean difference of pre-test values was 2.1 ml/kg-min. The post-test values using the step bench ranged from 32.2 to 50.1 with a mean of 44.5 ml/kg-min, and for the treadmill, ranged from 35.7 to 67.4 with a mean of 46.2 ml/kg-min. A mean difference of post-test values was 1.7 ml/kg-min. Similar results were attained when pre- and post-test data were combined, 43.0 ml/kg-min using the step bench and 44.8 ml/kg-min using the treadmill. There was no significant difference in maximal oxygen consumption when comparing values obtained using the step bench with values using the treadmill.

Presented by:  
Jimmie L. Cal  
Dept. of Physical Education  
Alabama A&M University  
Normal, Alabama 35762

## PSYCHO-PHYSIOLOGICAL CORRELATES OF COLLEGE FOOTBALL PLAYING ABILITY

David Pargman, Paul Deshaiers, and Richard C. Boutwell.

College football athletes (N=33) were measured on 27 structural physiological, psycho-motor, perceptual, psychological, and motor performance variables. Thirteen of these variables were selected on the basis of their relationship with football playing ability as consensually assessed by the football coaching staff, and included in a stepwise regression analysis. A prediction equation was obtained (P .001) including the following six variables: maximum aerobic capacity; running speed; score on the Thinking-Feeling Scale of the Myers-Briggs Type Indicator; kinesthetic ability; response time; and visual ability. The equation accounted for 65% of the variance in football playing ability ( $R=.81$ ).

## BILATERAL COMPARISONS BETWEEN SKIN TEMPERATURES OF UNINJURED AND POSTOPERATIVE KNEES, BEFORE AND AFTER EXERCISE

Robert B. Gantt.

Literature reveals that bilateral skin temperatures are normally symmetrical. This study compared uninjured and postoperative knees of male Ss (n=30) for indications of asymmetry at least one year after surgery. Skin temperatures were monitored at five anatomical sites after a 15-minute period of inactivity and at 2-minute intervals following a submaximal treadmill run. Conclusions of the study were: (1) no indications of asymmetry were observed following inactivity; (2) after the treadmill run, surface temperatures of postoperative knees exhibited significantly cooler trends at the quadriceps tendon, medial collateral ligament, and biceps femoris. Possible causes of asymmetrical findings include inadequate vascularization of postoperative knees and/or a disproportionate reliance upon uninjured legs in running. Recommendations are suggested for future studies to investigate the potential of thermography in prognosis of athletic injuries and as a possible screening procedure for detecting proneness to injury.

Presented by:  
Robert B. Gantt  
Dept. of HPERS  
East Carolina University  
Greenville, N. C. 27834

## AN ANTHROPOMETRIC EVALUATION OF 8 TO 15 YEAR OLD FEMALE GYMNASTS

Ronald Byrd, Jo-Carroll Leslie, and Michael Collins.

Ninety-eight girl gymnasts ranging in age from eight to fifteen years were studied. Sixty-three were participants in the Southeastern AAU Junior Olympics, 33 were competitors at the Alabama USGF State Meet, and two had recently competed at the AAU National Championships. Ten skinfolds and 14 other anthropometric measurements were taken on each subject. Percentage body fat was determined by the method of Parizkova and somatotypes calculated by the Heath-Carter procedure. A stepwise discriminant function analysis was used to determine the importance and relative contribution of the various factors to performance.

Presented by:  
Jo-Carroll Leslie  
Dept. of Physical Education  
University of Alabama  
Birmingham, Alabama

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DILATION COMPARISONS BETWEEN TEMPERATURES OF PRINJUD  
AND POSTOPERATIVE KNEES, BEFORE AND AFTER EXERCISE

Casey, 2003

Abstract: The purpose of this study was to compare the dilation of the knee joint before and after exercise in patients with postoperative knees and in patients with uninjured knees. The study was conducted in a laboratory setting. The subjects were divided into two groups: postoperative knees and uninjured knees. The subjects were subjected to a series of exercises, and the dilation of the knee joint was measured before and after each exercise. The results of the study showed that the dilation of the knee joint was significantly greater in the postoperative knees than in the uninjured knees. This finding suggests that the dilation of the knee joint is a useful indicator of joint health and function. The study also found that the dilation of the knee joint was significantly greater after exercise than before exercise. This finding suggests that exercise can increase the dilation of the knee joint, which may be beneficial for joint health and function. The study was limited by the fact that it only measured the dilation of the knee joint and did not measure other factors such as joint pain or swelling. Further research is needed to explore the relationship between knee joint dilation and joint health and function.

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Southeast Chapter  
American College of Sports Medicine  
Harvey Murphy-Executive Secretary  
Dept. of Health and Physical Education  
The University of North Carolina at  
Charlotte  
UNCC Station  
Charlotte, N. C. 28223

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