Southeast Chapter of the AMERICAN COLLEGE OF SPORTS MEDICINE annual meeting

February 1-3, 1990
17th Annual Meeting
Columbia, South Carolina

CONFERENCE ABSTRACTS

POSTER PRESENTATION Times and Locations

Friday, February 2

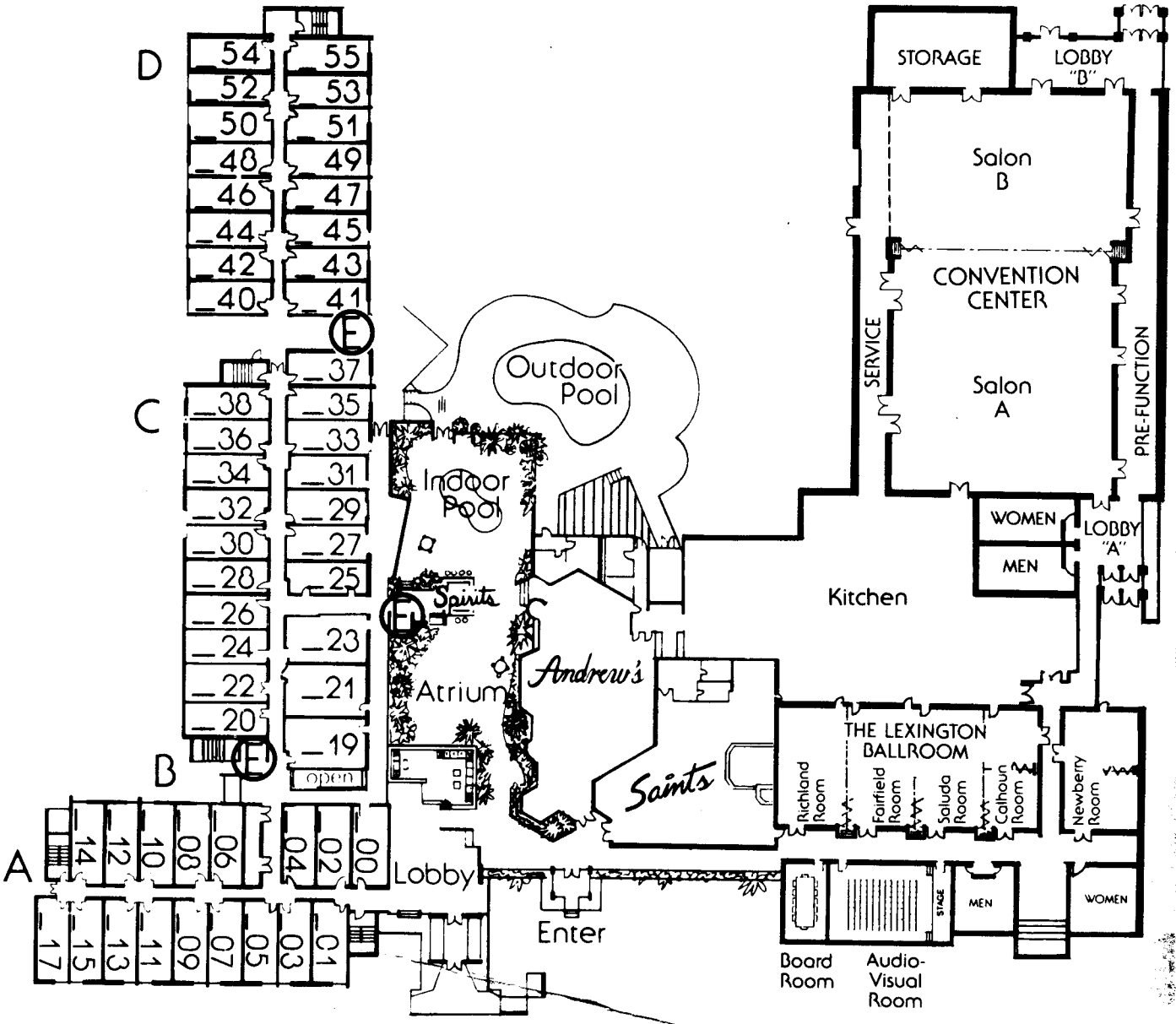
9:00 - 12:00 Group 1 (#45 thru 57)
Authors present
from 11:00 to 12:00
Salon A

2:15 - 5:15 Group 2 (#58 thru 70)
Authors present
from 4:15 to 5:15
Salon A

Saturday, February 3

9:00 - 11:45 Group 3 (#71 thru 82)
Authors present
from 10:45 to 11:45
Lobby Area outside
Salon A and B

Sheraton
Hotel & Convention Center
Columbia, South Carolina
The hospitality people of ITT



Seventeenth Annual Meeting

SOUTHEAST REGIONAL CHAPTER AMERICAN COLLEGE OF SPORTS MEDICINE

Sheraton Hotel and Convention Center
Columbia, South Carolina

February 1-3, 1990

Officers

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Department of Health, Physical Education, Recreation, and Safety, Middle Tennessee State University

CONFERENCE ABSTRACTS

SOUTHEAST CHAPTER OF THE AMERICAN COLLEGE OF SPORTS MEDICINE

1990 Annual Meeting Program

Sheraton Hotel and Conference Center
Columbia, South Carolina

Thursday, February 1

12:00 - 2:00 EXECUTIVE BOARD MEETING
President's Suite

2:00 - 6:00 VISIT EXHIBITS
Salon A

2:00 - 6:00 REGISTRATION
Foyer

4:00 - 5:00 TUTORIALS

Body Composition Determination using Electrical Impedance - Update and Analysis. J. Graves, Center for Exercise Science, University of Florida, Gainesville.
Salon B - Chair: Kirk Cureton, University of Georgia

Exercise, Endorphin and Psychological State. A.H. Goldfarb and D.J. Crews, University of North Carolina at Greensboro.
Saluda/Calhoun - Chair: Dianne Ward, University of South Carolina

Using Intracranial Self-Stimulation as Motivation for Exercise Tasks in Rats. R.P. Garner, University of South Carolina.
Newberry - Chair: Mark Davis, University of South Carolina

4:00 - 5:00 FREE COMMUNICATIONS - Biomechanics
A-V Room - Chair: Steve Messier, Wake Forest University

(4:00 - 4:15) **1** ***Training and Kinetic Factors Associated with Patellofemoral Pain in Runners.** S.E. Davis, S.P. Messier, W.W. Curl, and R. Lowery, Wake Forest University.

(4:15 - 4:30) **2** ***Mechanical Factors Contributing to Elite Discus Throws.** R.W. McCoy, The College of William and Mary.

*This abstract was selected by the reviewers as one of the top 30 abstracts out of 88 submissions.

(4:30 - 4:45) **In-Shoe Pressure Changes during Downhill Walking at Various Speeds.** K. Simpson, S. Odum, and T. Shewokis, University of Georgia.

3

(4:45 - 5:00) **Comparison of EMG Activity in the Semimembranosus and Erector Spinea Muscles Utilizing the David and Nautilus Knee Flexion Machines.** G.S. Rash, S.A. Coffman, F.H. Spechalske, and R. Banks, United States Sports Academy.

4

4:00 - 5:00 FREE COMMUNICATIONS - Health and Fitness I
Richland/Fairfield - Chair: Rod Dishman, The University of Georgia

(4:00 - 4:15) ***Determinants of Habitual Physical Activity in a Cooperative Extension Service Population.** L.N. Callis and R.D. Lewis, The University of Georgia.

5

(4:15 - 4:30) ***The Effects of Exercise on Murine Macrophage Phagocytosis.** J.A. Woods, T. Bacro, E. Mayer, J.M. Davis, F.J. Galiano, and R.R. Pate, University of South Carolina.

6

(4:30 - 4:45) **An Evaluation of the Daughton and Fix "Human Activity Profile" for Use in Clinical Settings.** W.R. Thompson, J.T. Danklefsen, F.J. Servedio, and E.L. Manning. The University of Southern Mississippi.

7

(4:45 - 5:00) **Effects of Smoking Cessation on Body Composition.** S.G. Owens, L.F. Chitwood, B. A. Stamford, and R.J. Moffatt, Florida State University.

8

5:00 - 6:00 PRE-DINNER STUDENT MIXER

7:45 - 9:00 KEYNOTE ADDRESS

Eric Newsholme, Ph.D.
Department of Biochemistry
The University of Oxford
Oxford, England
"The Metabolic Causes of Fatigue/Overtraining"
Salon B

*This abstract was selected by the reviewers as one of the top 30 abstracts out of 88 submissions.

BUSINESS MEETING

Emily Haymes, President, SEACSM
Salon B

9:00 - ? SEACSM SOCIAL
Pre-Function
Salon A

Friday, February 2

8:00 - 12:00 REGISTRATION
Foyer

9:00 - 5:30 EXHIBITS (Visit throughout the day!)
Salon A

9:00 - 12:00 POSTER PRESENTATIONS, Group 1 (#45 through 57)
Authors present from 11:00 to 12:00
Salon A

9:00 - 10:00 TUTORIALS

Effectiveness of Aerobic Exercise in the Modulation of Cardiovascular Reactivity to Non-Exercise Stressors. Douglas R. Southard, Virginia Polytechnic Institute and State University.
A-V Room - Chair: Robert Moffatt, Florida State University

Pulse Oximetry and Exercise-Induced Hypoxemia. Gordon L. Warren, III, University of Georgia.
Salon B - Chair: Diane Spitler, University of Florida

Combating Health Fraud. Amanda Timberlake, Takagi and Martin Women's Health Care, Riverdale, Georgia.
Richland/Fairfield - Chair: Jeff Rupp, Georgia State University

Strength Training in Prepubescent Children. Arthur Weltman, University of Virginia.
Newberry - Chair: Phil Bishop, University of Alabama

9:00 - 10:00 FREE COMMUNICATIONS - Prolonged Exercise
Saluda/Calhoun - Chair: Mindy Millard-Stafford, Georgia Tech

(9:00 - 9:15) **9** ***Metabolic Responses to Hyperglycemia during Prolonged Exercise.** M.T. Hamilton and E.F. Coyle, The University of Texas.

(9:15 - 9:30) **10** ***Effects of Post-Event Massage Therapy on Repeated Ultraendurance Cycling.** T. Drews, R.B. Kreider, B. Drinkard, C.W. Cortes, C. Lester, C.T. Somma, L.M. Shall, and M. Woodhouse, Old Dominion University.

(9:30 - 9:45) **11** **Chronotropic and Inotropic Adaptations to Repeated Ultraendurance Cycling.** B. Drinkard, R.B. Kreider, T. Drews, C.W. Cortes, L. Shall, and M. Woodhouse, Old Dominion University.

(9:45 - 10:00) **12** **Effects of Repeated Ultraendurance Cycling on Pulmonary Function.** R.B. Kreider, T. Drews, B. Drinkard, C.W. Cortes, L. Shall, M. Woodhouse, Old Dominion University.

10:00 - 10:15 BREAK - Coffee and Juice

10:15 - 11:45 SYMPOSIA

Physiology of Repeated Ultraendurance Cycling: The "Tour de Norfolk" Cycling Study. R. Kreider, M. Williams, C. Cortes, T. Drews, B. Drinkard, Old Dominion University.
Newberry - Chair: R. Kreider, Old Dominion University

Aerobic Dance Training: A Research Update. H. Williford, Auburn University at Montgomery; D. Blessing, Auburn University; M. Olson, Auburn University at Montgomery.
Salon B - Chair: Jerry Brandon, Georgia State University

Ethics in Research. W. Thompson, University of Southern Mississippi; R. Bulbulian, University of Kentucky; J. Rupp, Georgia State University.
A-V Room - Chair: Bill Herbert, Virginia Tech

*This abstract was selected by the reviewers as one of the top 30 abstracts out of 88 submissions.

10:15 - 11:45 FREE COMMUNICATIONS - Acute Response to Exercise
Richland/Fairfield - Chair: Phil Sparling, Georgia Tech

(10:15 - 10:30) **13** **Differences in the Exercise Ventilatory Responses between Blacks and Whites.** M.J. Berry, T.J. Zehnder and C.B. Berry, Wake Forest University.

(10:30 - 10:45) **14** ***Lung Diffusing Capacity in Highly-Trained Endurance Athletes.** K. Cureton, G. Warren, W. Middendorf, C. Ray, and J. Warren, University of Georgia, and St. Mary's Hospital, Athens, GA.

(10:45 - 11:00) **15** ***Incidence of Exercise-Induced Hypoxemia in Male and Female Athletes.** W. Middendorf, G. Warren, K. Cureton, C. Ray, and J. Warren, University of Georgia, and St. Mary's Hospital, Athens, GA.

(11:00 - 11:15) **16** ***The Effect of Continuous and Intermittent Exercise on Blood and Sweat Lactate Concentrations.** C.H. Martin and D.L. Bassett, University of Tennessee.

(11:15 - 11:30) **17** **The Effect of Exercise Intensity on Plasma Beta-Endorphin.** F.J. Galiano and J.M. Davis, University of South Carolina.

(11 :45) **18** **Effect of Passive Exercise on Cardiopulmonary Measures.** M.P. Foley, T. Boone, and W.R. Thompson, University of Southern Mississippi.

10:15 - 11:45 FREE COMMUNICATIONS - Health and Fitness II
Saluda/Calhoun - Chair: Dalynn Badenhop, East Carolina University

(10:15 - 10:30) **19** **The Kenyon Physical Activity Attitude Scale and the Myers-Briggs Type Indicator as Potential Instruments for Identifying Exercise Compliers.** H.F. Murphy and R.B. Simono, The University of North Carolina at Charlotte.

(10:30 - 10:45) **20** **Caloric Intake and Expenditure in Male and Female Runners.** L.M. Szymanski, R.R. Pate, M. Dowda, C. Macera, and K. Powell, University of South Carolina.

(10:45 - 11:00) **21** **Physical Activity and Fitness in Adults Grouped by Percent Body Fat.** B. Ainsworth, D.R. Jacobs, Jr., C. McNally, and A.S. Leon, University of Minnesota, and University of North Carolina at Chapel Hill.

*This abstract was selected by the reviewers as one of the top 30 abstracts out of 88 submissions.

(11:00 - 11:15) **22** **The Effects of Aerobic Circuit Training on Metabolic Control, Lipid Profiles and Cardiovascular Fitness in Adolescent Type I Insulin Dependant Diabetics.** P.E. Mosher, University of Tennessee at Chattanooga, A. Perry, M. Nash, J. Devitt, I. Lowenstyn, and G. Steiner, University of Miami

(11:15 - 11:30) **23** **Riboflavin Status of Female Athletes.** L.A. Alt and R.E. Keith, Auburn University.

(11:[illegible]:45) **24** ***Left Ventricular Response to Weight Lifting in Endurance Trained Men.** S.P. Brown, W.R. Thompson, K. Nayak, J. Goff, L. Wood, and M. Bean, University of Southern Mississippi.

11:45 - 12:00 BREAK - Walk time/visit exhibits

12:00 - 1:00 TUTORIALS

Anabolic Steroids: Physiology and Pharmacology. Alan Rogol, M.D., University of Virginia.
Salon B - Chair: Janet Walberg, Virginia Tech

Delayed Onset Muscle Soreness: Practical Applications. Lucille Smith, East Carolina University.
Richland/Fairfield - Chair: Mitch Collins, Kennesaw State College

Review of the Mechanical Aspects of Pitching. Charles J. Dillman, American Sports Medicine Institute, Birmingham, Alabama.
Newberry - Chair: Walter Thompson, University of Southern Mississippi

Reduced Training and Exercise Performance. Joseph A. Houmard, East Carolina University.
Saluda/Calhoun - Chair: Terry Bazzarre, University of North Carolina-Greensboro

12:00 - 1:00 FREE COMMUNICATIONS - Aging
A-V Room - Chair: Edward T. Howley, University of Tennessee

(12:00 - 12:15) **25** **Cardiac Output during Submaximal Cycling Exercise in Young and Elderly Individuals.** D. Turnoff, University of Pennsylvania, D.L. Spitler, L.A. Strzepek, L.R. Reider, G. Goodwin, and L. Chenowith, University of Florida.

*This abstract was selected by the reviewers as one of the top 30 abstracts out of 88 submissions.

(12:15 - 12:30) **26** ***Age Effects on Systolic Blood Pressure Index During Recovery from Submaximal Exercise.** L.R. Reider, D.L. Spitler, L.A. Strzepek, G.S. Goodwin, and L. Chenowith, University of Florida.

(12:30 - 12:45) **27** ***Bone Mineral Content and Bone Width Changes in Aged Female Fisher 334 Rats Following Five Months of Training.** R.T. Smith, C.L. Stebbins, and E.L. Smith, University of Southern Mississippi, University of California, Davis, and University of Wisconsin.

(12:45 - 1:00) **28** ***Cardiopulmonary Factors in Memory Decline in Old Age.** W.J. Chodzko-Zajko, P.B. Schuler, and J.C. Kime, University of Alabama.

1:00 - 2:15 LUNCH

2:15 - 5:15 POSTER PRESENTATIONS, Group 2 (#58 through 70)
Authors present from 4:15 to 5:15
Salon A

2:15 - 3:15 SEACSM SCHOLAR LECTURE

Russell R. Pate, Ph.D.
University of South Carolina
"Youth Fitness - Current Status and Issues for the 1990's"
Salon B

3:15 - 3:45 STUDENT MEETING

Maria Burgess, University of South Carolina
Salon B

3:45 - 5:15 SYMPOSIA

Evolving Standards of Care in Cardiac Rehabilitation. R. Humphrey, Virginia Tech; P. Ribisl, Wake Forest University; W. Herbert, Virginia Tech; K. Wood, University of South Carolina at Aiken.
Salon B - Chair: R. Humphrey, Virginia Tech

Adult Health and Fitness: State of the Art Programs in Exercise, Nutrition, and Stress Management. T. Branner, University of North Carolina at Chapel Hill.
Richland/Fairfield - Chair: Don Franks, Louisiana State University

*This abstract was selected by the reviewers as one of the top 30 abstracts out of 88 submissions.

The Cardiovascular and Behavioral Risks Associated with Anabolic Steroids. J. Rejeski, Wake Forest University; P. Brubaker, Temple University; E. Gregg, Wake Forest University; A. Weyrich, Bowman Gray School of Medicine.
Saluda/Calhoun - Chair: Bruce Gladden, University of Louisville

3:45 - 4:45 TUTORIAL

Plasma Loss During Exercise: Hydrostatic or Osmotic? P. Watson, University of South Carolina.
A-V Room - Chair: J. Larry Durstine, University of South Carolina

3:45 - 5:15 FREE COMMUNICATIONS - Muscular Strength and DOMS
Newberry - Chair: Art Weltman, University of Virginia

(3:45 - 4:00) **29** ***Specificity of Lumbar Extension Strength Training.** S.H. Leggett, J.E. Graves, M.L. Pollock, D. Foster, D.M. Carpenter, and R. Vuoso, University of Florida.

(4:00 - 4:15) **30** ***Effect of Training with Pelvic Stabilization on Lumbar Extension Strength.** J. Graves, D. Webb, M. Pollock, J. Matkozich, S. Leggett, D. Carpenter, and J. Cirulli, University of Florida.

(4:15 - 4:30) **31** ***Changes in Peak Torque, Limb Volume and Delayed Onset Muscle Soreness Following Repetitive Eccentric Contractions.** D.T. Evans, L.L. Smith, T.C. Chenier, R.G. Israel, M.R. McCammon, and M.E. Franklin, East Carolina University.

(4:30 - 4:45) **32** ***Concentric and Eccentric Strength Loss and Recovery Following Exercise-Induced Muscle Soreness (EIMS).** J.W. Yates and W.J. Armbruster, University of Louisville.

(4:45 - 5:00) **33** **The Responses of Alanine Aminotransferase and Total Creatine Kinase Activity to an Acute Bout of Swim Training.** M.C. Washam, M.H. Bean, M. Hall, H.M. Neisler, and W.R. Thompson, The University of Southern Mississippi.

(5:00 - 5:15) **34** **Serum Creatine Kinase in Competitive Swimmers during a Competitive Swimming Season.** M.H. Bean, H.M. Neisler, W.R. Thompson, M.J. Hall, and J.T. Johnson, University of Southern Mississippi, and North Mississippi Medical Center.

*This abstract was selected by the reviewers as one of the top 30 abstracts out of 88 submissions.

5:15 - 5:30 BREAK - Beverages/last chance to visit exhibits

5:30 - 6:30 PRESIDENT'S ADDRESS

Lyle J. Micheli, M.D.
Harvard Medical School
"Sports Injuries in Children: Changing Patterns"
Salon B

6:30 - EXERCISE, DINNER, REUNIONS!

SEE AND ENJOY COLUMBIA!

Saturday, February 3

8:30 - 10:30 REGISTRATION
Foyer

9:00 - 11:45 POSTER PRESENTATIONS, Group 3 (#71 through 82)
Authors present from 10:45 to 11:45
Lobby area outside Salon A and B

9:00 - 10:30 FREE COMMUNICATIONS - CV Response and Methods
Newberry - Chair: Scott Powers, University of Florida

(9:00 - 9:15) **35** ***Aortic Blood Flow Velocity Responses to Anaerobic Power Testing Using Cycle Ergometry.** W.D. Franke, S.A. Smith, K.P. Davy, and J.H. Williams, Virginia Tech.

(9:15 - 9:30) **36** ***Arterial Pressure and Plasma Volume Loss During Exercise in Swine.** D.R. Dengel, K.I. Norton, and R.B. Armstrong, The University of Georgia.

(9:30 - 9:45) **37** **A Comparison of Cardio-Respiratory Dynamics in Three Groups of Children: Swimmers, Gymnasts, and Non-Athlete Controls.** F.J. Servedio, T. Boone, and W.H. Poole, The University of Southern Mississippi.

(9:45 - 10:00) **38** ***Validity and Reliability of Pulse Oximetry in Highly-Trained Endurance Athletes.** G. Warren, K. Cureton, W. Middendorf, C. Ray, and J. Warren, University of Georgia, and St. Mary's Hospital, Athens, GA.

*This abstract was selected by the reviewers as one of the top 30 abstracts out of 88 submissions.

(10:00 - 10:15) **39** **Reliability of Electrical Bioimpedance Cardiography in the Measurement of Cardiac Output During Steady State Exercise.** L.A. Strzepek, D.L. Spitler, L.R. Reider, G.S. Goodwin, and M.E. Knafelc, University of Florida.

(10:15 - 10:30) **40** **Reliability of a Modified Acetylene Rebreathing Method for the Determination of Cardiac Output.** R.W. Braith, G.S. Goodwin, D.L. Spitler, L.R. Reider, L.A. Strzepek, J.E. Graves, and S.H. Leggett, University of Florida.

9:00 - 10:30 SEACSM STUDENT SYMPOSIUM

Victor Convertino, Ph.D.
Kennedy Space Center
"Research Opportunities Outside the University Setting"
Salon B

9:00 - 10:30 SYMPOSIA

Nutritional Ergogenic Aids Update: Facts and Fallacies. M. Davis, University of South Carolina, M. Williams, Old Dominion University, J. Walburgh, Virginia Tech; E. Haymes, Florida State University.
Richland/Fairfield - Chair: Mark Davis, University of South Carolina

Identification of Skillful Movement: A Biomechanical Approach. J. Hudson, S. Strohmeyer, M. Doll, University of North Carolina at Greensboro.
A-V Room - Chair: Kathy Simpson, University of Georgia

9:00 - 10:00 TUTORIAL

Stratifying Coronary Heart Disease Risk Using Exercise Testing. T. Sheffield, University of Alabama Medical Center.
Saluda/Calhoun - Chair: Russell Pate, University of South Carolina

10:30 - 10:45 BREAK - Walk Time

10:45 - 11:45 TUTORIALS

Issues in Muscle Studies Related to Isolation of the Circulation and the Use of Artificial Perfusates. W.N. Stainsby, University of Florida.
Saluda/Calhoun - Chair: Bob Armstrong, University of Georgia

A Lactate Carrier in Skeletal Muscle Membrane? L. B. Gladden, Auburn University.
Richland/Fairfield - Chair: Robert McMurray, University of North Carolina-Chapel Hill

Back Injuries in the Young Athlete. Lyle J. Micheli, M.D., Harvard Medical School.
A-V Room - Chair: Dennis Wilson, Auburn University

Problems and Issues in the Noninvasive Measurement of Cardiac Output During Exercise. Diane L. Spitler, University of Florida.
Salon B - Chair: Paul Ribisl, Wake Forest University

10:45 - 11:45 FREE COMMUNICATIONS - Exercise Evaluation
Newberry - Chair: Gay Israel, East Carolina University

(10:45 - 11:00) **41** ***The Prediction of Maximal Oxygen Consumption in Young Black Males.** T.J. Zehnder, M.J. Berry, and C.B. Berry, Wake Forest University.

(11:00 - 11:15) **42** ***Validation of the 12-Minute Swim as a Field Test of Maximal Aerobic Power.** D.S. Conley, K.J. Cureton, D.R. Dengel, and P.G. Weyand, The University of Georgia.

(11:15 - 11:30) **43** **Validation of Work Rate Settings on the Stairmaster 4000 and Comparison of Heart Rate Responses at Similar Work Rates on the Treadmill.** E.T. Howley, D. Colacino, and T. Swensen, The University of Tennessee.

(11:30 - 11:45) **44** **Use of Recovery VO2 to Predict Running Economy.** D. Morgan, J. Daniels, P. Carlso, and K. Filarski, The University of North Carolina at Greensboro.

12:00 - 2:00 SEACSM LUNCHEON
Salon A

SEACSM LUNCHEON SPEAKER

Ethan R. Nadel, Ph.D.
Fellow, Professor of Epidemiology and Physiology
John B. Pierce Foundation Laboratory
"Physiological Considerations for Human Powered Flight"

2:00 - SEACSM EXECUTIVE BOARD MEETING

2:00 - HAVE A SAFE TRIP HOME

*This abstract was selected by the reviewers as one of the top 30 abstracts out of 88 submissions.

1990 SEACSM AUTHOR-ABSTRACT INDEX

Columbia SC

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from 10:45 to 11:45
Lobby Area outside
Salon A and B

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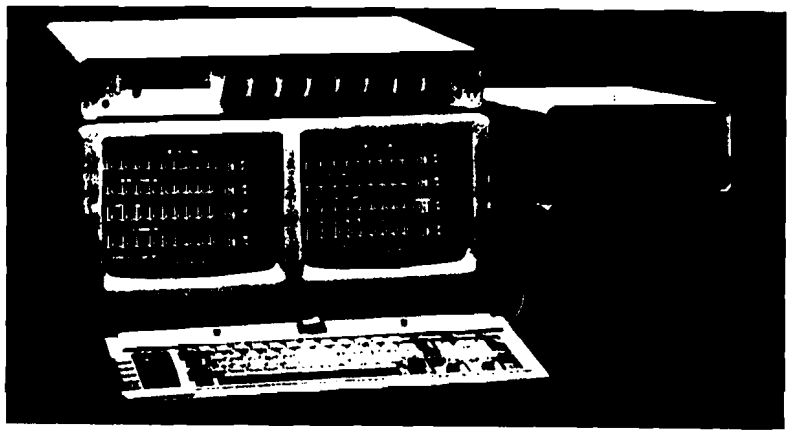

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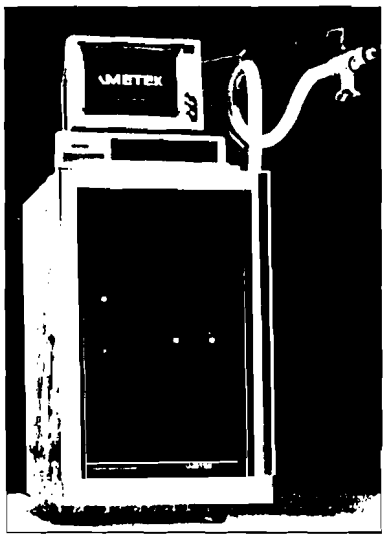

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1

TRAINING AND KINETIC FACTORS ASSOCIATED WITH PATELLOFEMORAL PAIN IN RUNNERS

S. E. Davis, S. P. Messier, W. W. Curl, and R. Lowery.
J. B. Snow Biomechanics Laboratory, Wake Forest University,
Winston-Salem, NC 27109

The purpose of this study was to determine whether a relationship exists between selected training and kinetic variables and the development of patellofemoral pain in runners. Recreational and competitive runners, who had been running a minimum of one year and four times weekly, volunteered as subjects. Sixteen subjects were classified as having patellofemoral pain (INJ) whereas 20 non-injured runners served as controls (NI). All runners completed a runners' history form for the collection of training data. Subjects were given adequate practice running along a 21.33 m instrumented runway at a speed equivalent to their average training pace. Running speed was monitored with a Lafayette Model 63501 photoelectric control system interfaced with a digital timer. Each subject ran on the runway and contacted an A.M.T.I. force platform with either the right or left foot in normal stride. A discriminant function analysis of the kinetic variables between the two groups revealed vertical impulse (mean ± se INJ = 257.70 ± 7.99; mean ± se NI = 234.46 ± 8.58) as a significant discriminator (U-Stat = .6218; Approx. $F(2, 22) = 6.690$, $p < .01$). In addition, descriptive statistics on the training variables illustrated three trends. First, approximately 18% more of the injured group ran on crowned roads as part of their training than the control group and second, approximately 20% more of the injured group ran on hills than the control group. Lastly, the control group had 33% more weekly mileage than the injured group.

2

MECHANICAL FACTORS CONTRIBUTING TO ELITE DISCUS THROWS

R.W. McCoy, Human Performance Lab., Physical Education Dept.
The College of William and Mary, Williamsburg, VA 23185

Five men and seven women elite discus throwers were examined to determine the kinematic parameters contributing to successful throws (men > 64 m; women > 57 m). Two-dimensional video recordings of two throws from each athlete from the 1989 U.S. National Championships were digitized at a frequency of 60 Hz (Peak Performance Tech.). Release parameters of the discus along with selected parameters of the throwers were calculated for each throw. These parameters included trunk angle, temporal patterns of the feet placement, and movement of the center of mass. Results of the discus release parameters indicated that the average of the successful throws ($\bar{x}$ = 65.34 m) compared to the least successful throws ($\bar{x}$ =58.64 m) had: 1) a lower angle of discus projection (women-29.4 to 35.5°; men-34.4 to 38.0°), 2) a higher horizontal velocity (women-22.11 to 19.59 m/s; men-21.47 to 19.54 m/s), and 3) a lower vertical velocity (women-12.41 to 13.93 m/s; men-14.71 to 15.37 m/s). Also observed for the more successful throws was the less time to place the left foot on the ground after the right foot to begin the delivery phase (women-0.18 to 0.26 s; men-0.17 to 0.22 s). These data illustrate some of the mechanical characteristics needed to achieve winning discus throws at an elite level.

Supported by a grant from the United State's Olympic Committee

3

IN-SHOE PRESSURE CHANGES DURING DOWNHILL WALKING AT VARIOUS SPEEDS

K. Simpson, S. Odum, and T. Shewokis. Biomechanics Lab., University of Georgia, Athens, GA 30602

The purpose of the study was to investigate the effect of downhill slope and walking speed on the plantar pressures of the foot during fitness walking. Five female fitness walkers who had a natural overground pace of 4.1 +/-.2 m/s were selected. Each subject performed 5 trials for each of 5 grades (0, -4, -8, -12, and -16%) and 3 speeds (3.8, 4.1 and 4.4 m/s) while walking on a treadmill. Pressures from 6 sensors on the bottom of the right foot were collected (200 Hz) using a Langer Electrodynography in-shoe pressure system. The peak pressures (PP) of the sensors for each subject and sensor were compared using a level x speed ANOVA ($p < .05$). The effect of level on the heel sensors demonstrated mixed results. There was, however, a trend to land with increased pressure on the heel with increased downhill slope. The 5th metatarsal PPs increased, and the medial forefoot (3rd, 2nd, and 1st metatarsal) pressures decreased. Most subjects demonstrated no significant speed differences for the heel sensors, but the PPs of the forefoot decreased. These results indicate that pressures during landing increase with increased downhill grades. PPs during propulsion decrease with increasing grade and speed. Although these results indicate grade and speed affect plantar pressures, these effects are influenced by the biomechanical requirements of treadmill walking.

4

COMPARISON OF EMG ACTIVITY IN THE SEMIMENBRANOSUS AND ERECTOR SPINAE MUSCLES UTILIZING THE DAVID AND NAUTILUS KNEE FLEXION MACHINES.

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The purpose of this study was to determine if there were any significant differences in the EMG activity of the erector spinae or semimembranosus muscles with respect to the DAVID and Nautilus knee flexion machines. Mechanically, the greatest difference between the two knee flexion machines is the operator's position. The Nautilus knee flexion machine places the operator in the prone position, whereas the DAVID knee flexion machine places the operator in the seated position. The peak EMG activity was standardized to percent of maximum voluntary isometric contraction for the respective muscle. The standardized EMG activity was then compared using paired t-test at the 0.05 alpha level. Both muscles showed a significant difference with respect to knee flexion machine utilized. The results of this study have implications to both the rehabilitation professionals and fitness conscious individual. The DAVID machine caused significantly less activity in the low back musculature and therefore may be safer for the average user of knee flexion machines.

5

DETERMINANTS OF HABITUAL PHYSICAL ACTIVITY IN A COOPERATIVE EXTENSION SERVICE POPULATION

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This study was conducted to assess the expected benefits and perceived barriers of regular exercise in an adult population group consisting of Cooperative Extension Service employees. Estimates of energy expenditure were also determined in an effort to characterize the degree of physical activity involvement. A questionnaire, using a five-point Likert scale (strongly disagree=1 to strongly agree=5) to rate a pool of 30 items related to the perceived benefits and barriers to exercise, was mailed to approximately 1,200 extension employees. A 7-day physical activity recall questionnaire was also included in the mailing. The response rate was 42.4% with an n=509. The distribution of the summated score for perceived benefit values ranged from 24 to 74 with a mean and SD of 55.19 $\pm$ 8.03. The major factors identified as expected outcomes of regular physical activity included: improve health ($\bar{x}$ = 4.33 + 0.68), stay in shape ($\bar{x}$ = 4.23 $\pm$ 0.72), release tension ($\bar{x}$ = 4.19 $\pm$ 0.83), and enhance self image ($\bar{x}$ = 4.15 $\pm$ 0.80). The distribution of the summated score for perceived barriers ranged from 15 to 75 with a mean score and SD of 42.50 $\pm$ 8.0. Those factors identified as the most common reasons for not exercising were not enough time ($\bar{x}$ = 4.25 $\pm$ 0.95), lack of motivation ($\bar{x}$ = 3.39 $\pm$ 1.11), family obligations ($\bar{x}$ = 3.39 $\pm$ 1.26), and too tired ($\bar{x}$ = 3.32 $\pm$ 1.17). Though the population group was diverse, the mean summated scores for the expected outcomes and perceived barriers to exercise were similiar based on age, sex, activity level and locality. The mean energy expenditure for the population group was 193 kcal/kg/wk with 93.7% considered inactive (<245 kcal/kg/wk) and only 10 individuals (2.0%) considered highly active (>280 kcal/kg/wk). Future physical activity programs for this population group should lead to improved health and body image. Incentives should be included to help overcome the barriers of time and effort needed to participate.

6

THE EFFECTS OF EXERCISE ON MURINE MACROPHAGE PHAGOCYTOSIS

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Acute and chronic exercise has been shown to adversely effect many components of specific immunity. However, studies on the effects of exercise on non-specific immunity are sparse, with the exception of the NK cell. Macrophages (Mϕ) play a central role in host defense against microorganisms and may be the most appropriate cell subset for studying the effects of exercise on immune status. Sixteen female C3H/HEN mice, 11 weeks of age, were divided into 3 groups. One group (T-EXH) ran on a treadmill at 28m/min until exhaustion (approx. 70min) following a 10 wk training protocol (26-32m/min, 30min/d, 5d/wk). A second untrained group (UT-EXH) similarly ran to exhaustion (approx. 58min) but only after a 2 wk treadmill adaptation period (8-10m/min, 10min/d, 3d/wk). A 3rd group acted as resting controls. Resident peritoneal Mϕ's were harvested 15-30 min post-exhaustion by lavage. $2x10^6$ Mϕ were prepared and incubated for 30 min with antibody coated flourescently labelled S. aureus (1:100). 5000 cells from each sample were analyzed on a flourescence activated cell sorter. Student's t-test results indicated that both T-EXH and UT-EXH mice had an increased peritoneal phagocytic potential when compared to controls (t = -2.7 and -2.4 for the T-EXH and UT-EXH, respectively, $p<.05$). There were no significant differences between the exercised groups. It remains to be seen if these differences are of physiologic importance in affecting susceptibility to illness. Likewise, the mechanism of this increased phagocytic potential awaits further investigation.

7

AN EVALUATION OF THE DAUGHTON AND FIX "HUMAN ACTIVITY PROFILE" FOR USE IN CLINICAL SETTINGS

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Several self-test quality of life instruments have been developed to assess a patient's relative degree of physical impairment. It was the purpose of this investigation to further evaluate the "Human Activity Profile" (Daughton & Fix, 1986), a 94-item profile ranging from very low (getting in and out of chairs or bed) to very high (running or jogging three miles in thirty minutes or less) energy level requirements. Two scores were developed: Maximum Activity Score (MAS, respondents current maximum activity level) and Adjusted Activity Score (AAS, an adjustment of the MAS in a case where the respondent has engaged in high energy activity yet has stopped several other activities of lesser demand). This study considered five samples -- young healthy (college students aged 17 to 25 years, n=92), old healthy (persons aged 60 years and over living independently, n=99), COPD patients (n=54), CHD patients (n=92), and a sample not considered by Daughton and Fix, the obese (n=100). A canonical discriminant function analysis was used to determine how successful the HAP was in predicting the subjects into their appropriate group. The young healthy were predicted back into their true group 89.1%, the old group 21.1%, the COPD group 59.3%, the CHD group 26.1%, and the obese group 44% of the time. Within the limitations of this study and of the instrument, the investigators conclude that without significant refinement, the HAP has little clinical significance.

8

EFFECTS OF SMOKING CESSATION ON BODY COMPOSITION

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This study examined the effects of smoking cessation on body weight (BW) and body fat (%BF). Thirteen males and 15 females who had smoked a minimum of 20 cigarettes per day for the past five years served as volunteers. One group (7 males, 10 females) abstained from smoking for a period of 30 days (ex-smokers), while a second group (6 males, 5 females) continued their typical smoking behavior for 30 days. An additional 7 males and 5 females who had never smoked served as controls (non-smokers). Body weight was measured at baseline and on days 6, 14, 22, and 30. Body fat was determined by hydrostatic weighing at baseline and again on day 30. As compared to baseline values, BW was significantly increased ($P<0.05$) by day 22 in both male and female ex-smokers, and %BF was significantly ($P<0.05$) higher at day 30 in female ex-smokers. No significant changes in BW or %BF were observed in the other two groups (smokers, non-smokers). These results indicate that unfavorable changes in body composition can occur rapidly following discontinuance of smoking and suggest that exercise intervention should be considered as a concomitant to smoking cessation.

9

METABOLIC RESPONSES TO HYPERGLYCEMIA DURING PROLONGED EXERCISE

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The metabolic responses to 2 hours of intense exercise (i.e; 73% maximal oxygen uptake) were compared in eight endurance trained subjects on two occasions, one week apart. During the hyperglycemic trial (HT), blood glucose concentration was maintained at approximately 10 mM. Comparisons were made to a control trial (CT) which elicited a normal blood glucose response (i.e. 4.6 mM at 20 min declining to 3.7 mM at 120 min). Hyperglycemia was attained early in exercise (by 11 min) and blood glucose concentration was maintained at 10.1±0.4 mM by a variable rate intravenous infusion of an 18% glucose solution. Plasma insulin concentration remained low (i.e. 7 µU/ml) during CT. During HT, plasma insulin was similar to CT during the first 40 min of exercise; yet increased above CT during the 60 to 120 min period ($P<0.01$), ranging from 16 to 24 µU/ml. During both trials, the RER was 0.88±0.01 at 10 min. During CT the RER declined to 0.84±0.01 by 120 min ($P<0.01$). During HT, the mean RER was maintained between 0.87-0.90 throughout the 2 hrs of exercise. Following the initial attainment of hyperglycemia, the glucose infusion rate was stable until 60 min, averaging 1.62±0.54 g/min. The glucose infusion rate increased throughout the second hr to 2.71±0.51 g/min by the end of exercise. Hyperglycemia (10 mM) during intense exercise for 2 hrs is characterized by the following responses: a) large amounts of exogenous glucose (1.62 g/min) is disposed of during the first hr despite normal plasma insulin concentration, and only a slightly greater total carbohydrate oxidation than CT (<0.23 g/min); (b) the increased exogenous glucose disposal during the second hr is associated with increases in plasma insulin and maintained carbohydrate oxidation.

10

EFFECTS OF POST-EVENT MASSAGE THERAPY ON REPEATED ULTRAENDURANCE CYCLING

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Post-event muscle massage therapy has been proposed to hasten recovery and improve ensuing performance. However, limited scientific evidence is available to substantiate these claims. Six elite cyclists competed in two four-day stage races (100-mile per day). During the first four-day event, subjects were assigned to receive either a 30-min post-event massage therapy or a 30-min microwave diathermy treatment (blind placebo) following each 100-mile race. Eighteen days later, the subjects repeated the four-day event with alternated post-event therapy. Races were performed on the Schwinn Velodyne computerized race simulator under laboratory controlled conditions with an average completion time of 275.6 +/-28.6 min. Massage and placebo data were analyzed by ANOVA for repeated measures with Newman-Keuls post-hoc analysis. No ($p<0.05$) differences were observed between the massage or placebo treatment groups in the following performance related variables: final or split times; oxygen uptake; ventilation; heart rate; ventilatory equivalent; respiratory quotient; mean arterial pressure; rate pressure product; rectal and skin temperature; rating of perceived exertion; and feeling scale. In addition, no $p<0.05$ differences were observed in the following pre-event, event, post-event, post-treatment, or 3-day post event blood parameters: CPK, LDH, SGOT, SGPT, CKMB, GGT, glucose, lactate, amonia creatinine, magnesium, phosphorus, serum carbon dioxide, total protein, blood urea nitrogen, total bilirubin, hematocrit, hemoglobin, sodium, potassium, calcium, and chloride. It can be concluded that post-event muscle massage therapy does not enhance recovery from ultraendurance cycling or improve subsequent performance.

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11

CHRONOTROPIC AND INOTROPIC ADAPTATIONS TO REPEATED ULTRAENDURANCE CYCLING

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Myocardial adaptations to repeated ultra-endurance cycling were examined in six elite cyclists competing in two, four-day, 100-mile per day races. Races were performed on a Schwinn Velodyne race simulator under controlled laboratory conditions. No significant ($p<0.05$) differences were observed among daily 100-mile performance times with a mean time of 275.6 +/-28.9 min. Chronotropic adaptations were determined by electrocardiography while global left ventricular inotropic compliance was measured using a 3 MHz continuous wave doppler. Mean 10-mile oxygen uptake ($\dot{V}O_2$), heart rate (HR), peak acceleration (PKA), peak velocity (PKV), and stroke distance (SD) data were statistically analyzed by repeated measures ANOVA with Newman-Keuls post-hoc procedures. Significant ($p<0.05$) differences among data are indicated as: (a) from Day 1; (b) from Day 2; (c) from day 3; and, (d) from day 4. Data were:

	Day 1	Day 2	Day 3	Day 4
$\dot{V}O_2$ $l \cdot min^{-1}$	4.24+/-.4 bd	4.39+/-.3 acd	4.27+/-.4 bd	4.60+/-.3 abc
HR $b \cdot min^{-1}$	150+/-5 bcd	142+/-6 acd	140+/-6 ab	140+/-5 ab
PKA m/s/s	62.5+/-5 cd	62.1+/-5 cd	65.8+/-5 ab	65.6+/-3 ab
PKV m/s	1.06+/-.1 cd	1.08+/-.1 cd	1.13+/-.1 ab	1.14+/-.1 ab
SD cm	8.29+/-.2 bcd	9.29+/-.8 acd	9.79+/-.5 ab	9.98+/-.7 ab

Results demonstrate that the heart responds to repeated ultraendurance exercise with a decreased chronotropic (HR) and an increased global inotropic activity (PKA) resulting in an increased stroke volume (PKV,SD) in order to maintain cardiac output.

Supported by the Wellness Institute and Research Center, Old Dominion U., Quinton Instruments, and Sentara Leigh Hospital, Kinetix Center

12

EFFECTS OF REPEATED ULTRAENDURANCE CYCLING ON PULMONARY FUNCTION

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Prolonged exercise has been assumed to promote respiratory muscle fatigue, diminish pulmonary function, and contribute to a decreased ventilatory compliance during prolonged exercise. Pre-event and post-event pulmonary function tests were performed on six elite cyclists competing in two separate four-day stage races (100-mile per stage). Each 100-mile race was performed on the Schwinn Velodyne computerized race simulator under controlled laboratory conditions with an average completion time of 275.6 +/-28.9 min. Minute ventilation averaged 99.6 +/-12.2, 102.4+/-6.8, 100.6+/-10.3, and 109.3+/-8.5 $l \cdot min^{-1}$ during Day 1, Day 2, Day 3, and Day 4, respectively. Functional vital capacity (FVC), forced expired volume in the first second (FEV1), FEV1/FVC, and 12 second maximal voluntary ventilation (MVV) were analyzed by repeated measures ANOVA with Newman-Keuls post-hoc procedures. Data were as follows:

		Day 1	Day 2	Day 3	Day 4
FVC	PRE	6.60+/-.8	6.52+/-.5	6.35+/-.7	6.40+/-.9
l	POST	6.37+/-1.1	5.96+/-.8	6.23+/-.8	6.46+/-1.0
FEV1	PRE	5.16+/-.7	5.06+/-.6	4.86+/-.6	4.99+/-.7
l	POST	5.00+/-1.0	4.68+/-.7	4.91+/-.7	5.13+/-.9
FEV1/FVC	PRE	78.2+/-3.7	77.2+/-5.4	76.6+/-4.5	77.9+/-4.3
%	POST	78.3+/-6.8	78.5+/-6.0	79.1+/-3.0	79.6+/-6.7
MVV	PRE	253+/-49	228+/-36	231+/-37	222+/-40
$l \cdot min^{-1}$	POST	243+/-36	233+/-28	240+/-24	237+/-39

Results revealed no ($p<0.05$) differences between pre-event and post-event responses or among Day 1, Day 2, Day 3, or Day 4 Ve, FVC, FEV1, FEV1/FVC and MVV values. Results demonstrate that ultraendurance exercise does not educe respiratory muscle fatigue or alter pulmonary function which may affect ventilatory compliance during exercise.

Supported by the Wellness Institute and Research Center, Old Dominion U. and Sentara Leigh Hospital, Kinetix Center

13

DIFFERENCES IN THE EXERCISE VENTILATORY RESPONSES BETWEEN BLACKS AND WHITES

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Previous research has shown differences in the ventilatory adaptations to exercise when comparing Black and White children. To determine if these differences continue to exist in adulthood, 7 Black adult males and 7 White adult males completed a progressive incremental exercise test on a cycle ergometer. Initial power output was set at 0 watts and increased by 30 watts each minute. Minute ventilation ($\dot{V}E$) and its components, tidal volume (VT) and breathing frequency (fB), along with the ventilatory flow pattern were monitored on a breath-by-breath basis. Maximal oxygen consumption was not significantly different between the Black and White groups (3.10 ± 0.45 and 3.28 ± 0.50 $l \cdot min^{-1}$, respectively) nor was maximal $\dot{V}E$ (120.4 ± 22.7 and 119.8 ± 33.6 $l \cdot min^{-1}$, respectively). As compared to Whites, Blacks were found to have a significantly lower VT (2.45 ± 0.49 vs. 3.01 ± 0.61 l) and a significantly higher fB (49.7 ± 6.7 vs 40.3 ± 7.8 breaths $\cdot min^{-1}$) at maximum exercise. These increases in breathing frequency were mediated by a decrease in both inspiratory time (TI) and more importantly expiratory time (TE). Both TI and TE were shorter in Blacks than Whites at maximum exercise. The inspiratory flow rate (VT/TI) was not significantly different between the Blacks and the Whites at maximum exercise (4.10 ± 1.36 and 4.35 ± 0.77 $l \cdot sec^{-1}$, respectively). During submaximal exercise, $\dot{V}E$ was not significantly different between Blacks and Whites at low power outputs. However, at higher power outputs $\dot{V}E$ tended to be higher in the Blacks. At all power outputs Blacks had a slightly lower VT and higher fB. The increased $\dot{V}E$ in Blacks at the higher power outputs was associated with a disproportionately higher fB. Mean inspiratory flow rates were not significantly different between Blacks and Whites at any power output. These results demonstrate differences in the ventilatory patterns of Blacks and Whites during submaximal and maximal exercise. These differences should be considered when evaluating the ventilatory responses of Blacks to incremental exercise.

14

LUNG DIFFUSING CAPACITY IN HIGHLY-TRAINED ENDURANCE ATHLETES

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It has been hypothesized that a diffusion limitation exists in the lungs of athletes exhibiting exercise-induced hypoxemia. However, the critical measurements necessary to support this hypothesis have not been reported. The objective of this study was to measure lung diffusing capacity for carbon monoxide (DLCO in ml/min/mm Hg), pulmonary capillary blood volume (Vc in ml), and membrane diffusing capacity (Dm in ml/min/mm Hg) in highly-trained endurance athletes. DLCO was measured in 16 males (mean $\dot{V}O_{2max}$ = 4.90 l/min; mean minimum HbO2% = 91.5%) while at rest and cycling at work loads designed to elicit 55, 65, 75, 85, and 95% $\dot{V}O_{2max}$. DLCO was measured using the single-breath technique and was performed twice on each athlete to allow determination of Dm and Vc, once while breathing a 21%02/79%N2 gas mixture and once with a 89%02/11%N2 mixture.

	Rest	55%	65%	75%	85%	95%
DLCO (21% 02)	46.3	68.8	77.1	80.2	79.5	85.1
DLCO (89% 02)	19.5	28.2	30.5	33.0	34.2	37.7
Vc	100	151	164	177	189	215
Dm	91	100	118	123	110	112

There was no tendency for either Vc or DLCO to level off with increasing $\dot{V}O2$ within individuals (p=0.0001). It was concluded that it was unlikely that a diffusion limitation could explain the desaturation observed in these athletes.

15

INCIDENCE OF EXERCISE-INDUCED HYPOXEMIA IN MALE AND FEMALE ATHLETES

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Relatively little is known about the incidence rate of exercise-induced hypoxemia (EIH) in athletes, especially in females. The objective of this study was to estimate the incidence rate of EIH in well-trained males and females (i.e., running $\geq$ 40 miles/wk or cycling $\geq$ 150 miles/wk). Eighty one athletes (68 males and 13 females) performed a VO2max test using an aggressive protocol (i.e., work time of 6-8 min) on a cycle ergometer or treadmill. Minimum HbO2% was estimated by pulse oximetry (SpO2%). One of two pulse oximeters (Novametrix 500 or Criticare 501+) was utilized. Of the 28 males with a VO2max exceeding 65 ml/kg/min, 54% desaturated (i.e., minimum Sp02% $\leq$ 90%). Of the lesser trained males (i.e., VO2max < 65 ml/kg/min), only 20% desaturated. Of the 7 females with a VO2max exceeding 55 ml/kg/min, 71% desaturated. Of the lesser trained females, 33% desaturated. In addition, 16 males (mean VO2max = 68 ml/kg/min, 9 with SpO2% $\leq$ 90%) had arterial blood withdrawn while cycling at 95% VO2max. Hb02% was determined using a Corning 2500 CO-oximeter. None of the 16 athletes exhibited a HbO2% less than 90.3%. The mean HbO2% of the 9 "desaturating" athletes was not significantly different from that of the 7 other athletes (91.8% vs. 91.1%). In addition, the minimum SpO2% observed on the VO2max test could not predict the HbO2% observed at 95% VO2max (r = -O.46, p = 0.07). It was concluded that by relying on pulse oximetry, the incidence rate of EIH may have been overestimated in this study as well as in others.

16

THE EFFECT OF CONTINUOUS AND INTERMITTENT EXERCISE ON BLOOD AND SWEAT LACTATE CONCENTRATIONS

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The purpose of this study was to determine if a relationship exists between sweat lactate concentrations and blood lactate concentrations during exercise. Eight males served as subjects for the experimental testing protocol. All subjects performed continuous exercise on a bicycle ergometer at 60% VO_2 max and intermittent exercise at 100% VO_2 max to create variable blood lactate concentrations. The exercise bouts were 60 minutes in duration and were separated by approximately one week. Measurements of blood lactate were taken at 20, 40, and 60 minutes of exercise and sweat lactate was measured via whole body washdown. There was no significant difference in sweat lactate concentrations (P = 0.49) between continuous (92.4 +- 34.9 mg/dl) and intermittent exercise (80.9 +- 23.2). Blood lactate concentrations for intermittent exercise (50.0 +- 4.8) was significantly higher (P = 0.0082) than those for the continuous exercise (25.6 +- 3.6). Regression line analysis showed no significant relationship between sweat and blood lactate concentrations (r = .30). These results indicate that a significant correlation does not exist between sweat lactate concentrations and blood lactate concentrations.

17

THE EFFECT OF EXERCISE INTENSITY ON PLASMA BETA-ENDORPHIN

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The purpose of this study was to determine the effect of exercise intensity on plasma Beta-endorphin (B-EP). Seven endurance-trained male subjects completed three experimental trials (counterbalanced) on an electronically braked cycle ergometer. The subjects were blind to the intensity of the exercise and were told the duration of the bout approx. 30 min prior to the onset of exercise. Two trials consisted of cycling for 30 mins at 60 and 80% of their pre-determined VO_2max. A third trial (control) called for the subjects to merely sit on the cycle for the required 30 mins. Blood samples were obtained from an indwelling catheter at 20 min post-cath. (pre), 7, 14, 21, 28, and rec 20 (post). Resting B-EP were similar across treatments (9.1 $\pm$ 1.3 pmol/l). B-EP during the control and 60% trials remained unchanged. Cycling at 80% of VO_2max increased B-EP to 25.4 $\pm$ 9.1 pmol/l ($p < .05$) at min 14 and 55.7 $\pm$ 22.6 pmol/l ($p < .01$) by min 28. Post-exercise B-EP returned to near resting levels. These data illustrate the intensity-dependent manner of plasma Beta-endorphin levels.

18

EFFECT OF PASSIVE EXERCISE ON CARDIOPULMONARY MEASURES

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The purpose of this study was to investigate the effects of passive exercise on ventilatory and cardiovascular measures. Thirty healthy college-age male subjects were seated in a chair with the legs fully extended while attached to a Beckman Metabolic Measurement Cart, electrocardiograph, and sphygmomanometer. After resting for five minutes, heart rate (HR) and ventilatory data were collected for 10 minutes. At the tenth minute, the CO_2 rebreathing procedure (plateau method) allowed for the calculation of cardiac output and related measures. Upon completion the legs were passively raised 45° by a pulley device. Upon completion of data collection for 10 minutes the legs were passively lowered. Subjects rested for 10 minutes while data were collected for a third time. ANOVA for repeated measures revealed significant ($p<0.05$) increases in minute ventilation (V_E), frequency of breaths (F_b), oxygen consumption (VO_2), carbon dioxide production (VCO_2), stroke volume (SV), cardiac output (Q), systolic blood pressure (SBP), and diastolic blood pressure (DBP) when the legs were raised and subsequent decreases when the legs were lowered. Significant ($p<0.05$) decreases were observed for ventilatory equivalent of carbon dioxide ($V_{EQ}CO_2$), arterial-mixed venous oxygen difference (a-vO_2 diff), mixed venous PCO_2 ($PvCO_2$), and arterial-mixed venous carbon dioxide difference (a-vCO_2 diff). No changes were observed for tidal volume (TV), fraction of expired oxygen (F_EO_2), fraction of expired carbon dioxide (F_ECO_2), ventilatory equivalent of oxygen ($V_{EQ}O_2$), respiratory exchange ratio (RER), heart rate (HR), and arterial PCO_2 ($PaCO_2$). These data suggest passive exercise increases venous return to the heart which subsequently may cause an adjustment in ventilation and stroke work by heterometric autoregulatory mechanisms.

19

THE KENYON PHYSICAL ACTIVITY ATTITUDE SCALE AND THE MYERS-BRIGGS TYPE INDICATOR AS POTENTIAL INSTRUMENTS FOR IDENTIFYING EXERCISE COMPLIERS

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Instruments which assist in recognizing individual probability of exercise compliance are needed. The purpose of this post hoc analysis of data was to determine if the Kenyon Physical Activity Attitude Scale (PAAS) and Myers-Briggs Type Indicator (MBTI) scores of a group of subjects who chose to enroll in physical education classes (n 21) were different from the scores of a group of subjects who did not choose to enroll in physical education classes (n 39). Each subject was paid a small stipend to participate. The groups are referred to as A (voluntary enrollees in physical education) and B (not enrolled). The MBTI scores were not statistically different between Group A and Group B. However, statistical analysis by t-tests for independent samples yielded mean differences between the groups ($p < .05$) on PAAS for Health and Fitness ($\bar{x}$ of A = 11.6 $\pm$ 6.3, B = 7.4 $\pm$ 4.5), Pursuit of Vertigo ($\bar{x}$ of A = 10.3 $\pm$ 7.6, B = 6.7 $\pm$ 5.9) and Catharsis ($\bar{x}$ of A = 9.2 $\pm$ 5.3, B = 5.8 $\pm$ 4.0). A treadmill evaluation for time (min) using a Balke protocol (3.4 miles/hour and 2% elevation in grade every 2 minutes) and skinfold measures for estimating body composition (% fat) were also administered to each subject. The subjects in group A endured longer on the treadmill ($\bar{x}$ of A = 18.4 $\pm$ 5.1, B = 15.2 $\pm$ 4.7) and were less fat ($\bar{x}$ of A = 12.4 $\pm$ 6.3, B = 16.4 $\pm$ 5.9). Both differences were significant ($p < .05$). The heart rate of each subject at the end of the treadmill evaluation was converted to a percentage of predicted maximum heart rate to determine if a difference in relative effort existed between the two groups. Relative effort did not differ ($\bar{x}$ of A = 94.6 $\pm$ 6.5, B = 93.1 $\pm$ 7.6). These data show promise for PAAS as an instrument for recognizing individual probability of exercise compliance.

20

CALORIC INTAKE AND EXPENDITURE IN MALE AND FEMALE RUNNERS

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Examination of the data regarding caloric intake and expenditure in female athletes consistently demonstrate an imbalance, with females expending more calories than consuming. However, this imbalance does not result in weight loss as would be expected. The purpose of this study was to further examine this question and compare energy intake and expenditure in male and female runners. Daily caloric consumption (kcal-c) and expenditure (kcal-e) were determined in 113 male and 61 female runners, divided into 2 mileage groups: High (H = $\geq$ 20 mi/wk) and Low (L= < 20 mi/wk). In addition, energy expenditures during 2 submaximal exercise intensities were measured. Results of daily caloric intake, daily expenditure and expenditure per kilogram (kg) of body weight are provided below:

Group	kcal-c *	kcal-e *	kcal-e/kg **
Males-L	2481 $\pm$ 913	2898 $\pm$ 395	37.8 $\pm$ 4.2
Males-H	2280 $\pm$ 635	2899 $\pm$ 419	40.1 $\pm$ 4.1
Females-L	1817 $\pm$ 552	2163 $\pm$ 465	38.1 $\pm$ 3.6
Females-H	1800 $\pm$ 731	2375 $\pm$ 495	42.6 $\pm$ 7.0

* Gender difference ** Mile group difference ($p < .05$)

Although females expended significantly less kcal/day than males, the difference disappeared when expressed as kcal/kg. Data from submaximal exercise indicate that females expended significantly less kcals/min than males ($p < .05$), however, when expenditure was expressed per kg of body weight the females actually expended more kcals than males at one of the submax intensities ($p < .05$). The data from this study show greater expenditure than intake for both males and females. In addition, when kcals were expressed per kg of body weight, gender differences disappeared.

21

PHYSICAL ACTIVITY AND FITNESS IN ADULTS GROUPED BY PERCENT BODY FAT.

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Comparisons in physical fitness and physical activity between subjects grouped by percent body fat were made in 28 men and 50 women (X age, 39 ± 9 yrs). Percent fat was determined by hydrostatic weighing. Body fat ranged from 9.8 to 49.1% and were grouped as follows: <20% (n = 29), 20-30% (n = 27), >30% (n = 22). Data averaged over one year from treadmill exercise tests (VO2 max), body weight, Caltrac Accelerometer (CALTOT), Caltrac activity units (CALACT), a four-week history modification of the Minnesota Leisure Time Physical Activity questionnaire (FWH), and the College Alumnus questionnaire (sport activities, SPORTS; watching tv, TV; riding in a car, (CAR) were used to compare activity and fitness differences among body fat groups. Results from regression analysis, adjusted for age and gender, are

PERCENT FAT	>30%	20-30%	<20%	P < .05
VO2 MAX (ml/kg/min)	32.0 ± 1.4	36.9 ± 1.2	41.4 ± 1.3	(1vs2)(2vs3)(1vs3)
WEIGHT (kg)	90.4 ± 2.6	74.6 ± 2.2	63.6 ± 2.6	(1vs2)(2vs3)(1vs3)
CALTOT (kcal/day)	2502 ± 65	2291 ± 57	2088 ± 64	(1vs2)(2vs3)(1vs3)
CALACT (AU/day)	1.91 ± 0.03	1.80 ± 0.03	1.75 ± 0.03	(1vs2,3)
TOTAL FWH(kcal/day)	417 ± 50	440 ± 43	527 ± 49	NS
HEAVY FWH(kcal/day)	85 ± 26	132 ± 22	142 ± 25	NS
LIGHT FWH(kcal/day)	71 ± 9	74 ± 8	90 ± 9	NS
SPORTS(kcal/week)	534 ± 262	1025 ± 231	1653 ± 259	(1vs3)
TV (hours/week)	11 ± 1.6	9.9 ± 1.5	6.9 ± 1.6	NS
CAR (hours/week)	7.9 ± 1.1	8.9 ± 1.0	5.6 ± 1.1	(2vs3)

As anticipated, body fatness was inversely related to physical fitness and directly related to sports participation and time spent in sedentary activities. Lower Caltrac scores in the leaner subjects suggests the Caltrac may be an insensitive measure of activity patterns in more active persons.

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22

THE EFFECTS OF AEROBIC CIRCUIT TRAINING ON METABOLIC CONTROL, LIPID PROFILES AND CARDIOVASCULAR FITNESS IN ADOLESCENT TYPE I INSULIN DEPENDANT DIABETICS.

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Twenty-one adolescent males, 9 with IDDM (D) and 12 non-diabetics (ND) participated in a 12-week aerobic circuit training program. The circuit included five, 3 minute aerobic stations each followed by a 1-minute rest period and twenty-four 30-second calesthenic, flexibility and weight training stations, each followed by a 30-second rest. Subjects were assessed prior to and following training for VO_2 max, cardiac output (Q), glycosylated hemoglobin (HbAlc), HDL-C, LDL-C and time to maximum on a stress test. The results included:

Variable	Group	Pre	Post
VO_2 max	D	40.53 ± 5.8	44.80 ± 5.1***
($ml \cdot s \cdot kg^{-1} min^{-1}$)	ND	41.55 ± 7.1	46.65 ± 5.2***
Q rest	D	5.76 ± .92	6.46 ± 1.2**
($L \cdot min^{-1}$)	ND	6.02 ± .77	7.60 ± .41***
HbAlc	D	7.72 ± 1.26	6.76 ± 1.07*
(%)	ND	4.50 ± .45	4.47 ± .60
HDL-C	D	55.7 ± 17.1	57.88 ± 13.0
($mg \cdot dl^{-1}$)	ND	46.0 ± 9.1	52.25 ± 12.1*
LDL C	D	114.22 ± 26.0	100.44 ± 25.1*
($mg \cdot dl^{-1}$)	ND	108.6 ± 26.8	100.16 ± 31.6
Time to Max	D	512.11 ± 120	623.11 ± 120**
(seconds)	ND	627.33 ± 73	740.66 ± 65.8**

* p<.05 ** p<.01 *** p<.001

Conclusion: Aerobic circuit training is effective in improving metabolic control, lipid profiles and cardiorespiratory fitness in adolescent IDDM patients. In addition, these patients may safely participate in aerobic circuit training and exhibit training responses comparable to those observed in non-diabetic subjects.

23

RIBOFLAVIN STATUS OF FEMALE ATHLETES

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Riboflavin (B2) status of female athletes (A) (n=13) and untrained females (U) (n=14) was assessed. A and U were similar in age, ht and wt. Subjects ingesting large quantities of B2 were excluded from the study. Dietary information was obtained via three-day weighed food records and evaluated for B2 and caloric content. B2 status was evaluated using the erythrocyte glutathione reductase activity coefficient (EGRAC) and urinary B2 excretion (total 24 hr excretion and B2 excretion/g creatinine). Results indicated total B2 intake/24 hr was greater ($p<0.05$) in A than U (1.9±0.9 mg and 1.2±0.2 mg, respectively) (x+SD). However, no difference in intake was noted when B2 consumption was expressed per 1000 kcal consumed (1.0±0.4 mg, 0.9±0.2 mg, A and U). All subjects had normal EGRAC. However, A tended to have slightly higher ($p<0.1$) EGRAC when compared to U (1.06±0.06 vs 1.01±0.07). Total B2 excretion/24 hr was not different (98±51 mcg, 86±16 mcg, A vs U), although B2 excretion/g creatinine was somewhat ($p<0.1$) lower in A (63±26 mcg/g) than in U (82±28 mcg/g). Five A and five U subjects with B2 intakes near Recommended Dietary Allowance (0.6 mg, 0.7 mg/1000 kcal, respectively) were compared. No differences were noted for EGRAC (1.06±0.06, 1.03±0.07, A and U) or total B2 excretion (73.4±20.0 and 90.0±6.0 mcg/24 hr, A and U). However, A excreted less ($p<0.05$) B2/g creatinine than did U (50.8±15.5 and 81.3±16.7 mcg/g, respectively). While A in the present study maintained adequate B2 status from dietary intake alone, B2 status in A could have been somewhat improved as compared to U subjects.

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24

LEFT VENTRICULAR RESPONSE TO WEIGHT LIFTING IN ENDURANCE TRAINED MEN

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To determine whether endurance trained (ET) athletes have a diminished left ventricular (LV) response to strenuous weight lifting (WL) when compared to untrained (UT) counterparts 2D-guided M-mode echocardiograms (EC) were analyzed 20 s post WL. Systolic (Ds) and diastolic (Dd) cavity diameter, shortening fraction (SF) and shortening velocity (SV) were measured on age- and weight-matched ET (n=12) and UT (n=11) men. The WL protocol (knee extensions) was performed as follows:

Set 1	(10 s rest)	Set 2	(10 s rest)	Set 3
60% 1-RM @ 8 reps		60% 1-RM @ 8 reps		60% 1-RM to fatigue

Both groups performed equally on estimated work ($\bar{x}$ = 4.9 ± 0.9 KJ); MAP ($\bar{x}$ = 117.5 ± 9.7 mmHg); and HR ($\bar{x}$ = 124.7 ± 29.9 bpm). There were no differences between groups on EC variables at rest and exercise. The groups decreased Ds and Dd ($P<0.01$) by an average of 21% and 8%, respectively, and increased SV and SF ($P<0.01$) by an average of 110% and 27%, respectively. The ET subjects in this study did not decrease LV function during WL at similar work outputs and MAP compared to UT subjects when performing maximal weight lifting.

25

CARDIAC OUTPUT DURING SUBMAXIMAL CYCLING EXERCISE IN YOUNG AND ELDERLY INDIVIDUALS.

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The purpose of this study was to compare the cardiac output ($\dot{Q}$) response of young adults (Y), 18-35 years, and elderly adults (E), 60-77 years, during submaximal steady state exercise. All subjects performed a screening treadmill test to maximal exertion. On a subsequent day, subjects were monitored during seated rest on a cycle ergometer for 10 minutes followed by 20 minutes exercise (60% heart rate reserve, Karvonen). Heart rate (HR) and stroke volume (SV) were measured by impedance cardiography (Minnesota) and $\dot{Q}$ calculated twice during rest and steady state exercise. Differences between the groups were analyzed by paired t-Test techniques ($p<0.05$). Average $\dot{V}02$ for exercise was 32.7 ± 4.5 ml.kg-1.min-1 Y men, 29.5 ± 6.1 ml.kg.-1.min-1 Y women, 19.2 ± 13.3 ml.kg-1.min-1 E men, 13.5 ± 3.6 ml.kg-1.min-1 E women. E subjects had significantly lower resting SV and $\dot{Q}$ compared to Y. Women had lower SV and $\dot{Q}$ than the men in each age category. Mean resting $\dot{Q}$ for all subjects ranged from 3.0-5.6 l.min-1. During exercise E subjects had significantly lower HR and $\dot{Q}$ although no differences in SV were noted between age groups. Mean exercise $\dot{Q}$ were 12.5 ± 5.76 l.min-1 for Y men, 11.9 ± 4.46 l.min-1 for Y women, 10.8 ± 4.40 l.min-1 for E men, and 7.2 ± 3.86 l.min-1 for E women. The lower cardiac output demonstrated by the elderly subjects was a function of lower heart rate. Cardiac output response to submaximal exercise is limited by aging trends in maximal heart rate. The results of this study support maintained stroke volume despite decreased chronotropic capacity in healthy elderly adults during submaximal cycling exercise.

26

AGE EFFECTS ON SYSTOLIC BLOOD PRESSURE INDEX DURING RECOVERY FROM SUBMAXIMAL EXERCISE

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To evaluate the effects of age on peripheral cardiovascular function, systolic blood pressure index (SBPI) was measured during 15 minutes of recovery following 20 minutes of submaximal exercise (60% of heart rate reserve, Karvonen). The measurements were performed on two groups: 26 young subjects (Y), aged 18-35 years, and 51 elderly subjects (E), aged 60-77 years. Arm and ankle blood pressures were taken by auscultation twice during ten minutes of rest (preceding 20 minutes of cycling), immediately post exercise (IPE), and during recovery minutes 1, 2, 3, 4, 5, 7.5, 10, 12.5, and 15. SBPI was calculated as the ratio of ankle systolic blood pressure to arm systolic blood pressure (ASBP). T-tests were performed to determine significant differences in SBPI between the groups at each measurement time. Mean resting values of SBPI were 1.42 SEM 0.03 and 1.34 SEM 0.03 for Y and E respectively. At IPE, the mean SBPI for Y decreased 5.6% and the mean SBPI for E decreased 3.7%. No significant differences between groups of SBPI were found at rest nor the first three measurement times following exercise. At each of the remaining six measurement times, the mean SBPI of E was significantly lower ($p<0.05$) than Y as a function of slightly higher ASBP. In both groups, recovery SBPI tended to rise above resting values, then gradually returned to near baseline by minute 15. The effect of age tended to be for elderly adults to maintain a higher arm systolic blood pressure longer through recovery, which decreased the systolic blood pressure index more than in younger adults, indicating an attenuated recovery response.

27

BONE MINERAL CONTENT AND BONE WIDTH CHANGES IN AGED FEMALE FISHER 334 RATS FOLLOWING FIVE MONTHS OF TRAINING

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The purpose of this study was to determine the influence of chronic treadmill running on bone mineral content (BMC) and bone width (W) of aged female rats. Animals trained 5 days/week for 30 minutes/day at 60-80% estimated VO2max from 21 to 26 months of age. Three groups studied were: Baseline (N=15), Control (N=15), and Exercise (N=35). BMC and W were determined using Single Photon Absorptiometry (SPA) at the beginning (Baseline) and after five (5) months of training. ANCOVA was used to analyze the BMC and W using body weight as the covariate. BMC of the Exercise group was significantly greater ($p<.003$) than that of the Control group (12.6%) and significantly greater ($p<.006$) than that of the Baseline group (10.0%). Baseline and Control BMC was not different. Exercise W was significantly greater ($p<.001$) than both the Control (12.2%) and Baseline (14.9%). Baseline and Control W was not different. These results indicate that the bone of the Exercise animals was metabolically more active than the Baseline or Control. Greater bone mineral was deposited and bone width increased as a result of exercise training. These results suggest that treadmill exercise in aged female rats is effective in increasing BMC and W.

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28

CARDIOPULMONARY FACTORS IN MEMORY DECLINE IN OLD AGE.

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Extensive efforts have been directed to understanding the variability with which memory performance declines with age. Our own research has concentrated on the evaluation of the influence of health status on various aspects of the aging process. In this experiment, we focus on the influence of physiological status on age-related declines in human memory. In a cross-sectional design, forty-eight volunteers were divided into Young (n=13, 18-27 yrs.), Middle-Aged (n=20, 50-65 yrs.), and Old (n=13, 60-89 yrs.) groups and evaluated on a series of cardiovascular, pulmonary, hemodynamic and biochemical tests, including a symptom-limited, exercise-stress test. In addition, memorial function was evaluated by an extensive battery of memory tasks distributed along an automatic-to-effortful processing continuum. Traditional chronological age analyses revealed expected declines in memory function with advancing age. However, further analyses demonstrated that the magnitude of these declines varied as a function of cardiovascular fitness. Specifically, elderly individuals in relatively good cardiovascular health (mean VO2 max, 30 ml/kg) exhibited significantly less memory loss than a group of less healthy (mean VO2max, 19 ml/kg) age-matched peers. Similar relationships were observed when subjects were categorized according to their performance on several standard clinical tests of pulmonary function. These data suggest that declines in cognitive function which are most often attributed to chronological age factors are also dependent upon physiological changes which usually, but not always, accompany the passage of time. In order to increase our understanding of the variability with which performance declines in advancing age, future reearch should supplement traditional measures of chronology with appropriate physiological indices of senescence.

29

SPECIFICITY OF LUMBAR EXTENSION STRENGTH TRAINING

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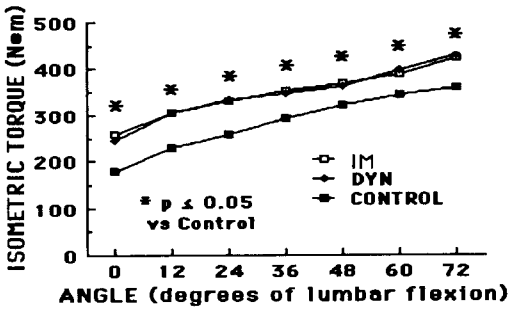
A multiple joint angle isometric test has recently been used to quantify changes in full range-of-motion (ROM) lumbar extension (LB-EXT) strength from dynamic resistance training. The purpose of this study was to compare the effect of multiple joint angle isometric training and variable resistance dynamic training on the isometric strength of the lumbar extensors. Fifty healthy, untrained men (n=31) and women (n=19), 19 to 50 yrs of age, completed the study. Following a pre-training isometric LB-EXT test at 7 positions through a 72 degree ROM, subjects participated in either dynamic training (DYN, n=21), isometric training (IM, n=14), or a control group (CONT, n=15). Training sessions were held 1x/wk for 12 wks. For DYN, subjects completed 1 set of 8-12 repetitions of variable resistance LB-EXT to volitional fatigue. For IM, subjects completed the 7 angle isometric exercise test, holding each contraction for 3 to 4 s and resting for 10 s between contractions. Analysis of covariance revealed a significant ($p \leq 0.05$) improvement in isometric torque at all angles for both DYN and IM when compared to CONT (see figure). There was no statistical difference ($p > 0.05$) between DYN and IM. No injuries occurred during training for either DYN or IM. These data indicate that both variable resistance and multiple joint angle isometric training are safe and equally effective for improving full ROM isometric LB-EXT strength.



30

EFFECT OF TRAINING WITH PELVIC STABILIZATION ON LUMBAR EXTENSION STRENGTH

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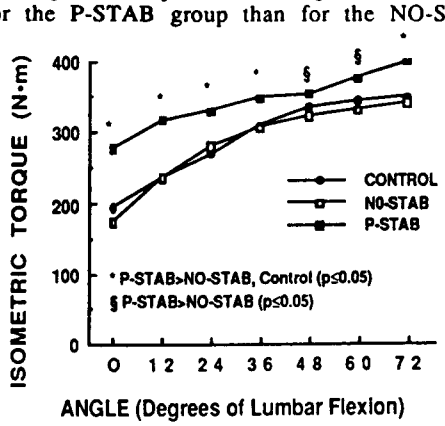
Pelvic Stabilization (P-STAB) is required to isolate the lumbar extensor (LB EXT) muscles. The purpose of this study was to evaluate the effect of P-STAB during training on the development of LB EXT strength. Isometric (IM) strength of the isolated LB EXT muscles was measured at 7 positions through a 72° range-of-motion on 47 men and 30 women before and after 12 weeks of variable resistance training. Subjects were assigned to either a group that trained with P-STAB (N=21), a group that trained with no STAB (N=41) or a control group that did not train (N=15). Subjects trained 1 day/wk with 8 to 12 repetitions to volitional fatigue. Analysis of covariance showed that the post-training IM torques describing isolated LB EXT strength were greater ($p \leq 0.05$) for the P-STAB group than for the NO-STAB group (see figure).



The NO-STAB group did not differ statistically ($p > 0.05$) from the control group at any of the positions measured. The P-STAB and NO-STAB groups showed similar improvements in dynamic training load (P-STAB=24.1±9.4 kg; NO-STAB=19.4±11.0 kg). These data indicate that P-STAB is required to effectively train the LB EXT muscles. The increased training load for the NO-STAB group is probably a result of training the muscles involved in pelvic rotation (hamstring and buttocks).

31

CHANGES IN PEAK TORQUE, LIMB VOLUME AND DELAYED ONSET MUSCLE SORENESS FOLLOWING REPETITIVE ECCENTRIC CONTRACTIONS

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The purpose of this study was to examine sequential changes in delayed onset muscle soreness (DOMS), limb volume (LV), and eccentric peak torque (ET), following repetitive eccentric contractions. Method: Six untrained males performed three sets of isokinetic eccentric contractions of the elbow flexors (Biodex Isokinetic Dynamometer) at 60 degrees/sec. DOMS (0-10 scale), LV (in exercised vs non-exercised arm, water displacement), and ET (Biodex) were recorded, before and at 0, 24, 48, 72, 96, 120, 144, 168 and 336 hours after eccentric exercise. A repeated measures ANOVA was performed on all dependent variables and when appropriate a Tukey's post hoc test was done. Results: There was a significant decrease ($p<0.05$) in ET at 0 h (-43.5%), 24 h (-38.8%) and 48 h (-30.2%); by 336 h ET was back to baseline levels. DOMS was significantly elevated at 24 h ($p<0.05$) and peaked in intensity at 72 h. There were no significant changes in LV in the exercised vs non-exercised arm across time. Conclusion: Since peak decreases in torque were seen prior to the onset of peak DOMS, there does not appear to be a direct association between the ability to produce power and the sensation of DOMS.

32

CONCENTRIC AND ECCENTRIC STRENGTH LOSS AND RECOVERY FOLLOWING EXERCISED-INDUCED MUSCLE SORENESS (EIMS)

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Recent studies have shown decreases in maximum static voluntary strength following EIMS, but have provided no data concerning changes in dynamic strength. This study determined the changes in both concentric and eccentric strength in 7 male subjects following EIMS. Elbow flexor strength was measured on a Kin-Com isokinetic dynamometer at the following speeds: -210, -120, -30 (eccentric contractions), 0, 30, 120, and 210 °/sec. Muscle torque production was averaged over an elbow flexion range from 60° to 120° for dynamic contractions. Each subject then performed 70 maximum, isokinetic, eccentric contractions to induce muscle soreness. Strength was reassessed 2, 4, and 7 days following exercise. Subjective muscle soreness was determined by having the subject place a mark on a scale 10 cm in length with 0 representing a complete absence of pain and 10 representing an extremely sore muscle which was difficult to use. Two days following the EIMS, eccentric strength (ES) was reduced an average of 23% over the tested velocities (58 to 75 Nm) while concentric strength (CS) decreased by only 15% (33 to 39 Nm). By day 4, ES was still 15% less than initial strength (63 Nm) and remained at that level by day 7. However, CS had returned to initial values by day 4. Static strength was reduced by 14, 10, and 7% over the test days 2, 4, and 7, respectively. Subjective muscle soreness peaked 2 days following the exercise bout and decreased to normal values by day 7. These new findings suggest that EIMS causes greater and longer lasting changes in eccentric strength than in concentric strength.

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33

THE RESPONSES OF ALANINE AMINOTRANSFERASE AND TOTAL CREATINE KINASE ACTIVITY TO AN ACUTE BOUT OF SWIM TRAINING

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The purpose of this investigation was to determine if long duration swim exercise elicited a change in the serum activity of enzymes often associated with traumatic muscle injury. Sixteen male collegiate swimmers were studied prior to and at the conclusion of a 75 minute continuous bout of swim training to compare the effects of the exercise on the activity levels of serum alanine aminotransferase (ALT) and total creatine kinase (CK). Both enzymes are distributed widely in most tissues with elevated serum levels reflecting skeletal muscle proteolysis. Swim training was chosen in an effort to eliminate the effects of impact-induced damage to the cellular infrastructure of the muscle cells and subsequent leakage of cellular contents into the extracellular fluid. Results of the assays demonstrated no significant increase ($p>0.05$) in the activity level of CK, while there was a significant increase ($p<0.05$) in ALT activity.

	rest	exercise
CK (U/L)	193.50 ± 77.63	157.94 ± 67.95
ALT (U/L)	12.44 ± 6.32	25.27 ± 14.95*

*$p<0.05$

Although both analytes reflect skeletal muscle proteolysis, these results indicate that the mechanisms by which the changes in serum ALT occur may be different than those of CK after prolonged bouts of exercise.

34

SERUM CREATINE KINASE IN COMPETITIVE SWIMMERS DURING A COMPETITIVE SWIMMING SEASON

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Fourteen male NCAA division I AA competitive swimmers were monitored during the course of a competitive swimming season. Venous blood samples were obtained preceding a morning training session seven times during the training session. Sampling times were held consistent with the previous weight training session. A baseline sample was taken one day prior to the initiation of training. The purpose of this study was to observe changes in serum creatine kinase (CK) in response to different training volumes experienced during the training season. Serum CK was significantly lower in all samples obtained ($p <0.05>$) during the second one-half of the training season (Samples 4-7) despite training volumes similar to or greater than those during the first one-half of the training season (Samples 0-4). Sampling dates, CK concentrations, and training volumes (average yardage swum per week) are given below:

Sample	0	1	2	3	4	5	6	7
Date	8/26	9/10	10/22	11/22	1/2	1/10	2/18	2/26
CK (U/L)	172	213	171	180	93	105	103	74
±SD	±49	±78	±83	±72	±30	±47	±47	±22
Volume	0000	15,325	49,815	44,423	46,450	69,450	52,606	27,725

These results indicate that an adaptation to competitive swim training may occur allowing for decreases in serum CK concentrations.

35

AORTIC BLOOD FLOW VELOCITY RESPONSES TO ANAEROBIC POWER TESTING USING CYCLE ERGOMETRY.

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Blood flow velocity changes due to aerobic and isometric exercise have been evaluated extensively using continuous wave (CW) Doppler echocardiography. However, the blood flow velocity responses to anaerobic work have yet to be investigated. Consequently, nine males (age=24.4±1.5yrs, weight=75.2±5.0kg, X±SE) underwent an anaerobic power test, on a cycle ergometer, consisting of five bouts of 10 s maximal work interspersed with 20 s rest intervals. Resistance was 10% body weight. A warm-up consisting of four min pedalling at 50W was given. During the rest interval, CW Doppler variables of peak aortic blood flow acceleration (PkA), velocity (PkV) and stroke velocity integral (SVI) were obtained using the suprasternal notch view. Sitting rest values were: HR=73.2±3.9bpm, PkA=17.9±3.9 $m*s^{-2}$, PkV=0.79±.07$m*s^{-1}$, SVI=11.7±1.5cm. Repeated measures ANOVA with a Tukey test for post hoc comparisons was used to determine differences between bouts of exercise. Each of these variables was found to be significantly ($p<.01$) increased during each bout, compared to rest. However, HR (150.7±5.1bpm), PkA (48.4±2.5$m*s^{-2}$), and SVI (9.0±.4cm) were not significantly different between bouts 1-5. PkV for bouts 1 (1.18±0.09$m*s^{-1}$) and 5 (1.14±0.07$m*s^{-1}$) differed significantly from bouts 2-4 (1.06±.30$m*s^{-1}$). A similar trend was seen in the other blood flow velocity variables where bout 1 had the greatest value, declining by bout 3 and returning to near-bout 1 levels at bout 5. These results suggest that, as with aerobic and isometric exercise, anaerobic exercise results in a general increase in inotropic condition. The noted trend, particularly for PkV, warrants further mechanistic investigation.

36

ARTERIAL PRESSURE AND PLASMA VOLUME LOSS DURING EXERCISE IN SWINE

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It has been hypothesized that the amount of plasma volume (PV) lost from the circulation during exercise is related to the increase in capillary pressure that, in turn, is due to the rise in mean arterial pressure (Pa) (Miles et al. J. Appl. Physiol. 54:491, 1983). To experimentally increase Pa during exercise, eight miniature swine were infused with homologous whole blood (15% blood volume expansion). The animals were trained for 6-8 weeks to run at supramaximal intensities (115% of VO_{2max}). Each pig ran twice for 90 seconds, once on each of two days with one day separating the tests: 1) once under normovolemic condition (NV); and 2) once following blood volume expansion(HV). Exercise intensity was the same under both conditions. Heart rate (HR) and Pa were obtained from an aortic catheter attached to a pressure transducer. Hemoglobin was assessed in duplicate using the cyanmethemoglobin methodology. Hematocrit was assessed in quadruplicate. Percent PV change was calculated using the method described by Dill and Costill (J. Appl. Physiol. 37:247, 1974). Maximal HR was not different between the two conditions. Pa was significantly ($p<0.05$) higher during HV exercise (149 ± 5 mmHg) than during NV exercise (137 ± 6 mmHg). Absolute PV loss (206.4 ± 29.1 vs 157.6 ± 32.7 ml) and relative PV loss (18.0 ± 2.3 vs 14.5 ± 2.8%) were also greater during exercise in the HV condition when compared to the NV condition. Although absolute PV loss was increased following blood volume expansion, this PV amounted to an average of 39% of the infused PV. The results of this study lend support to the hypothesis that an increase in Pa leads to an increase in PV lost during exercise. However, it is recognized that other factors may also contribute to the PV loss that occurs during exercise.

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37

A COMPARISON OF CARDIO-RESPIRATORY DYNAMICS IN THREE GROUPS OF CHILDREN: SWIMMERS, GYMNASTS, AND NON-ATHLETE CONTROLS

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The purpose of this study was to determine if differences in cardio-respiratory parameters were evident when comparisons were made across groups of children who participated in different rigorous training programs, or no training program at all. Thirteen boys and fifteen girls, (N=28, age=11.8±1.3yr, ht=148.4±10.6cm, wt=38.9±8.5kg) volunteered to participate in this investigation. Swimmers (S, n=12) and gymnasts (G, n=10) were members of a local age-group swim team or local gymnastics club, respectively. Controls (C, n=6) were their neighbors and siblings. S and G were training specifically for their sport on an almost-daily basis for the year prior to data collection. C were involved in nothing more than normal activities of daily living. Variables examined in this study included sub-maximal VO_2 and cardiac output (Q, CO_2 rebreathe), as well as heart rates (HR), stroke volumes (SV) and cardiac index based on body surface area (CI). Variables were measured during treadmill running exercise. ANOVA, with Fisher's post hoc test, indicate that at a standard submaximal workload, VO_2 and Q were not different across groups, but CI for S (6.9±1.0) was significantly ($p<.05$) greater than G (6.0±0.8) and C (5.6±0.8). Also, submaximal HR for G was greater than S ($p=.078$) and significantly greater than C ($p=.014$) (174±16, 163±14, and 155±10 bpm, respectively), while SV for G was significantly less than S ($p=.009$) but not different from C (42±9, 55±12, and 47±12 ml, respectively). These data indicate that different training procedures, even in children, may account for physiological adaptations which result in different responses to exercise.

38

VALIDITY AND RELIABILITY OF PULSE OXIMETRY IN HIGHLY-TRAINED ENDURANCE ATHLETES

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The majority of the work investigating exercise-induced hypoxemia has relied on the use of pulse oximeters for assessing the degree of hypoxemia. However, the validity of pulse oximetry in highly-trained endurance athletes has yet to be established. The objective of this study was to determine the bias and precision of a Criticare Model 504 pulse oximeter during moderate-to-heavy exercise in highly-trained athletes. Twelve males (mean VO2max = 4.92 l/min) cycled for 4 min each at 100 W and at work rates designed to elicit 55, 65, 75, 85, and 95% VO2max. During the last 30 sec of each bout, arterial blood was withdrawn and analyzed by a Corning 2500 CO-oximeter for Hb02%, HbCO%, and metHb%. Bias was determined as the mean of the difference between the pulse oximeter readings and the sum of the three hemoglobin fractions measured by CO-oximetry. The precision was taken as the standard deviation of the bias values.

	Rest	100 W	55%	65%	75%	85%	95%
Bias	-0.84	-0.93	-0.60	-2.03	-2.62	-1.33	-3.50
Precision	0.72	0.90	0.98	4.57	3.35	1.45	4.55

It was concluded that this pulse oximeter markedly underestimated arterial saturation in heavy exercise and that caution must be used when attempting to determine the incidence and/or degree of hypoxemia with this instrument.

39

RELIABILITY OF ELECTRICAL BIOIMPEDANCE CARDIOGRAPHY IN THE MEASUREMENT OF CARDIAC OUTPUT DURING STEADY STATE EXERCISE

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The purpose of this study was to determine the reliability of two methods of electrical bioimpedance cardiography (EBIC) for the calculation of stroke volume (SV), heart rate (HR), and cardiac output ($\dot{Q}$). Stroke volume and HR were measured twice at rest and twice during steady state exercise (60% heart rate reserve) by computerized and hand analyzed EBIC (Minnesota Impedance Cardiograph). Subjects (n=78), 18-77 years performed a 20 minute cycle ergometer test following a 10 minute seated rest. Test re-test reliability for each method was analyzed by Pearsons Correlation Coefficient and the differences between methods were evaluated by a paired t-test. Reliability analysis indicated significant, high, positive correlations between repeated measures at rest and during exercise for both of the two methods. Mean resting HR ranged from 72.1 to 75.5 bpm, SV 50.8 to 60.7 ml, and $\dot{Q}$ 3.6 to 4.3 l·min-1. Mean exercise HR ranged from 124.7 to 131.1 bpm, SV 67.3 to 78.4 ml, and $\dot{Q}$ 8.7 to 10.2 l·min-1. The computerized method produced higher test re-test correlation coefficients at all times when compared to hand analysis ($p<0.0001$). Mean computer resting correlations were HR r=.89, SV r=.96, $\dot{Q}$ r=.96, while mean exercise data were HR r=.93, SV r=.87, $\dot{Q}$ r=.89. Mean resting hand analysis correlations were HR r=.77, SV r=.80, $\dot{Q}$ r=.78, while mean exercise data were HR r=.90, SV r=.68, $\dot{Q}$ r=.68. Significant differences in HR were found between the repeated measures during ($p<0.05$) exercise in both methods. The paired t-test indicated $\dot{Q}$ was significantly higher during rest when analyzed by hand. There were no significant differences between the methods during exercise. While either method could be considered a reliable estimate of $\dot{Q}$ and SV under steady state conditions, the Minnesota computerized system of bioimpedance cardiography seems more acceptable for use in noninvasive measurement of $\dot{Q}$ during exercise.

40

RELIABILITY OF A MODIFIED ACETYLENE REBREATHING METHOD FOR THE DETERMINATION OF CARDIAC OUTPUT

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To establish the reliability of a computerized modified acetylene rebreathing method for the determination of cardiac output ($\dot{Q}$), healthy subjects (18-77 years) were studied at rest (N=40) and during submaximal bicycle exercise at 60% maximal heart rate reserve (N=49). Two measurements of $\dot{Q}$ were performed in all test situations and plotted data were independently evaluated by two investigators. ANOVA with repeated measures showed a significant ($p\leq0.05$) difference between investigators but not between trials during rest ($p>0.05$). ANOVA with repeated measures indicated that there were no significant differences between trials or between investigators during exercise ($p>0.05$). Values shown are $\dot{Q}$ means (l·min-1) ± SD (*$p\leq0.05$ Invest 1 vs. Invest 2):

	Rest 1	Rest 2	Exer 1	Exer 2
INVEST 1	4.10±1.44	3.96±1.31	9.11±2.76	9.42±3.04
INVEST 2	4.18±1.45*	4.07±1.46*	9.20±2.91	9.60±3.31

Reliability coefficients between investigators were high (r=0.92 to 0.98). Although a significant investigator effect was revealed at rest, the differences in mean $\dot{Q}$ were less than 3% for both trials and thus of limited physiologic importance. We conclude that acetylene rebreathing is a reliable method for determining cardiac output. However, in serial trials the calculation of cardiac output ideally should be performed by the same investigator.

41

THE PREDICTION OF MAXIMAL OXYGEN CONSUMPTION IN YOUNG BLACK MALES

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The accuracy of predicting maximal oxygen consumption ($\dot{V}O_{2\,max}$) has been shown to be predicated on a number of factors such as age, sex and level of training. One factor which may also affect the accuracy of predicting $\dot{V}O_{2\,max}$ is racial ethnicity. To determine the effects of racial ethnicity on the prediction of $\dot{V}O_{2\,max}$, 26 black males (aged 23.8 yr) were studied during submaximal and maximal exercise on a cycle ergometer. Data from 19 of these males were used to develop equations to predict oxygen consumption ($\dot{V}O_2$) from watts at a given submaximal workload and to predict % $\dot{V}O_{2\,max}$ from submaximal heart rates. These equations were then used to develop a nomogram (BZB) which predicted $\dot{V}O_{2\,max}$ from heart rate and an estimated $\dot{V}O_2$ at a submaximal load (BZB-WATTS) and from heart rate and the measured $\dot{V}O_2$ at a submaximal workload (BZB-$\dot{V}O_2$). The BZB nomogram was used to predict $\dot{V}O_{2\,max}$ in the remaining 7 black men. In addition, the Åstrand-Rhyming nomogram was used to predict $\dot{V}O_{2\,max}$ from heart rate and an estimated $\dot{V}O_2$ at a submaximal load (ÅR-WATTS) and from heart rate and the measured $\dot{V}O_2$ at a submaximal workload (ÅR-$\dot{V}O_2$) in these 7 subjects. The correlations between the measured $\dot{V}O_{2\,max}$ (3.07 ± .54 $l \cdot min^{-1}$) and the $\dot{V}O_{2\,max}$ predicted from the BZB-WATTS (2.90 ± .47 $l \cdot min^{-1}$), BZB-$\dot{V}O_2$ (2.96 ± .55 $l \cdot min^{-1}$), ÅR-WATTS (2.70 ± .51 $l \cdot min^{-1}$) and the ÅR-$\dot{V}O_2$ (3.35 ± .71 $l \cdot min^{-1}$) were .96, .95, .96 and .96, respectively. Whereas there was a significant correlation between the measured $\dot{V}O_{2\,max}$ and the $\dot{V}O_{2\,max}$ estimated from any of the four methods, there were significant differences when comparing the measured $\dot{V}O_{2\,max}$ with the $\dot{V}O_{2\,max}$ estimated from either the ÅR-WATTS or ÅR-$\dot{V}O_2$. There were no significant differences when comparing the measured $\dot{V}O_{2\,max}$ with the $\dot{V}O_{2\,max}$ estimated from either the BZB-WATTS or BZB-$\dot{V}O_2$. These results suggest the need for ethnic specific equations when estimating $\dot{V}O_{2\,max}$ in young black males.

42

VALIDATION OF THE 12-MINUTE SWIM AS A FIELD TEST OF MAXIMAL AEROBIC POWER.

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The 12-minute swim is widely used as a field test to classify maximal aerobic power (Cooper, K. The Aerobics Way, 1977, p. 91). However, this test has not been directly validated. The purpose of this study was to validate the 12-minute swim as a field test of maximal aerobic power ($\dot{V}O_{2peak}$). Thirty-six male recreational swimmers (mean ± SD age = 22.0 ± 2.9 y, height = 178.3 ± 5.5 cm, weight = 73.1 ± 6.9 kg, % fat = 15.1 ± 3.9) completed a 12-minute swim test, and tethered swimming and treadmill running $\dot{V}O_{2peak}$ tests within a 3-week period. Mean ± SD 12-minute swim distance was 581 ± 88 m, and mean tethered swimming and treadmill running $\dot{V}O_{2peak}$ values were 50.3 ± 6.2 and 57.2 ± 5.5 $ml \cdot kg\ BW^{-1} \cdot min^{-1}$, respectively. The correlation coefficient and standard error of estimate from the prediction of tethered swimming $\dot{V}O_{2peak}$ $ml \cdot kg\ BW^{-1} \cdot min^{-1}$ from 12-minute swim distance were 0.40 and 5.7 $ml \cdot kg\ BW^{-1} \cdot min^{-1}$. The 12-minute swim distance accounted for only 16% of the variance in tethered swimming $\dot{V}O_{2peak}$. The corresponding statistics for prediction of treadmill running $\dot{V}O_{2peak}$ ($ml \cdot kg\ BW^{-1} \cdot min^{-1}$) from 12-min swim distance were 0.38 and 5.1 $ml \cdot kg\ BW^{-1} \cdot min^{-1}$. Other expressions of $\dot{V}O_{2peak}$ ($l \cdot min^{-1}$, $ml.kg\ FFW^{-1} \cdot min^{-1}$, and $l \cdot (m^2\ SA)^{-1} \cdot min^{-1}$) did not improve the predictions. It was concluded that the 12-minute swim does not have acceptable validity as a field test of maximal aerobic power in young male recreational swimmers regardless of how $\dot{V}O_{2peak}$ is expressed or whether it is measured during running or swimming.

43

VALIDATION OF WORK RATE SETTINGS ON THE STAIRMASTER 4000 AND COMPARISON OF HEART RATE RESPONSES AT SIMILAR WORK RATES ON THE TREADMILL

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Heart rate and VO_2 were measured on 12 male subjects during treadmill (TM) exercise at estimated work rates of 4, 6, 8, 10, and 12 METs (ACSM Guidelines), and on the StairMaster 4000 (SM) stepping ergometer at similar machine settings. A discontinuous test was used on both ergometers, with expired gas collected during the fifth minute of each five minute stage. The subjects held on "lightly" to the SM railings during the test. This has been shown in this lab to have no effect on VO_2 compared to not holding on. The TM test used a constant speed of 100 meters/min, and the grades were 0%, 4%, 8%, 12%, and 16%. The results of the SM and TM tests are shown in the following table:

	Estimated Work Rate (METs)				
	4	6	8	10	12
StairMaster Actual METs	3.6±.1	5.0±.2	6.4±.2	8.1±.2	9.5±.1
Treadmill Actual METs	4.0±.1	5.7±.2	7.7±.3	10.1±.2	12.1±.2

The heart rate responses were plotted against the measured oxygen uptake for each test. The heart rate response on the SM was as linear (r=.98) as that measured on the TM (r=.97), with the only exception being that it was systematically 5 beats/min higher at any given oxygen uptake. The finding that the MET values were lower than specified on the SM suggests that a correction be made. The following regression equation yields the true MET value relative to the settings on the StairMaster 4000:

True MET Values = 0.556 + 0.744 (StairMaster settings)

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44

USE OF RECOVERY $\dot{V}O_2$ TO PREDICT RUNNING ECONOMY

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Running economy (RE), defined as the aerobic demand ($\dot{V}O_2$) for a given running speed, is an important determinant of distance-running success among individuals relatively homogeneous in maximal oxygen consumption ($\dot{V}O_2$ max). The measurement of RE under field conditions, however, is often hampered by the encumbrances of gas collection equipment. The purpose of this study was to determine whether RE could be predicted accurately using recovery $\dot{V}O_2$ values. Twelve runners ($\bar{X}$ $\dot{V}O_2$ max = 61.9 ± 4.9 ml/kg/min) completed three 6-min RE treadmill sessions on three separate days. During each session, subjects performed runs at 69%, 78%, and 87% $\dot{V}O_2$ max. RE was calculated from a single 2-min gas collection during the last 2 min of each run. Immediately following each run, recovery $\dot{V}O_2$ data obtained during randomly-assigned 15-, 20-, and 25-sec gas collections were used to predict exercise $\dot{V}O_2$. Correlations and mean absolute percent variation (%Δ) between actual and predicted $\dot{V}O_2$ at each relative intensity and recovery period are shown below:

	Recovery period					
	15-sec		20-sec		25-sec	
	r	%Δ	r	%Δ	r	%Δ
69% $\dot{V}O_2$ max	0.55	4.3	0.65*	3.9	0.50	5.8
78% $\dot{V}O_2$ max	0.63*	4.8	0.69*	4.5	0.68*	4.6
87% $\dot{V}O_2$ max	0.79*	4.6	0.71*	4.6	0.81*	3.7

* $p \leq 0.05$

Although the correlation between actual and predicted $\dot{V}O_2$ was significant and more pronounced at higher exercise intensities, the overall magnitude of the relationship was low to moderate. Mean relative variation between actual and predicted aerobic demands (4% - 6%) also obscured a wide range of intersubject variability (0% - 17%). These data suggest that 15-, 20-, and 25-sec recovery $\dot{V}O_2$ values do not correlate strongly with steady-state $\dot{V}O_2$, nor do they adequately account for variation in individual economy profiles.

COMPARISON OF PEAK HEART RATES DURING MAXIMAL TREADMILL RUNNING AND TETHERED SWIMMING: IMPLICATIONS FOR PRESCRIBING EXERCISE.

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45

Thirty-four fitness swimmers were maximally tested during treadmill running (TR) and tethered swimming (TS). Subjects were 19 males and 15 females, aged 18-25. Resting HRs were measured in supine, sitting and standing body positions. A discontinuous, graded test protocol was used for both TR and TS with 2 min stages and 1 min rest periods. TR was at a constant speed (188 $m \cdot min^{-1}$ for females, 201 for males) with 2.5% increase in grade per stage. TS began with a percentage of a pre-determined maximum workload (25% for females, 30% for males) and increased 0.5 to 1.0 kg per stage. Peak HRs were obtained via a UNIQ CIC monitor during the last 10 s of each stage. Blood lactate was measured at 3 min following TR and TS using a YSI Model 27 analyzer. The TS peak HR was significantly lower than the age-predicted max HR (220 -age) by 13 $bt \cdot min^{-1}$ and TR peak HR by 11.5 $bt \cdot min^{-1}$. Blood lactate for TR (8.1 $mmol \cdot l^{-1}$) and TS (8.0 $mmol \cdot l^{-1}$) were similar. The sitting and supine resting HRs were significantly lower than standing HR with mean differences of 12.3 and 17.5 $bt \cdot min^{-1}$, respectively. Mean target heart rate range (THRR) calculated from the TS peak HR (144 -176 $bt \cdot min^{-1}$) was significantly lower than the mean age-predicted (151 -187 $bt \cdot min^{-1}$) and mean TR (151 -186 $bt \cdot min^{-1}$) THRR. For young adult fitness swimmers, a correction factor applied to the age-predicted max HR [220 -(age + 13)] would reduce the overestimation of the THRR. The data also indicate that agreement upon a standard body position for resting HR is needed.

THE VALIDITY OF A SINGLE BODY LANDMARK TO ESTIMATE CENTER OF GRAVITY DISPLACEMENT DURING VERTICAL JUMPING

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46

The purpose of this study was to determine if a single body landmark is an accurate indicator of the total body center of mass (COM). Thirty college-age subjects (15 female, 15 male) conducted three successive vertical jumps filmed with a shuttered video camera operating at 60Hz. The film was analyzed with a "Peak Performance" video motion measurement system to determine vertical displacements for the hip, first lumbar vertebrae (L1), and COM. Center of mass was computed through standard modeling techniques and full segmental analysis. No significant difference ($p>.01$) in prediction accuracy was found between gender, therefore results were presented from pooled data. ANOVA with repeated measures indicated no significant difference between trials ($p>.05$). Pearson moment correlations were high between the hip and COM ($r=.99$), L1 and COM ($r=.98$), and hip and L1 ($r=.98$). Although, a t-test indicated a significant difference ($p<.01$) between both hip and COM and L1 and COM. Linear regression revealed an R square value of .97 for the hip and .98 for L1 as potent predictors of COM displacement. Intraclass "R" coefficients assessing reliability were R=.99 for the hip and R=.98 for L1. Based on these results, it was concluded that correction factors can be used for both the hip and L1 landmarks to be accurate predictors of vertical jumping displacement of the total body center of mass.

RECOVERY OF CARDIAC OUTPUT FOLLOWING SUBMAXIMAL CYCLE EXERCISE IN YOUNG AND ELDERLY SUBJECTS

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47

Cardiac output ($\dot{Q}$) of young (Y) and elderly (E) subjects was measured to assess post-exercise cardiovascular response. To evaluate the age related changes in dynamic cardiac recovery, the present study compared recovery cardiac output between Y (18-35 years) and E (60-77 years) subjects following submaximal exercise. Subjects (n=78) were monitored before and after 20 minutes of cycling (60% heart rate reserve, Karvonen). A Minnesota Impedance Cardiograph was used to calculate $\dot{Q}$ from stroke volume (SV) and heart rate (HR). Cardiac outputs were calculated at rest, immediately post-exercise (IPE) and during recovery minutes 1, 2, 3, 4, 5, 7.5, 10, 12.5, and 15. Gender and age groups were analyzed by a 2x2 ANOVA ($\alpha = 0.05$). Resting $\dot{Q}$ were 5.0 $\pm$ 1.8 l·min-1, 5.6 $\pm$ 1.8 l·min-1, 3.3 $\pm$ 1.6 l·min-1, and 4.2 $\pm$ 0.9 l·min-1 for Y females, Y males, E females, and E males respectively. From IPE to recovery minute 15, $\dot{Q}$ declined from 9.7 $\pm$ 3.5 l·min-1 to 4.9 $\pm$ 1.8 l·min-1 for the Y women, from 13.3 $\pm$ 5.4 l·min-1 to 5.8 $\pm$ 2.1 l·min-1 for the Y men, from 7.2 $\pm$ 3.4 l·min-1 to 3.3 $\pm$ 1.3 l·min-1 for the E women, and from 10.6 $\pm$ 4.1 l·min-1 to 4.9 $\pm$ 1.7 l·min-1 for the E men. Recovery SV in the E group was significantly lower ($p<0.05$) than the Y group, but had comparable HRs. Hence, the main difference between age groups was an attenuated change in cardiac output through reduced stroke volume in elderly adults.

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EFFECT OF CAFFEINE ON ANAEROBIC PERFORMANCE

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48

Ten women rugby players participated in three anaerobic bicycle tests of 10 sec, 30 sec and 90 sec in duration under caffeinated and placebo treatments to determine the effects of caffeine on blood lactate concentration as well as anaerobic power and capacity. Subjects abstained from caffeine for 4 days prior to and throughout the testing period. A solution containing 5mg/kg body weight caffeine or a placebo was ingested by each subject 1 hr before each test. Bicycle work loads were set at .09 kp/kg, 10 sec; .075 kp/kg, 30 sec and .05 kp/kg, 90 sec. Anaerobic Alactic Capacity(AAC), the total work output for the 10 sec test; Anaerobic Lactic Capacity(ALC), the total work output for the 90 sec test; Anaerobic Alactic Power(AAP), the highest 1 sec work output in the 10 sec test; and Anaerobic Lactic Power(ALP), the mean work output in the last 5 sec of the 30 sec test, were measured. No significant differences in post lactate concentrations, AAC, ALC, or ALP were found between caffeine and placebo treatments. There was a significant increase in AAP following caffeine ingestion, of P=.04. These data demonstrate the ergogenic effect of caffeine on one aspect of anaerobic performance, that of AAP which is a measure of peak power. Other measures of anaerobic activity seem unaffected by the drug.

49

EFFECTS OF CAFFEINE INGESTION ON FREE FATTY ACID MOBILIZATION AND SKIN TEMPERATURE IN EXERCISING ENDURANCE ATHLETES

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This study was done to determine if caffeine ingestion improved athletic performance and to find if caffeine affected energy substrate utilization or dissipation of heat from the body. Five well trained athletes rode a cycle ergometer on 3 occasions at 65% of VO_2 max. The trials were a control ride; a 200 mg. caffeine load 30 min. before exercise with 50 mg. caffeine every 30 min., and a third trial with 400 mg. caffeine before and 75 mg. every 30 min. during exercise. Water ad lib was taken during exercise and the ride was stopped when the athlete was unable to maintain cadence. Measurement of RQ, $\dot{Q}_c$ and min. ventilation was done every 30 min. and blood was collected for measurement of glucose, FFA, acetoacetate, Hgb, Hct and total proteins. Covered skin, rectal and ambient temperatures were measured every 10 min., as were blood pressure and heart rate. The results showed an increase in the 200 mg. caffeine trial time of 59.7%, compared to the control. We attribute the increased endurance to enhanced heat dissipation which delayed fatigue. The 400 mg. caffeine trial caused nausea leading to an inability to continue exercise. No significant elevation of FFA occurred in the 200 mg. caffeine trial and the steady state RQ did not decrease as would be expected if a shift to oxidation of fat had occurred. The results suggest that a moderate dose of caffeine prior to exercise can enhance the body's ability to dissipate heat from the skin's surface, and this improves performance and endurance.

50

EFFECT OF VASCULAR VOLUME DEPLETION ON THERMOREGULATORY MECHANISMS DURING EXERCISE

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Six male endurance athletes exercised on a cycle ergometer at 65% of VO_2 max. until perceived exhaustion was declared; once with normal volume(N) and a second time after volume depletion(D) was induced by diuretic administration. Rectal temperatures(T_r) were significantly higher ($p<0.05$) during D trials as compared to N trials. Skin temperatures(T_{sk}) were covered to prevent heat loss from the thermal sites. An increase in T_{sk} reflected an increase in skin blood flow, which is a mechanism to dissipate excess heat from the core. Blood volume(BV) decreased from 61 ml/cm ht. to 54.7 ml/cm ht. in the N trial. In the D trial diuresis produced a drop from 61 ml/cm ht. to 54.5 ml/cm ht.; exercise further decreased BV to 47.2 ml/cm ht. Cardiac output was significantly decreased ($p<0.05$) due to the reduction in BV. Vascular volume loss was caused by sweating and fluid shift to the intracellular space in N and D trials, and by diuresis in D trial limiting total work output (D=10,244 watts, N=11,962 watts), as well as total exercise time (D=84.1 min, N=91.9 min). During D trials sweat rate (17.1 ml/min) was significantly less ($p<0.05$) and T_r higher than in N (sweat rate 21.9 ml/min), reflecting, impaired heat transfer to skin. The data suggest that a reduced BV, with resultant lowered cardiac output, also diminishes peripheral perfusion thereby limiting heat dissipation despite higher T_r. This mechanism, we believe, reduces the capacity for endurance exercise.

THE EFFECT OF SUBJECT COUNT AND RIGHT AND LEFT CAROTID ARTERY PALPATION ON POST-EXERCISE HEART RATE

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51

The purposes of this study were to determine: (1) if the exercise heart rate (ExHR) differs significantly from the post-exercise heart rate (PexHR) during right carotid palpation (RCP), Treatment I, and during left carotid palpation (LCP), Treatment II; and (2) if the subjects' PexHR counts during RCP and LCP were accurate. Twenty-four college age males (n=13) and females (n=11) were randomly assigned to the Treatment protocols. Treatment I consisted of 5 min of treadmill (TM) exercise at 80% HR intensity followed by RCP and subjects' HR count, another 5 min of exercise followed by no CP. Treatment II followed the same protocol except the LC was palpated. Exercise and PexHRs were determined by counting the number of R waves in each 10-sec strip, which was then multiplied by six. All subjects were given instructions and practice time to palpate the carotid arteries prior to TM exercise. They were instructed to start counting with the first palpation pass "0" on the clock and to stop counting with the last palpation on the number "10" to complete the full 10-sec palpation period. ANOVA with repeated measures revealed no significant (p>.05) differences. In Treatment I, the ExHR was 158 bpm, the PexHR during RCP was 157 bpm, and the subjects' PexHR count was 158. In Treatment II, the ExHR was 156 bpm, the PexHR during LCP was 155 bpm, and the subjects' PexHR count was 156 bpm. These data do not support previous research that CP results in a significant decrease in PexHR and that the subjects' PexHR count is generally inaccurate. Future research should examine the possible role of high intensity versus low intensity exercise on negating the effects of CP on PexHR.

THE HEART RATE - VO_2 RELATIONSHIP OF AEROBIC DANCE: A COMPARISON OF PREDICTION EQUATIONS

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52

In order to test the validity of employing traditionally prescribed target heart rates with aerobic dance, two prediction equations describing the relationship between heart rate (HR) and VO_2 were made from responses elcited via an "aerobic dance test." Eleven active females completed a maximal treadmill test and a dance-exercise "test". Correlation coefficients (r) for both prediction equations were: r = .88. The results showed that the HR max method under-prescribed appropriate levels of oxygen consumption in accordance with the ACSM guidelines. Based on these data, dance-exercise heart rates must be approximately 80% of HR max in order to elicit an oxygen uptake rate representative of 50% of max VO_2. In comparison, dance-exercise intensity corresponding to 65% of maximum heart rate reserve (HRR) placed the subjects within the recommended training zone for oxygen consumption. These findings illustrate that oxygen uptake responses from aerobic dance are less pronounced at similiar relative heart rates compared to previous works which have elucidated HR-VO_2 regression equations from treadmill running and cycle ergometry. In addition, these findings indicate that the max HRR method is a more appropriate index for prescribing aerobic dance exercise intensity.

A COMPARISON OF ELECTRICAL IMPEDANCE AND WATER DISPLACEMENT FOR DETERMINING BODY COMPOSITION

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53

The present investigation assesses body composition using a Whitmore Volumeter™ and a Bio-Analogics Impedance Analyzer™. Fifty-eight subjects (N= 28 males, M= 36.3 ± 9.7 yrs.; N= 29 females, M= 27.3 ± 6.6 yrs.) were tested with both techniques. Measures of impedance involved the derivation of body composition both with and without anthropometric adjustments. A two-way ANOVA (Gender x Measure) with repeated measures on the last factor revealed a significant ($p<.001$) main effect for gender. The females had a significantly greater percent fat (M= 21.0%) than the males (M= 15.6%). A significant ($p<.01$) interaction indicated that both of the impedance procedures underestimated percent fat in the males but overestimated percent fat in the females. Furthermore, in the males, impedance measures with anthropometric adjustments gave a closer estimate than impedance without anthropometric adjustments. However, in the females the impedance technique that did not involve anthropometric measurements more accurately estimated body composition. Although the ANOVA revealed impedance-derived estimates of percent fat were dependent on gender and anthropometric data, the impedance estimates were only ±2.2% from the volumetric derived measurements.

EFFECTS OF SEXUAL INTERCOURSE ON MAXIMAL AEROBIC POWER, OXYGEN PULSE, AND DOUBLE PRODUCT IN MALE SEDENTARY SUBJECTS.

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54

The purpose of this study was to determine the effects of sexual intercourse on maximal aerobic power (VO_2 max), oxygen pulse (O_2 pulse), and double product (DP). Eleven male subjects (Mean=26 years) were randomly tested within 12 hours of sexual intercourse (SI) and with no prior SI using a Bruce multistage protocol to the point at which the subjects were no longer able to continue to exercise. Also, a respiratory exchange ratio (R) in excess of 1.00 was used to substantiate that VO_2 max had been reached. Both treadmill (TM) tests were performed within one week of each other. The Beckman-MMC was used to collect VO_2 max data. Oxygen pulse and DP data were used as a relative measure of stroke volume (SV) and as an index of myocardial work and oxygen demand (MVO_2), respectively. Paired t-tests revealed that sexual intercourse within 12 hours of the maximal TM test had no significant ($p>.05$) effect on VO_2 max (with SI, 3.43 L/min +/- .68; without SI, 3.53 L/min +/- .70). Moreover, there were no significant differences in oxygen pulse (with SI, 18.05 ml +/- 3.76; without SI, 18.62 ml +/- 3.90) and DP (with SI, 345 +/- 21; without SI, 342 +/- 17) between the two maximal TM tests. The results of this study suggest that sexual intercourse within 12 hours of maximal exercise does not decrease VO_2 max, O_2 pulse, or DP. In addition, it seems reasonable therefore to conclude that sexual intercourse prior to maximal exercise does not decrease SV or increase MVO_2.

UPPER BODY WINGATE TEST PERFORMANCE IN SPRINT AND DISTANCE SWIMMERS.

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55

This study was conducted to assess the effectiveness of the upper body Wingate Anaerobic Power Test (UBW) in discriminating between sprint and distance swimmers. Twenty varsity swimmers from a nationally competitive team (mean age 19.8 yrs) were grouped as sprint (6M, 4F) or distance (6M, 4F) swimmers according to their competitive events. Each subject was given a warm-up to familiarize them with the arm cranking test. A Monark 868 ergometer and a resistance of 60 g/kg of body weight was used for the test. The ergometer was mounted on a table and the subject seated on a stool at the end of the table. Pedal revolutions were counted using a microswitch interfaced with a computer. Peak power (PP), mean power (MP), and power decrease (PD), each expressed in Watts (W), were calculated for each subject. The data were analyzed with ANOVA. Results were as follows:

	PP(W)	MP(W)	PD(W)
Sprint	787±180	653±149	232±76
Distance	765±188	660±159	200±87

UBW variables were not significantly different in sprint and distance swimmers in this sample. The difficulty in categorizing swimmers exclusively as sprint or distance performers and similarities in training programs may reduce the ability of the UBW to discriminate between them.

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ANTHROPOMETRIC CORRELATES OF EXERCISE STATUS IN HIGH SCHOOL SENIORS

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56

One hundred high school seniors were studied for correlations between anthropometry and levels of physical activity. Height (Ht), weight (Wt), chest (C) and hip (H) circumferences, triceps, chest, subscapular, abdominal, thigh and suprailiac skinfolds (SF) were measured. Levels of physical activity were determined by detailed and structured interviews and participation in athletics. Mean values for Wt, Ht and Hc were higher in athletes ($p < .005$). Hc was higher ($p < .05$) for non-exercisers. As Sum of SF's increased Cc decreased ($p < .02$) and BMI increased ($p < .06$). BMI did not differ between activity groups but waist/hip ratio increased significantly ($p < 0.05$) in non-athletes and non-exercisers. Significant correlations were noted between: Wt, Ht, Wc and Hc when Sum of SF were less 120 mm; Wt and W/H^2 when this sum was more than 120mm; Wt and W/H in all groups; Wt, all C's and SF's only in females, non-athletes and non-exercisers. These findings indicate that regular exercisers are taller and heavier than non-exercisers, BMI is not a sensitive measure for body fat and physical activity but waist/hip ratio is.

57

EFFECT OF EXERCISE INDUCED DEHYDRATION AND DIURNAL VARIATION ON WHOLE BODY BIORESISTANCE

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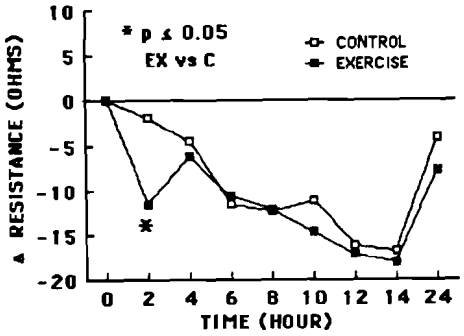
The purpose of this study was to assess the effect of exercise induced dehydration (EID) and diurnal variation on whole body bioresistance (BIO-R). BIO-R was measured on 19 men (age=28±7 yr) at 2 h intervals between 6 am and 8 pm and at 6 am the next morning on two separate test days. One test day included a moderately strenuous 1 h exercise (EX) following the first BIO-R measurement and the other test day included no EX (control, C). Mean weight loss due to EID was 1.54±0.55 kg. Fluid intake and volume voided were similar (p>0.05) for EX and C. There was a significant (p≤0.05) trend for BIO-R to decrease between 6 am and 8 pm for both the EX (18 ohms) and C (17 ohms) conditions (see figure). When EX was compared to C, BIO-R was significantly reduced (9 ohms, p≤0.05) immediately post exercise but recovered within 2 h. Although the EID effect is short-lived, these data indicate that it is an important factor to consider for standardization of BIO-R measures. The diurnal variation in BIO-R, which is probably related to normal daily body fluid shifts, shows an even greater potential for error and must also be considered when using BIO-R measures to predict physiologic variables.



58

POTASSIUM AND PLASMA VOLUME CHANGES DURING HOT ENVIRONMENT EXERCISE

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Twelve male subjects (age=26.5±4.42) participated in two separate cycle ergometer tests to determine the effects of acute hot environment exercise on plasma volume (PV) and potassium (K). Serial blood samples were drawn during both the cool (T_1, 21° C) and hot (T_2, 35° C) environment protocols at rest, 30% max, 70% max and max exercise. Samples were later appropriately analyzed for K and PV.

	Rest	30%	70%	Max
K_{T1} (mEq/L)	3.98(±.24)*	4.23(±.25)*	4.61(±.34)*	5.26(±.52)*
K_{T2} (mEq/L)	4.19(±.25)	4.48(±.26)	4.98(±.29)	5.83(±.34)
PV_{T1} (%)	57.9(±2.8)*	55.6(±3.2)*	51.2(±3.0)*	48.7(±3.0)*
PV_{T2} (%)	59.1(±2.6)	56.2(±3.1)	52.1(±2.4)	49.8(±2.4)

(*=p<.05 between treatments)

These results revealed a significant difference (p<.05) between the T_1 and T_2 exercise protocols at all intensity levels for both K and PV. There were no significant correlation coefficients (p>.05) for K between the treatment protocols at any intensity level. However, there were significant correlations between the two treatments for PV for each intensity. Correlation coefficients for PV were .92 (p<.001) for the resting sample, .89 (p<.001) for the 30% sample,.96 (p<.001) for the 70% sample, and .67 (p<.05) for the max sample. These results indicate that the T_2 exercise created an increased concentration of K with decreased PV when compared with the T_1 protocol, but the impact of the hot environment may be greater on K than PV.

THE EFFECT OF A MAGNESIUM DEFICIENT DIET ON CARDIAC ISOMYOSIN DISTRIBUTION.

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59

Serious cardiovascular dysfunction is frequently associated with chronic magnesium deficiency. These effects may arise from a modification in the relative distribution of cardiac myosin among its three isoenzymes. To test this possibility, young male Wistar rats were fed either a diet adequate (N) or deficient in Mg^{2+} (MD). Because the Mg^{2+}-deficient diet leads to significant weight loss, a second control group was fed the Mg^{2+}-adequate diet and pair weighted to the MD animals (NFR). After either 8 or 12 weeks of feeding, animals were cannulated for heart rate (HR) and mean arterial blood pressure (MAP) determinations. Then, they were sacrificed, hearts removed, myofibrils isolated from the left ventricle, and analyzed electrophoretically for relative myosin isoenzyme distribution. Consumption of the Mg^{2+}-deficient diet reduced serum Mg^{2+} levels by approximately 50% and body weight by 27%.

	8WkN	8WkMD	8WkNFR	12WkN	12WkMD	12WkNFR
N	6	6	6	6	6	6
%V1	86+2.8	83+4.8	57+2.8*	84+1.7	84+3.0	61+1.3*

(* = P<0.05)

Neither HR nor MAP were altered by the dietary manipulations. These data demonstrate that both resting cardiac functional capacity and normal cardiac isomyosin distribution are preserved despite consumption of a Mg^{2+}-deficient diet.

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PREDICTION OF SWEAT AND PLASMA VOLUME LOSS IN TRIATHLETES DURING SIMULATED COMPETITION.

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60

The relative importance of training status as a predictor of sweat and plasma volume loss were determined in 12 male triathletes with similar aerobic capacities. Subjects' mean physical characteristics were: age, 29.2 yr; ht, 176.6 cm; wt, 73.7 kg; BSA, 1.09 m^2; and $\dot{V}O_{2max}$, 67.0 $ml \cdot kg^{-1} \cdot min^{-1}$. Subjects' weekly training distances ranged from 4.5 to 18 km swimming, 96 to 440 km cycling, and 32 to 80 km running. Subjects performed a simulated triathlon (ST) comprised of 1.5 km swimming, 40 km cycling, and 10 km running at self-selected race pace under warm, humid conditions while consuming 150 ml of fluid every 12 min. Nude body weight was recorded and blood samples obtained prior to and after the ST. Mean sweat loss during the ST was 4.5 kg, or 4.2% of body weight. Mean plasma volume change, (% Δ PV) calculated by changes in hemoglobin concentration and hematocrit, was -12.6%. Mean skin ($\bar{T}_{sk}$) and rectal temperatures (T_{re}) were 32.2°C and 39.9°C, respectively at the end of the ST. The % Δ PV to % Δ body wt ratio of 3:1 was similar to previous exercise studies conducted in the heat (Armstrong 1988). Pearson's correlation demonstrated that sweat rate was significantly related to T_{re} (r =.76). Sweat loss was not related to % $\dot{V}O_{2max}$, % HRmax, $\dot{V}O_{2max}$, BSA or % Δ PV. % Δ PV was significantly related to training mileage (r = .69) and T_{re} (r = .67). Stepwise linear regression indicated: 1) T_{re} to be the most significant predictor of sweat loss (R^2 = .59, p < .003); and 2) training mileage was the most significant predictor of %ΔPV (R^2 = .49, p < .01). These results suggest that training status based on weekly mileage was predictive of plasma volume loss, but not sweat loss, among highly-fit triathletes during a simulated competition. Although previous studies have found that highly-trained individuals may exhibit greater sweat rates than untrained subjects, it is more difficult to predict sweat loss within a group of highly-trained subjects.

PREDICTION OF THE VENTILATORY THRESHOLD BY THE LACTATE THRESHOLD

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61

In order to test the theory that the increase in CO_2 flow to the lung due to bicarbonate buffering of H+ from lactic acid causes the rise in ventilation at the ventilatory threshold, the lactate thresholds of 10 subjects were used to predict their ventilatory thresholds. The subjects performed an incremental exercise test on the cycle ergometer until volitional fatigue, starting at 30 w and increasing in increments of 30 w every 3 min. Arterialized venous blood samples were drawn the last 30 sec of each stage. $\dot{V}_E$ and $\dot{V}O_2$ were measured the third minute of each stage. Ventilatory thresholds were determined according to the following criteria: the $\dot{V}O_2$ at which $\dot{V}_E/\dot{V}O_2$ exhibited a systematic increase and the $\dot{V}O_2$ at which $\dot{V}_E$ began to increase nonlinearly. The lactate thresholds were determined by Beaver's method as well as by Baker's modification of Beaver's method. Both log-log and semilog models were used. The Baker log-log lactate threshold, determined in a previous study to be the threshold from the model that best fit the data, had the least mean difference from the ventilatory threshold (-0.088 $l \cdot minute^{-1}$), as visualized by a better scatter of points around the line of identity. However, it was a poor predictor of the ventilatory threshold with slope not significantly different from zero ($p>.05$) and $R^2=.13$. In conclusion, this study did not support the theory that the increase in CO_2 flow concomitant with the increase in blood lactate is the stimulus for the nonlinear rise in ventilation at the ventilatory threshold.

PLASMA LIPID AND LIPOPROTEIN RESPONSES TO ENDURANCE TRAINING IN OLDER WOMEN

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62

To investigate the influence of a short-term endurance training program on selected physical variables and serum lipids and lipoproteins, 31 females ranging in age from 61-81 volunteered to participate in a walking program (WLK, N=18) or a control (CTL, N=13) group. The walking program consisted of three sessions/wk for eight consecutive weeks at 70-80% of the subjects predicted maximum heart rate. Pre and post-training data collection included height (HT), body weight(BW), total skinfold fat (TSF), resting heart rate (RHR), resting blood pressure (SBP/DBP), one mile walk for time (1-mile) and 12-h fasting plasma levels of total cholesterol (T-CHOL), triglycerides (TG), high density lipoprotein cholesterol (HDL-C) and low-density lipoprotein cholesterol (LDL-C). An ANOVA revealed significant ($p<0.05$) pretraining differences between groups for HT (WLK=161.0±1.0; CTL=157.8±1.0 cm) BW (WLK=66.1±2.4; CTL=61.4±2.2 kg) TSF (WLK=107.5±6.8; 63.5±1.5 mm), 1-mile (WLK=17.9±0.23; CTL=19.2±0.56 min) and estimated VO2 max (WLK=21.2±2.1; CTL=20.2±2.8 ml/kg/min). An ANCOVA, using the pretraining values as covariates, identified significant ($p<0.05$) group differences following training for RHR (EX=68.0±2.0; CTL=73.0±1.3 bpm), SBP (WLK=133.±4.0; CTL=136.7±4.2 mmHg), DBP (WLK=75.5±1.6; CTL=82.0±2.7 mmHg), 1-mile (WLK=16.5±0.31; CTL=18.7±0.61 min) estimated VO2 max (WLK=24.2±2.3; CTL=20.8±2.2 ml/kg/min), TG (WLK=118.5±6.5; CTL=122.8±9.8 mg/dl) and HDL-C (WLK=57.3±1.8;5.8±1.6 mg/dl). In addition to demonstrating the typical physiological adaptations associated with endurance training, these data suggest that older women can favorably alter their serum lipid profile after a relatively short period of training.

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Effects of an at-home exercise program on blood chemistry status of dialysis patients R. Stephens, A. Williams, B. Benjamin, T. McKnight, and S. Dodd LSU., Depart. of Kinesiology, Greater Baton Rouge Dialysis Center, Baton Rouge, LA 70803

63

The effects of exercise on patients with end-stage renal disease (ESRD) is relatively unexplored. Of the complications associated with kidney failure, anemia and abnormal blood lipids profiles are among those that exercise may alter. Thus, the purpose of this study was to determine the effects of an 8 month at-home exercise program on blood chemistry status in ESRD patients. The program consisted of aerobic activity maintained for 15 min at least three times/week at an intensity of 12 on the Borg scale. Monthly blood samples were taken to assess the patients status regarding anemia and blood lipids. Results indicate no significant differences ($p > 0.05$) were seen from the beginning of the program until the end as seen below:

	Chol. mg/dl	Trig. mg/dl	HGb g/dl	RBC $10^6/mm^3$	Hct %	MCV μ^3
Beginning	187.8 ±6.5	290.1 ±24.6	8.8 ±.4	3.1 ±.1	26.8 ±1.2	83.8 ±2.6
8th Month	192.2 ±6.0	347.0 ±34.6	8.7 ±.4	3.0 ±.1	26.9 ±1.2	88.7 ±2.7

Values are $\bar{X}$ ± SEM

These data indicate an exercise program of moderate intensity may not be beneficial in helping regulate the anemia and altered blood lipid status of ESRD patients.

VELOCITY ANALYSIS OF AN AUTOMATIC TENNIS BALL DELIVERY SYSTEM

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64

Data from 36 trials on two separate days were analyzed to determine the velocity of an automatic tennis ball delivery system. The purpose of our study was to quantify the velocity of each ball delivered by a commercial tennis serving device and to determine the consistency between trials and between days. These data were collected utilizing two computer-interfaced phototransistor cells with appropriate software developed for velocity analysis. The mean (±SEM) velocities were 21.1 (±.03) $m \cdot s^{-1}$ for day 1 and 20.9 (±.04) $m \cdot s^{-1}$ for day 2. Reliability for day-to-day trials was established by a Pearson product moment correlation ($r=.59$), and an intraclass R reliability coefficient ($R=.73$). A 95% confidence interval was determined to establish consistency for within day trials yeilding a velocity range of 20.65-21.35 $m \cdot s^{-1}$ ($N=72$). An independent t-test ($p=.0001$) revealed significance differences between days. It was concluded that there were significant differences in velocities between day trials from this machine device.

MECHANICAL VALIDATION AND RELIABILITY OF A COMPUTER ASSISTED METHOD FOR MEASUREMENT OF VERTICAL DISPLACEMENT

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65

The purpose of this experiment was to determine mechanical validation and reliability of a computer interfaced lever mechanism measuring vertical displacements. An apparatus was constructed that would physically index the movements of a lever mechanism to the desired dimension. Multiple trials (4 sets of 5 repetitions) were recorded at linear distance settings of 20 cm, 45 cm, 70 cm, 95 cm, and 120 cm, with upward and downward deflection measured from a designated midpoint from the floor. Trials were repeated twice on one day and twice again on another day. Repetitions were performed manually. A least squares curve fitting procedure was utilized for interpretation to yield displacement data. Measurement errors ranged from 2.5% - 7.9% and 4.7% - 13.4% respectively, for upward and downward deflection with an average of 6.9% across all conditions. A repeated measures ANOVA showed significant differences in displacement, day, and condition by displacement by day using distance as the dependent variable ($p<.01$). Pearson product moment coefficients revealed that correlations were moderate ($r=.80$) between day-to-day measures, and low ($r=.55$) between criterion distance and displacement measures. The results for this experiment indicate the mechanical device tested will require additional modification in order to yield an accurate measurement of vertical displacement.

REPRODUCIBILITY OF THE CO_2 REBREATHING METHOD TO ESTIMATE CARDIAC OUTPUT AT REST AND DURING EXERCISE

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66

This study compared cardiac output (Q) and related measures at rest and during 75% heart rate (HR) intensity on the treadmill. Ten male subjects (mean age=23 yrs) were tested on four different days using the Beckman-MMC CO_2 rebreathing (equilibrium) method. ANOVA with repeated measures was used to analyze the data. Although one of the oxygen uptake (VO_2) values at rest was significant, HR, stroke volume (SV), Q, arteriovenous oxygen difference (a-vO_2 diff), blood pressure (BP), double product (DP), and systemic vascular resistance (SVR) were not significantly different across the four test-days. The intraclass correlation coefficients for Q, volume of CO_2 produced (VCO_2), mixed venous PCO_2 ($PvCO_2$), and arterial PCO_2 ($PaCO_2$) were .79, .58, .91, and .78, respectively. The lack of significant differences in Qs and related CO_2 rebreathing values during the four tests indicates good reproducibility for Q at rest. Exercise Q and related measures during the four tests resulted in no significant changes in Qs (T_1 = 16.36, T_2 = 16.34, T_3 = 15.59, and T_4 = 16.10 L/min), HR, SV, a-vO_2 diff, VO_2, BP, DP, and SVR. Intraclass correlation coefficients for exercise Q, VCO_2, $PvCO_2$, and $PaCO_2$ were .93, .95, .85, and .84, respectively. Again, the lack of significant differences in exercise Qs and as well with the related cardiovascular data coupled with the high correlation coefficients indicate good reproducibility. We therefore conclude that the Beckman-MMC CO_2 rebreathing method for estimating Qs at rest and during exercise is a reliable method to use in exercise physiology research.

EFFECT OF BICYCLE SEAT HEIGHT ON OXYGEN UPTAKE AND CARDIAC OUTPUT

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67

The purpose of this study was to determine the effect of bicycle seat height on cardiovascular responses at a power output of 270 kpm/min while pedaling at 90 rpm. Seven male (mean age, 26 years) subjects were studied using 95%, 100%, and 105% of the subjects' leg length to established seat heights. ANOVA with repeated measures and the Tukey post-hoc test were used to analyze the data. Oxygen uptake (VO_2) at the 95% seat height was significantly ($p<.05$) lower than the 105% seat height (2.87 L/min +/- .31 vs 3.04 L/min +/- .36, respectively), but the size of the observed effect (.17 L/min) lacks practical importance. Cardiac output was not significantly different across the three seat heights (95%, 19 L/min +/- 2.32; 100%, 20 L/min +/- 2.17; 105%, 20 L/min +/- 2.16). Heart rate, stroke volume, and arteriovenous oxygen difference responses were not significantly different. Therefore, given that the subjects' central and peripheral adjustments for total-body VO_2 were the same for each of the three seat heights, these data suggest that the cardiovascular responses are the same within a 10% seat height variation.

EVALUATION OF THE FITNESSGRAM ONE-MILE RUN/WALK CRITERION-REFERENCED STANDARDS.

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68

Criterion referenced standards (CRS) have recently been developed for the Fitnessgram and AAHPERD Physical Best youth fitness tests, but these standards have not been scientifically evaluated. The objectives of this study were: (a) to evaluate assumed values for % VO_{2max} utilized during the mile run/walk used in development of the Fitnessgram one-mile run/walk CRS and (b) to validate these standards. Sixty-nine children, 6 to 14 years of age, performed a one-mile run/walk test in the field, followed by laboratory testing in which the VO_2 utilized at the average mile run/walk pace and VO_{2max} were measured. The mean % VO_{2max} utilized for boys and girls 6-8 y (82-85%) and for girls 9-11 y (83%) were not significantly ($p < .05$) different from those utilized in development of Fitnessgram CRS, but the means for boys 9-11 y (76%), and boys and girls 12-14 y (84-91%) were significantly ($p < .05$) lower than assumed values. A contingency table that classified the subjects as being above or below criterion VO_{2max} values and mile run/walk CRS was used to validate the CRS. The mile run/walk correctly classified 53 (77%) subjects on VO_{2max}. It was concluded that % VO_{2max} values used in development of the Fitnessgram CRS were probably too high for older children, but that the validity of the Fitnessgram one-mile run/walk CRS for classifying maximal aerobic power of children 6 to 14 years of age is good.

69

EFFECTS OF PRIOR HYDROTHERAPY ON CARDIOVASCULAR RESPONSES TO EXERCISE

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The use of hydrotherapy prior to exercise is a common practice in athletic training. The purpose of this study was to determine the effects of prior hydrotherapy (105 ^{o}F) on cardiovascular responses of to exercise. Fifteen males participated in a two session cross-over experimental design. Subjects cycled at 125 W for ten minutes without prior hydrotherapy (control) and following 10-min of hydrotherapy immersed to the mid-sternum. Tenth minute exercise oxygen uptake, cardiac output (CO_2 rebreathing), heart rate, stroke volume, arterio-venous oxygen difference, mean arterial pressure, and core temperature data were analyzed by ANOVA for repeated measures. Results revealed no significant differences ($p>0.05$) between control and post-hydrotherapy: oxygen uptake (1.99 +/-.2 to 1.96 +/- .2 $l \cdot min^{-1}$); cardiac output (14.3 +/- 1.6 to 14.3 +/-2.1 $l \cdot min^{-1}$); heart rate (146 +/- 11 to 149 +/-15 $beats \cdot min^{-1}$); stroke volume (98 +/-15 to 97 +/-21 $ml \cdot min^{-1}$); arterio-venous oxygen difference (14.5 +/-2 to 14.2 +/2 $ml \cdot 100ml^{-1}$); and core temperature (97.9 +/-1.1 to 97.9 +/-1.0 ^{o}F). However, hydrotherapy significantly reduced ($p<0.05$) mean arterial pressure (103 +/-11 to 98 +/-15 mmHg). Results suggest that hydrotherapy promotes a vasodilatory effect resulting in a modest decrease in mean arterial pressure. However, this decline elicited no significant alterations in cardiovascular compliance to exercise.

70

EFFECTS OF DEEP WATER EXERCISE ON BLOOD LIPIDS AND BODY COMPOSITION IN OLDER INDIVIDUALS

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The purpose of this study was to compare the effects of a deep water aerobic exercise program (using the Wet Vest) to a traditional overground aerobic exercise program. Subjects (n=21), males and females (40-65 yr) with no history of coronary heart disease (CHD), participated in a 10-wk exercise program that was matched in terms of frequency (3x/wk), duration (30 min), and intensity (60-70% of max exercise capacity) for both the water (n=11) and land (n=10) groups. Pre- and post-training data included: blood lipid analyses (CHOL, Triglycerides, HDL, LDL, VLDL, and the HDL/CHOL ratio) and body composition (% BF) determined by hydrostatic weighing, with two blood lipid analyses performed seven days apart serving as the pre-exercise determination. Between- and within-group data analyses revealed: 1) a slight decrease in %BF for both groups (1-3%), with the water group demonstrating the greater change; and, 2) decreases in CHOL (16-30 mg/dL), Triglycerides (7-14 mg/dL), and LDL (7-26 mg/dL) for both groups with the land group demonstrating the greater change. These data suggest that aquatic aerobic exercise using the Wet Vest is comparable to overground aerobic exercise in terms of favorably affecting both body composition and blood lipid levels in older individuals without CHD.

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EXERCISE INDUCED CHANGES IN AORTIC BLOOD FLOW AND ECG INTERACTIONS

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71

Continuous wave (CW) Doppler echocardiography has been utilized extensively in the evaluation of myocardial performance. It is well established that both aortic blood flow velocity (BFV) and acceleration increases during exercise. However, few data are available concerning exercise-induced changes in other parameters of aortic blood flow such as blood flow deceleration kinetics and BFV-ECG interactions. Thus, we sought to examine changes in these additional parameters under exercise conditions. BFV signals were generated by a stand-alone 3MHz CW doppler system (Quinton EXERDOP) with probe placed at the sternal notch. Both BFV and ECG signals were digitized (200Hz) then filtered (10Hz) and analyzed for peak velocity (P_kV), peak acceleration (P_kA), peak deceleration (P_kD), stroke distance (SD), time to peak velocity (TP_kV), half-deceleration time (HDT), time delay between the onsets of the QRS complex and the pulse wave (E-P) and heart rate (HR) by microcomputer. Data were collected on 10 college males at rest and during mild cycle ergometer exercise (5min at 50watts). Percent change ($X\pm SE$, $*p<.05$) in each parameter between rest and exercise were as follows: $P_kV=48.2\pm3.6*$, $P_kV=52.4\pm7.2*$, $SD=24.4\pm19.3$, $TP_kV=6.0\pm4.9$, $P_kD=35.4\pm3.4*$, $HDT=3.0\pm2.1$, $E-P=-21.8\pm4.2*$. Heart rate increased from 68.7 ± 2.8 at rest to 95.8 ± 2.6 during exercise. This analysis procedure appears to be sensitive to small changes in BFV. Significant changes in P_kA and P_kD indicate that during mild exercise the aortic pulse wave increases in magnitude but not in time course. Moderate correlations were found between P_kD and P_kV, P_kA and SD (r=.84, .83 and .57). E-P, however, was not correlated with with any of these three parameters (r=-.66, -.64 and -.34). Thus traditional measures of P_kV, P_kA and SD may not adequately describe exercise-induced changes in myocardial performance.

DIGITAL FILTERING AND ANALYSIS OF DOPPLER BLOOD FLOW VELOCITY SIGNALS

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72

Continuous wave (CW) Doppler techniques have been employed as a means of evaluating myocardial performance. By analyzing the frequency shift of ultrasonic soundwaves reflected from moving red cells (Doppler effect), blood flow velocity (BFV) can be determined. We sought to establish a digital procedure for collecting and analyzing Doppler generated aortic BFV signals. BFV signals were produced by a stand-alone, 3MHz CW Doppler system (Quinton EXERDOP) with probe placed at the sternal notch. Initially, BFV signals were digitized at 1024Hz for 5sec. 512-point Fourier analysis determined the mean power frequency to be 6.3 ± 0.5Hz (resting) and 5.1 ± 0.2Hz (post-exercise)(n=10) with >99% of the signal power located below 10.2 ± 0.2Hz. Next, sampling frequency was reduced to 200Hz and both BFV and ECG signals were collected for 5sec intervals. Digitized data were then filtered via a 4th order Butterworth low-pass filter of the form:

$$V_f(t) = \sum_{j=0}^{2} A_j * V(t-j) + \sum_{k=1}^{2} B_k * V_f(t-k)$$

Coefficients were chosen such that the 3dB cutoff frequency (f_c) was approximately 10Hz (actual f_c = 10.3Hz). Increasing f_c to >15Hz tended to introduce variability within individual signals whereas decreasing f_c to <6Hz markedly depressed the magnitude of the signal. Optimal f_c for BFV signals thus appears to be about 10Hz. Finally, filtered data were analyzed for peak BFV (P_kV), time to peak velocity, half-deceleration time, peak acceleration (P_kA), peak deceleration, stroke distance (SD) and time between the onsets of the QRS complex and pulse wave (n=10). Intraclass correlation showed high reliability within and between sampling intervals for each variable (R^2=.99-.94). P_kV, P_kA and SD values also were highly correlated with those obtained from the EXERDOP (R^2=.96, .95 and .90). Results suggest that this method of collecting, filtering and analyzing BFV signals is reliable and valid. The additional variables determined by this analysis may provide additional information concerning myocardial function, particularly blood flow deceleration kinetics and ECG-BFV interactions.

THE EFFECT OF WEIGHT TRAINING ON MAXIMUM ARM AEROBIC POWER.

73

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The purpose of this study was to determine if weight training could promote increases in maximum arm aerobic power as measured by arm cranking on a modified Monark cycle ergometer. 18 untrained college age males served as subjects, 13 in the training group and 5 in a non-training control group. The training consisted of 8, 1.5 hour bouts of weight lifting over four weeks, and included 3 sets of 10 repetitions of the following exercises: biceps curl; bench press; bent back and upright rowing; military press; leg press; and hamstring curl. Arm aerobic power was measured before and after the training. The trained group experienced a 13.43% ($p<.01$) increase in maximum arm aerobic power, while the control group's performance on the arm cranking test declined by 4%. These data suggest that maximum arm aerobic power, as measured during an arm cranking test, can be limited by arm strength rather than by circulatory factors, since weight training is generally believed to improve the former without altering the latter.

EFFECTS OF REPEATED BOUTS OF SHORT-TERM, HIGH-INTENSITY EXERCISE ON POWER OUTPUT

74

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A front loading modified 818 Monark cycle ergometer integrated with a microcomputer was utilized to examine the effects of repeated bouts of short-term, high-intensity exercise on power output indices. Nine college aged males performed 2 ergometer trials 1 to 5 days apart. The protocol consisted of a 4 minute warm-up (50W) followed by 5, 10 sec. maximal effort bouts interspersed with 20 sec. rest intervals. Each bout began with the pedals in a static horizontal position and the subjects preferred limb forward. The ergometer resistance was set at 0.1 kg/kg body weight. Peak power (PP), time to peak power (TTPP), power fatigue rate (PFR), power fatigue index (PFI, percent decline from PP), and average power (AP) were calculated for each bout. A repeated measures ANOVA and subsequent Newman-Keuls post hoc test was used to determine differences between bouts 1 through 5. The results were as follows ($X \pm SE$):

Bout	PP(Watts)	AP(Watts)	TTPP(sec)	PFR(W/sec)	PFI(%)
1	940±48	842±42	3.9±.3	16.4±1.4	18.7±1.1
2	866±44	760±36	3.7±.4	17.2±1.6	21.8±1.7
3	782±28*	679±26*	3.1±.2	16.3±1.7	23.9±1.9
4	705±31*	616±26*	3.0±.1	14.3±1.7	23.6±2.3
5	665±30*	587±27*	3.2±.2	12.6±1.5	22.1±2.2

($p<.01$ vs bout 1). PP and AP decreased from bouts 1 to 5 while there was no changes in TTPP, PFR, or PFI. Thus, an inverse relationship exists between repeated anaerobic cycling bouts and the subjects ability to maximally produce power. That PFI and PFR remained constant across bouts indicates no change in the rate or magnitude of fatigue during this type of exercise. Such a protocol may provide more information on anaerobic power producing ability than the traditional single bout ergometer test. Thus, it may be better suited for assessment of performance in events requiring repeated bouts of anaerobic activity.

POWER OUTPUTS DURING THE VERTICAL JUMP AND RELATIVE ISOKINETIC LEG STRENGTH OF THE QUADRICEPS VERSUS HAMSTRING MUSCLES.

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75

This study compared the peak torque values of the knee flexor and extensor muscle groups with power outputs during vertical jumping. Twenty-five male collegiate football players volunteered as subjects for this study. Mean (±SD) physical characteristics were as follows: 19.6 ± 1.4 years of age, 95.6 ± 15.7 kg body weight, and 182.9 ± 7.0 cm in height. Subjects were tested for peak torque during leg flexion and extension at joint velocities of 180°/s and 300°/s using a Lido 2.0 isokinetic dynamometer. Each subject's power output was calculated from the mean displacement of three vertical jump (VJ) trials in the following manner: power output = $\sqrt{VJ(m)}$·body weight (kg)·$\sqrt{4.9}$. Mean (±SEM) power outputs were 161.8 + 4.6 kg-m·sec^{-1}. An ANOVA with repeated measures indicated no significant differences between vertical jump trials ($p>.05$). Stepwise regression revealed flexion at 180°/s as the only significant variable ($p=.007$) when all torque values are modelled against power output as the dependent variable. Pearson moment correlations were used to establish relationships between the power output data and each isokinetic measure. These correlations revealed significant relationships ($p<.05$) with power output for both flexion at 180°/s ($r=.53$) and flexion at 300°/s ($r=.45$). These data suggest that hamstring strength may play a greater role than the quadriceps in power production during vertical jumping.

COMPARATIVE PEAK POWER CAPABILITIES OF MEN AND WOMEN

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76

Minimal information is available on the comparative maximum strength and power capabilities of men and women. Thirty three men and 19 women were measured on the 1RM squat and modified Wingate cycle test (CT). Maximum Strength (1RM squat) and power tests were performed after 4 weeks (T1) and after 13 weeks (T2) of weight-training emphasizing leg and hip strength. Data was analyzed using T-tests for independent groups. Maximum (1RM) squat values showed a significant increase across time ($p\leq0.05$) for men and women (men= 8%; women= 13%). Peak power measured by the CT showed small but significant gains for both groups, men (2.5%) 825± 84 W - 846± 90 W ; women (4.5%) 440 ±37 W - 460 ±27 W). The women's squat as a percentage of the men's increased from 43% (T1) to 46% (T2); however, a small decrease in the % of the men's peak power output was noted (T2 = 57% ; T2 = 54%). Comparison of values for T1 and T2 suggest that gains in maximum leg and hip strength do not necessarily carry over to equal gains in power as measured by a CT. In relation to men, women gained a greater percentage of maximum strength and peak power. However, this gain was not reflected in relative (%) power outputs.

PELVIC ISOMETRIC ROTATIONAL STRENGTH IMPROVEMENT IN SELECTED KARATE STUDENTS

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77

Thirty-four members of a Karate class were randomly assigned into treatment (GP 1) and control (GP 2) groups for a test-retest design on the identification and development of pelvic isometric rotational strength (PIRS). In Karate this strength is called focus, and involves an instantaneous valsalva-like tightening of the muscles with the pelvic area initiating the response. A cable-tensiometer with a specially designed hip-harness was used to measure strength. A ten week hip-strength training program followed pretest measures and included adductor pulls, abductor pulls, hip-flexor lifts, knee extensions, squat leg lifts, leg curls, and abdominal crunches. Posttest values for GP 1 revealed a significant increase in pelvic isometric rotational strength ($p<0.01$), a 20.2% improvement. GP 2 showed no significant increases in pelvic isometric rotational strength.

	PIRS (lbs) pre-test	post-test	
GP 1 (N = 18)	43.83 ± 10.55	52.22 ± 8.99*	
GP 2 (N = 16)	51.19 ± 11.78	51.50 ± 9.81	*p<0.01

Pelvic isometric rotational strength, as identified in this study, was identified and improved on. The results of this study may be applied to other sport techniques that require a twisting motion of the hips.

EFFECTS OF WALKING DURATION ON POST-EXERCISE FUEL UTILIZATION.

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78

To examine the effect of exercise duration on post-exercise fuel utilization seven overfat sedentary females completed treadmill walking sessions of 10, 20, 30, 40, 50 and 60 min. Each of the six walking sessions followed a 12 hour overnight fast and consisted of one hour pre-exercise rest (PRE-EX), one of six randomly assigned exercise durations, and one hour of post-exercise rest (POST-EX). Exercise heart rate averaged 54 ± 2% of max heart rate reserve for all sessions. No significant effect of walking on resting metabolic rate was observed as POST-EX and PRE-EX resting oxygen consumption did not differ. Blood glucose levels following exercise (85.09 ± 2.38 mg%, POST-EX) were significantly lower ($p < .05$) than PRE-EX (86.99 ± 2.22 mg%) levels. Significant elevations in POST-EX FFA levels were observed following 30, 40, 50 and 60 min. of walking. POST-EX 40, 50 and 60 min. serum glycerol values remained significantly elevated above PRE-EX levels. PRE-EX respiratory exchange ratio (RER) was significantly higher than POST-EX following 30, 40, 50 and 60 min. walking sessions. These results suggest that walking durations of 10 to 60 minutes have no significant effect on the metabolic rate of sedentary overfat females one-hour post-exercise. Elevated blood glycerol and FFA levels and a lower RER one-hour after walking for 30, 40, 50 and 60 min. suggest a significant increase in the post-exercise rate of fat metabolism when walking duration is extended past 30 minutes.

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PHYSIOLOGICAL CHARACTERISTICS OF COMPETITIVE BOARDSAILORS

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79

Body composition, cardiovascular endurance, muscle strength and flexibility were determined in 5 male and 2 female competitive boardsailors. The subjects' ages ranged from 16 to 29 years and all had extensive experience in boardsailing, ranging from 10 years training and 7 competing to 3.5 years training and 1.5 years competing. The 2 females had %fat values of 9 and 17%, while the men's %fat averaged 14.1%. The female's values for VO2 Max were 43.17 ml/kg/min and 57.13 ml/kg/min, while the men's VO2 Max averaged 52.34 ml/kg/min. The strength values for bench press, arm curl and leg press obtained by all boardsailors were in the average higher than the optimal strength values reported for the 1 RM-test and classified as moderate to high when compared to standards based on sex and age. All but one of the boardsailors were classified as good or excellent in the sit and reach flexibility test while the test score of all boardsailors on the back hyperextension test was considered excellent under the same standards. The results suggest that this group of competitive boardsailors are a well trained group of athletes with %fat values lower than the average untrained population, VO2 max values considered high by various standards and comparable to athletes of various other sports, acceptable to high upper and leg strength and well developed flexibility.

PHYSIOLOGICAL CHARACTERISTICS OF FIRE FIGHTERS

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80

Fifty three male fire fighters were assessed for cardiovascular endurance (Bruce treadmill protocol), muscular strength (bench press, knee extension, knee flexion, two-arm curl), muscular endurance (total number of curl-ups), flexibility (sit and reach, shoulder, and side splits), body composition (skin fold), and blood lipids (total cholesterol, HDL-C, triglycerides, calculated LDL-C). Results were compared to a control group of forty four males tested immediately prior to entering a physical fitness program using a t-test for independent samples. Results showed that fire fighters were significantly ($p<.05$) lower in $\dot{V}O_2$max, muscular endurance, and side-split flexibility. Fire fighters were also significantly higher in body fat, total cholesterol, calculated LDL-C, triglycerides, total cholesterol/HDL-C ratio, and total body weight. No significant differences were found in any measures of muscular strength, sit & reach or shoulder flexibility, height, or age. It was concluded that the fitness level of male fire fighters is similar to other sedentary males. In addition male fire fighters have below average blood lipid profiles. These results may help explain the high incidence of injury and cardiovascular disease in this population.

EFFECT OF EXERCISE INDUCED DEHYDRATION ON BODY COMPOSITION

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81

This study evaluated the effect of exercise induced dehydration (EID) on the determination of body composition by the underwater weighing (UWW) and sum-of-seven skinfold (SF) techniques. Body Density (Db), percent fat (%F) and fat-free mass (FFM) were determined on 19 males (age=28±7 yr; ht=179.8±5.8 cm; wt=83.0±10.7 kg) 2 h apart on two separate days. On one day, subjects were measured prior to (pre) and following (post) a moderately strenuous 1 h bout of exercise (EX). The other testing day was considered a control (C) and did not include EX. The order of EX and C was randomly assigned. Mean body weight loss due to EID was 1.54±0.55 kg (EX<C, p<0.001). Changes in UWW and SF values for EX and C (Δ=post-pre) are shown below:

		Db (g/ml)	%F	FFM (kg)
Δ UWW	C	0.0008	- 0.30	0.10
	EX	0.0017	- 0.70	- 0.70*
Δ SF	C	0.0001	- 0.10	- 0.20
	EX	- 0.0003	0.10	- 1.40**

*p<0.01, **p<0.001

These data indicate that moderate EID does not significantly affect Db or %F determined by UWW or SF, and suggest that changes in FFM consequent to EID are due to reduced body weight.

ASSESSING CHILDREN FOR BODY COMPOSITION AND CIRCULATORY DIFFERENCES BASED ON AGE, RACE AND SEX

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82

This study was designed to evaluate 675 children for body composition and circulatory differences on three factors (1. age, $\bar{X}$ 9.1 yrs, N = 367; $\bar{X}$ 11.9 yrs, N = 308; 2. race, 244 black; 431 white; 3. sex, 330 female; 345 male). The subjects received identical treatments and were measured for height, weight, body mass index (BMI), triceps and subscapular skinfolds, and systolic and diastolic blood pressures. A factorial MANOVA procedure was employed to evaluate the model of variables for differences. The multivariate test of significance showed main effect differences (p <.01) for race, age and sex. The univariate test for the specific variables within the factors showed that black children had lower fat levels, but higher blood pressures (p < .05). That males had lower fat levels than females and that the older group had higher values on the body composition variables, but not for blood pressure measurements. Zero order correlation coefficients between the body composition and blood pressure variables ranged from 0.14 to 0.55 with systolic blood pressure and body weight sharing the higher correlations for all conditions. These data show that although black children are less fat than white children, they are heavier and have higher blood pressure. This suggests that some aspect of lean body mass may contribute to hypertension in black children.