AMERICAN COLLEGE of SPORTS MEDICINE

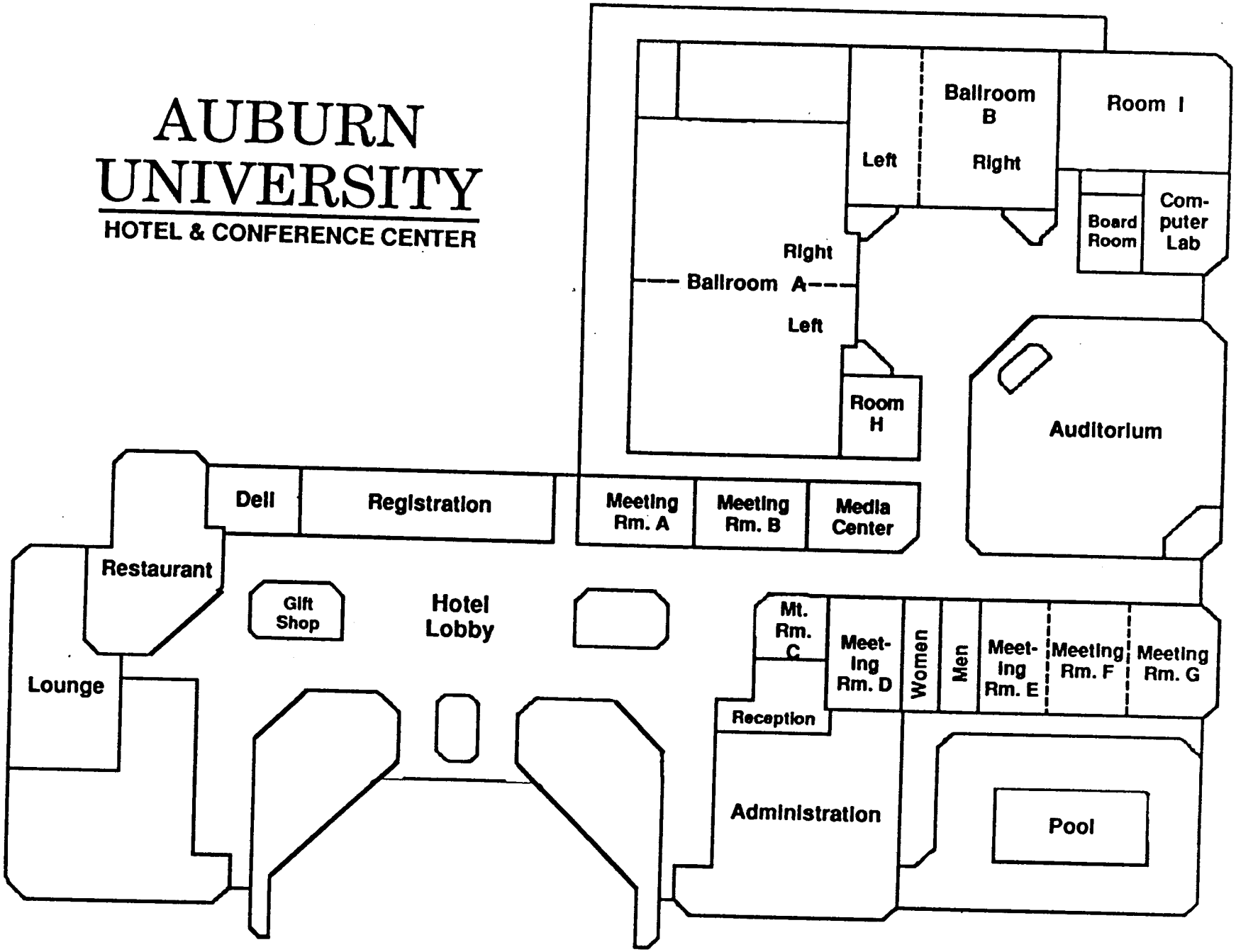
Southeast Regional Chapter

January 30 - February 1, 1992
19th Annual Meeting
Auburn University Hotel & Conference Center
Auburn, Alabama

ABSTRACTS

AUBURN UNIVERSITY

HOTEL & CONFERENCE CENTER



Nineteenth Annual Meeting

SOUTHEAST REGIONAL CHAPTER AMERICAN COLLEGE OF SPORTS MEDICINE

Auburn University Hotel and Conference Center
Auburn, Alabama

January 30 - February 1, 1992

Officers

President:
Stephen Messier, Wake Forest University

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Ron Bos, Virginia Tech

Meeting Host Committee: Auburn University
Dennis Wilson
Bruce Gladden
Dave Pascoe
Dan Blessing

Publisher and Editor:
Jon MacBeth, Middle Tennessee State University (Publisher)
Kent Johnson, David Lipscomb University (Newsletter Editor)

Meeting Objective

The objectives of this annual meeting are to provide students, scientists, educators and sports medicine practitioners with new research findings, a synthesis of current theories and applications, and contemporary approaches in clinical practice. These objectives will be accomplished via featured addresses, poster presentations, tutorials, symposium and free communications.

Planning Committee

Ron Bos
Jeff Chandler
Kevin Davy
Bill Deuy
Harry DuVal
Gay Israel, Program chair
Ben Kibler, Clinical track chair
Stephen Messier
Mindy Millard-Stafford
Bob Moffatt
Alan Rogol
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List of Reviewers

Barbara Ainsworth
Dalynn Badenhop
Michael Berry
Jerry Brandon
Ron Bulbulian
Jeff Chandler
Kirk Cureton
Kevin Davy
Bill Deuy
Patricia Dolan
Harry DuVal
Mary Ellen Franklin
Bruce Gladden
Alan Goldfarb
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Charles Hardy
Emily Haymes
Tibor Hortobagyi
Joe Houmard
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John Stevenson
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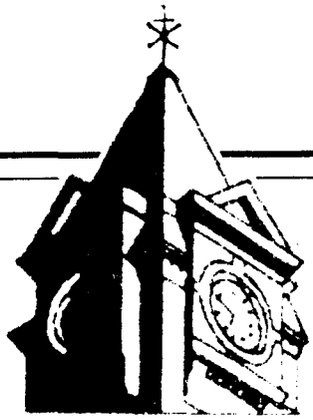
Janet Walberg-Rankin
Dianne Ward
Art Weltman
Jay Williams
Melvin Williams

Chronology of SEACSM Meeetings & Officers

	Date/Place	Pres/PastPres/PresElect	Executive Board
1st	Fall 1973 Gatlinburg, TN		
2nd	Fall 1974 Atlanta, GA	Andrew Kozar	
3rd	Fall 1975 Charlottesville, VA	Clyde Partin	
4th	Fall 1976 Murfreesboro, TN	Rankin Cooter	
5th	Fall 1977 Lexington, KY	Ed Howley	Steve Blair Ron Byrd Joe Smith
6th	Feb. 16-17, 1979 Atlanta, GA	Dennis Wilson Ed Howley Ron Byrd	Earl Allen Thad Crews Art Weltman
7th	Feb. 8-9, 1980 Charlotte, NC	Ron Byrd Dennis Wilson Paul Ribisl	Bruce Gladden Jay Kearney Russ Pate
8th	Feb. 6-7, 1981 Charleston, SC	Paul Ribisl Ron Byrd Bill Herbert	Joe Chandler Tom Cronan Kirk Cureton Harvey Murphy (ES)
9th	Feb. 5-6, 1982 Blacksburg, VA	Bill Herbert Paul Ribisl Russ Pate	Kirk Cureton Joe Chandler Harvey Murphy Tom Cronan Jon MacBeth (ES)
10th	Feb. 4-5, 1983 Gainesville, FL	Russ Pate Bill Herbert Kirk Cureton	David Cundiff Scott Powers Earl Allen Jon MacBeth (ES)
11th	Feb. 3-4, 1984 Auburn, AL	Kirk Cureton Russ Pate Chris Zauner	Emily Haymes Phil Sparling Mike Stone Ron Bos (ES)
12th	Jan.31-Feb2, 1985 Boone, NC	Chris Zauner Kirk Cureton Robert McMurray	Harry DuVal J.W. Yates John Billings Diane Spitler Ron Bos (ES)
13th	Jan. 23-25, 1986 Athens, GA	Robert McMurray Scott Powers	Diane Spitler John Billings Terry Bazzarre Larry Durstine Russ Pate (N) Ron Bos (ES)
14th	Jan. 29-31, 1987 Charleston, SC	Scott Powers Robert McMurray Diane Spitler	Terry Bazzarre Larry Durstine Janet Walberg Steve Messier Allen Moore (S) Russ Pate (N) Ron Bos (ES)

	Date/Place	Pres./PastPres/PresElect	Executive Board
15th	Jan. 28-30, 1988 Winston-Salem, NC	Diane Spitler Scott Powers Phil Sparling	Janet Walberg-Rankin Steve Messier Gay Israel Dalynn Badenhop Mark Senn (S) Russ Pate (N) Ron Bos (ES)
16th	Jan 19-20, 1989 Atlanta, GA	Phil Sparling Diane Spitler Emily Haymes	Dalynn Badenhop Mark Davis Gay Israel David Peltzer (S) Art Weltman Kirk Cureton (N) Ben Kibler (MD) Ron Bos (ES)
17th	Feb. 1-3, 1990 Columbia, SC	Emily Haymes Phil Sparling Harry DuVal	Jerry Brandon Mark Davis Diane Ward Art Weltman Maria Burgess (S) Ben Kibler (MD) Kirk Cureton (N) Ron Bos (ES)
18th	Jan. 31-Feb. 2, 1991 Louisville, KY	Harry DuVal Emily Haymes Steve Messier	Jerry Brandon Jeff Rupp Amanda Timberlake Dianne Ward Maria Burgess (S) Kevin Davy (S) Alan Rogol (MD) Kirk Cureton (N) Ron Bos (ES)
19th	Jan. 30-Feb.1, 1992 Auburn University	Steve Messier Harry DuVal Gay Israel	Mindy Millard-Stafford Bob Moffatt Amanda Timberlake Jeff Rupp Kevin Davy (S) Bill Deuy (S) Alan Rogol (MD) Ben Kibler (MD) Phil Sparling (N)

ES = Executive Secretary
S = Student Representative
N = National Representative
MD = Physician Representative



AUBURN UNIVERSITY

extends a warm welcome

to all

Annual Meeting Attendees

of the

Southeastern American College

of Sports Medicine

SOUTHEAST CHAPTER OF THE AMERICAN COLLEGE OF SPORTS MEDICINE

1992 Annual Meeting Program

Auburn University Hotel and Conference Center
Auburn, Alabama

Thursday, January 30

12:00 - 6:00	REGISTRATION
12:00 - 2:00	EXECUTIVE BOARD MEETING (Meeting Room H)
2:00 - 7:00	SPEAKER READY ROOM (Meeting Room H)
2:00 - 6:00	VISIT EXHIBITS (Ballroom B)
4:00 - 5:00	FREE COMMUNICATIONS: **Prolonged Exercise** Chair: Joe Houmard, East Carolina University (Ballroom A - Right)

(4:00 - 4:15) **1** **Effects of ultraendurance triathlon performance on serum enzyme levels.** E. Bertun, R.B. Kreider, M. Mitchell, G.W. Miller, V. Miriel, C.W. Cortes, D. Hill, T. Somma, and S. Sechrist. Old Dominion University.

(4:15 - 4:30) **2** **Analysis of electrolyte intake and serum electrolyte levels during an ultraendurance triathlon.** V. Miriel, R.B. Kreider, M. Mitchell, G.W. Miller, C.W. Cortes, D. Hill, T. Somma, and S. Sechrist. Old Dominion University.

(4:30 - 4:45) **3** ****Markers of muscle damage following prolonged swimming, cycling, and running and a triathlon competition.** B.T. Hinson, D.R. Dengel, and K.J. Cureton. University of Georgia.

** winner of Graduate Student Research Award (Advisor, Kirk J. Cureton)

(4:45 - 5:00)

4

*Effect of vitamin E on serum creatine kinase, and muscle soreness in cyclists completing a strenuous 100 mile ride. C.L. Lewis and A.H. Goldfarb. UNC-Greensboro.

4:00 - 5:00

FREE COMMUNICATIONS: **Hemodynamics**
Chair: Walter Thompson, University of Southern Mississippi
(Ballroom A - Left)

(4:00 - 4:15)

5

Hemodynamic responses to spontaneous exercise in rats. S.L. Yancey and J.M. Overton. University of Louisville.

(4:15 - 4:30)

6

***Comparison of left ventricular diastolic function during tachycardia induced by exercise and amyl nitrite.** R.F. Percy, D.A. Conetta, and A.B. Miller. University of Florida Health Sciences Center, Jacksonville.

(4:30 - 4:45)

7

Different hemodynamic response during single arm isometric contraction. D.T. Lee, E.M. Haymes, and R.L. Wilber. Florida State University.

(4:45 - 5:00)

8

Postural effects on cardiac output as measured by impedance cardiography compared to doppler ultrasound. S.J. Hodkin, D.L. Spitler, and D.L. Swart. University of Florida.

4:00 - 5:00

FREE COMMUNICATIONS: **Psychophysiology**
Chair: Tibor Hortobagyi, East Carolina University
(Room I)

(4:00 - 4:15)

9

Health, injury, and psychological profile of triathletes. D.L. Jackson, D.C. Dome, and J. Norton. University of Kentucky.

(4:15 - 4:30)

10

Effects of alcohol on work intensity interpretation using perceived exertion. E.J. Burke and A. Zarrow. Life College.

* This abstract was selected by the reviewers as one of the top 30 abstracts out of 103 submissions

(4:30 - 4:45)

11

***Perceived exertion may be subject to social influence during intense exercise.** R.N. Godsen and R.C. Brown. College of Charleston.

(4:45 - 5:00)

12

***Effects of ultraendurance triathlon performance on psychological profiles of exertion, feeling, and mood.** E. Dowling, R. Kreider, M. Mitchell, G. Miller, V. Miriel, C. Cortes, S. Sechrist, T. Somma, D. Hill, and D. Ballinger. Old Dominion University.

4:00 - -5:00

FREE COMMUNICATIONS: **Validation of Experimental Techniques**
Chair: Bruce Gladden, Auburn University
(Auditorium)

(4:00 - 4:15)

13

***Comparison of the 12-minute swim and run as field tests of peak aerobic power in young men and women.** D.S. Conley, K.J. Cureton, D.R. Dengal, B.T. Hinson, E.A. Higbie, and P.G. Weyand. University of Georgia.

(4:15 - 4:30)

14

***Comparison of bioelectric impedance and near infrared interactance for human body composition following either high intensity resistance or endurance training.** C.E. Broeder, K.A. Burrhus, L.S. Svanevik, and J.H. Wilmore. The University of Texas at Austin.

(4:30 - 4:45)

15

Predicting VO2 Max in females without exercise testing. H.N. Williford, M.S. Olson, D.L. Blessing, and F.H. Smith. Auburn University at Montgomery.

(4:45 - 5:00)

16

***Reliability of physiological parameters during maximal treadmill exercise in older adults.** J.F. Carroll, J.E. Graves, L.B. Panton, S.H. Leggett, D. Lowenthal,and M.L. Pollock. University of Florida.

*This abstract was selected by the reviewers as one of the top 30 abstracts out of 103 submissions

5:15 - 6:45 Auburn University HEALTH AND HUMAN PERFORMANCE LAB TOURS
Eaves-Memorial Coliseum Room 2129 (see back cover of abstract booklet for map and Auburn Conference Bulletin for details.)

7:45 - 9:00 **KEYNOTE ADDRESS**
(Auditorium)

Claude Bouchard, Ph.D
Physical Activity Sciences Laboratory
Laval University
Ste-Foy, Quebec
"Current Understanding of Obesity."

Sponsored by Roche Biomedical Laboratories Inc.

BUSINESS MEETING
Steve Messier, President, SEACSM

9:00 - 11:00 **SEACSM SOCIAL**
(Ballroom B)

Friday, January 31

7:00 - 12:00 REGISTRATION

7:00 - 7:30 **SEACSM CONTINENTAL BREAKFAST**
(Foyer and Ballroom A - Left)

7:30 - 8:15 **SEACSM BREAKFAST SPEAKER**
(Ballroom A - Left)

Joe Chandler, M.D
Peachtree Orthopaedic Clinic
Atlanta, GA
"Worst to First, Sports Medicine with the National League Champion Atlanta Braves."

7:30 - 5:30 SPEAKER READY ROOM
(Meeting Room H)

7:30 - 10:30 **POSTER PRESENTATIONS: Group 1(# 53 through 66)**
Authors present from 9:45 - 10:30
See author index to poster abstracts.
Chair: Michele Skelton, Auburn University
(Ballroom B - Left)

8:30 - 9:30 **TUTORIALS**

Healthy people 2000 physical activity and fitness objectives. Barbara Ainsworth, University of North Carolina- Chapel Hill, Brian Sharkey, ACSM President, University of Montana and all state representatives.
Chair: Mike McCammon, East Carolina University
(Auditorium)

Coping with exercise-induced bronchoconstriction in the athlete. Elizabeth Dowling, Old Dominion University.
Chair: Jeff Rupp, Georgia State University
(E, F, and G)

Exercise and trace mineral nutrition. Ron Smith, University of Southern Mississippi.
Chair: Melvin Williams, Old Dominion University
(Ballroom A - Left)

Use of the blood lactate response to exercise for: A) predicting exercise performance, B) exercise prescription. Arthur Weltman, University of Virginia.
Chair: Steve Dodd, University of Florida
(Ballroom A - Right)

8:30 - 9:30 TUTORIALS-**CLINICAL TRACK**
Chair: Letha Hunter-Griffin, Peachtree Orthopaedic Clinic
(Room I)

(8:30 - 9:00) **Patellofemoral problems in athletes.** Letha Hunter-Griffin, Peachtree Orthopaedic Clinic, Atlanta, GA.

(9:00 - 9:30) **ACL insufficiency: selection of patients for operative treatment and surgical alternatives.** David Caborn, Dale Boyd, and Michael Ray. University of Kentucky.

9:00 - 5:00 EXHIBITS - (Ballroom B) Visit throughout the day!

9:30 - 10:30 **SEACSM SCHOLAR LECTURE**
(Auditorium)

Robert Armstrong, Ph.D
Professor
Department of Exercise Science
University of Georgia
"*Skeletal Muscle: Does It Have to be Torn Down to be Built Up?*"

Sponsored by Auburn University

10:30 - 10:45 BREAK - Coffee and Juice
(Foyer)

10:45 - 11:45 **SEACSM INVITED LECTURE**
(Auditorium)

Joseph M. Chalovich, Ph.D
Associate Professor
Department of Biochemistry
School of Medicine
East Carolina University
"*If Myosin is Bound to Actin in Relaxed Muscle, Why Do I Keep Falling Out of My Chair?*"

Sponsored by SEACSM

10:45 - 11:45 TUTORIALS: **CLINICAL TRACK**
Chair: Joe Chandler, Peachtree Orthopaedic Clinic
(Room I)

(10:45 - 11:15) **Sprains, strains, and bumps about the knee.** Champ Baker, Hughston Orthopaedic Clinic, Columbus, GA.

(11:15 - 11:45) **Rehabilitation of the knee.** Tim Uhl and Tab Blackburn. Rehabilitation Services of Columbus, Columbus, GA.

10:30 - 12:30 **POSTER PRESENTATIONS: Group 2(# 67 through 80)**
Authors present from 11:45 - 12:30
See author index to poster abstracts.
Chair: Edith Smith, Auburn University
(Ballroom B - Left)

11:45 - 1:15 **LUNCH**

1:15 - 2:15 **PRESIDENTIAL LECTURE**
(Auditorium)
Brian J. Sharkey, Ph.D
President, American College of Sports Medicine
University of Montana
"New Dimensions in Aerobic Fitness."

Sponsored by Diversified Products

2:15 - 3:15 TUTORIALS - **Clinical Track**
Chair: John Henderson, Hughston Orthopaedic Clinic
(Room I)

(2:15 - 2:35) **Office based aerobic fitness testing for children and adolescents by pediatricians.** Ronald A. Feinstein, and Kennon Francis. University of Alabama, Birmingham.

(2:35 - 2:55) **Chest pain in athletes: a comprehensive review.** Henry A. Stiene. University of Kentucky.

(2:55 - 3:15) **Disqualifying conditions for sports participation.** John Henderson, Hughston Orthopaedic Clinic, Columbus, GA.

2:15 - 3:15 **TUTORIALS**

How students and faculty can make big money from research opportunities. Janis Beaird, University of Alabama - Tuscaloosa and Ron Bulbulian, University of Kentucky.
Chair: Mindy Millard-Stafford, Georgia Tech
(Room E, F, and G)

Auscultatory blood pressure measurement during exercise: mission impossible? J. Timothy Lightfoot, Florida Atlantic University.
Chair: Dalynn Badenhop, East Carolina University
(Ballroom A - Right)

The effects of exercise training on energy balance for the prevention and treatment of obesity. Craig Broeder, East Tennessee State University.
Chair: Amanda Timberlake, Life College
(Ballroom A - Left)

Exercise, immune function, and cancer. J. Mark Davis, Jeff Woods and Marian Kohut. University of South Carolina.
Chair: J.W. Yates, University of Louisville
(Auditorium)

2:15 - 3:15 **HANDS ON COMPUTER WORKSHOP:** Statistical Package, SAS. Bruce Reed, Academic Computing Services, Auburn University.
(Computer Lab)
NOTE: Limited enrollment; sign up at registration desk.

3:15 - 3:30 BREAK - VISIT THE EXHIBITS! (Foyer)

3:15 - 6:15 **POSTER PRESENTATIONS: Group 3 Research and Clinical Abstracts (# 81 through 95)**
Authors present from 5:30 - 6:15
See author index to poster abstracts.
Chair: Mike Webster, Auburn University
(Ballroom B - Left)

3:30 - 4:30 FREE COMMUNICATIONS: **Sports Nutrition**
Chair: Bob Keith, Auburn University
(Ballroom A - Right)

(3:30 - 3:45) **17** **Bioenergetic and nutritional analysis of an ultraendurance triathlon.** R.B. Kreider, M. Mitchell, G.W. Miller, V. Miriel, C.W. Cortes, D. Hill, T. Somma, and S. Sechrist. Old Dominion University.

(3:45 - 4:00) **18** ***Effects of restricted diet and exercise on resting metabolic rate and fat pad distribution in young female rats.** C.J. Wright, B.J. Warren, D.A. Henson, and R.L. Johnson. Appalachian State University.

*This abstract was selected by the reviewers as one of the top 30 abstracts out of 103 submissions

(4:00 - 4:15)

19

Exercise endurance is increased by a commercial glucose polymer electrolyte beverage. W.R. Thompson. The University of Southern Mississippi.

(4:15 - 4:30)

20

***Resting metabolic rate and food intake in trained and untrained females.** J.A. Flohr and E.T. Howley. James Madison University and University of Tennessee.

3:30 - 4:30

FREE COMMUNICATIONS: **Exercise Physiology**
Chair: Dave Pascoe, Auburn University
(Ballroom A - Left)

(3:30 - 3:45)

21

***Effects of a karate training technique on aerobic training.** T. Waggener and T. Boone. The University of Southern Mississippi.

(3:45 - 4:00)

22

Prediction of peak VO2 in younger and older girls without exercise testing. M. Sothern, M. Loftin, J. Oescher, L. Schroth, P. Kehoe, and D. Harsha. University of New Orleans and LSU School of Medicine.

(4:00 - 4:15)

23

***Comparison of a simulated 16.1-Km time trial, VO2 max and related factors in cyclists with different ventilatory thresholds.** M. Loftin and B. Warren. University of New Orleans.

(4:15 - 4:30)

24

Analysis of temperature regulation and fluid homeostasis during an ultraendurance triathlon. D. Redondo, R. Kreider, M. Mitchell, G. Miller, V. Miriel, C. Cortes, S. Sechrist, T. Somma, and D. Hill. Old Dominion University.

*This abstract was selected by the reviewers as one of the top 30 abstracts out of 103 submissions

3:30 - 4:30

FREE COMMUNICATIONS: **Biomechanics/ Exercise Efficiency**
Chair: Yong Tai Wang, Auburn University
(Room E, F, and G)

(3:30 - 3:45)

25

***Daily variation in step length of moderately-trained male runners.** M. Craib, D. Morgan, C. Caruso, R. Clifton, C. Burleson, and V. Mitchell. UNC-Greensboro.

(3:45 - 4:00)

26

***Short-term effects of prolonged maximal running on running economy and running mechanics in well-trained runners.** D. Morgan, S. Strohmeyer, J. Daniels, C. Caruso, M. Craib, R. Borden, P. Greer, and C. Burleson. UNC- Greensboro and State University of New York, Cortland.

(4:00 - 4:15)

27

***A Comparison of ground reaction forces in bench step aerobics with other aerobic activities.** B. Johnson, J. Rupp, S. Berry, and D. Rupp. Georgia State University.

(4:15 - 4:30)

28

***Body mass as a determinant of exercise efficiency during steady state cycling.** M.J. Berry, J.A. Storsteen, and C.M. Woodard. Wake Forest University.

3:30 - 4:30

TUTORIAL

Water movement between body fluid compartments.
Philip D. Watson, University of South Carolina, School of Medicine.
Chair: Diane Ward, University of South Carolina
(Auditorium)

3:30 - 4:30

HANDS ON COMPUTER WORKSHOP: Graphics package, SAS GRAPH. Bruce Reed, Academic Computing Services, Auburn University.
(Computer Lab)
NOTE: Limited enrollment; sign up at registration desk.

*This abstract was selected by the reviewers as one of the top 30 abstracts out of 103 submissions

3:30 - 5:30

CLINICAL TRACK: **Physicians Case Abstracts**
Chair: Michael Ray, University of Kentucky Sports Medicine
(Room I)

(3:30 - 3:45)
29

Low back pain - high school football. D.L. Jackson, B.L. Haglund and P.A. Tibbs. University of Kentucky.
Discussor: Daniel Joyce

(3:45 - 4:00)
30

Back pain - soccer. F.G. O'Connor and P. Nirschl. Virginia Sports Medicine Institute, Arlington, VA.
Discussor: David L. Jackson

(4:00 - 4:15)
31

Knee pain - football. J.M. Ray, D. Boyd and W. Mosley. University of Kentucky Sports Medicine.
Discussor: John Henderson

(4:15 - 4:30)
32

Knee pain - wrestling. E.W. Mosley, J.M. Ray and D. Tewes. University of Kentucky Sports Medicine.
Discussor: John Henderson

(4:30 - 4:45)
33

Shoulder pain - basketball. E.W. Mosley, J.M. Ray and M. Duby. University of Kentucky Sports Medicine.
Discussor: Joe Chandler

(4:45 - 5:00)
34

Shoulder pain - football. J.M. Ray, M. Duby, D. Boyd and J. Turba. University of Kentucky Sports Medicine.
Discussor: Joe Chandler

(5:00 - 5:15)
35

Wrist pain - football. J.M. Ray, R. Burgess, C. Kneller, and A. Smith. University of Kentucky Sports Medicine.
Discussor: David Jackson

(5:15 - 5:30)
36

Hindfoot pain - hiking. L.C. Almekinders, University of North Carolina at Chapel Hill.
Discussor: Michael Ray

4:30 - 5:30 **SEACSM STUDENT SYMPOSIUM**
(*Auditorium*)

Claude Bouchard, Ph.D
Physical Activity Sciences Laboratory
Laval University
Ste-Foy, Quebec
"Progress in Molecular and Reproductive Biology and Performance: The Athlete of the Future."

Sponsored by Roche Biomedical Laboratories Inc.

4:30 - 5:30 **HANDS ON COMPUTER WORKSHOP:** Graphics Package; Draw Perfect. Angie Jacobs, Academic Computing Services, Auburn University.
(Computer Lab)
NOTE: Limited enrollment; sign up at registration desk.

5:30 - 6:15 **CLINICAL TRACK: Clinical Research Poster Presentations Group 3 (# 88 through 95)**
Authors present from 5:30 - 6:15
See author index to poster abstracts.
Chair: Mike Webster, Auburn University
(Ballroom B - Left)

5:00 - 6:00 ALABAMA Coalition for Physical Fitness/Year 2000 - Group Meeting. (All SEACSM members invited.)
Chair: Kennon Francis, University of Alabama - Birmingham.
(E, F, & G)

6:00 EXERCISE, DINNER, REUNIONS! (See Auburn Conference Bulletin for information)

9:00 - 12:00 DANCE AND MIXER
(Ballroom A)

Saturday, February 1

8:00 - 10:00 REGISTRATION

8:00 - 11:30 SPEAKER READY ROOM
(Meeting Room H)

8:00 - 9:00 FREE COMMUNICATIONS: **Resistance Exercise**
Chair: Mike Stone, Appalachian State University
(Ballroom A - Right)

(8:00 - 8:15)
37
***Short-term high-volume weight-training: effects of different work-rest ratios on strength, power, and endurance.** J.M. Robinson, C.M. Penland, R.L Johnson, D.L. Lewis, B.J. Warren, and M.H. Stone. Appalachian State University.

(8:15 - 8:30)
38
Prediction of the caloric cost of the deadlift. S.P. Brown, J.M. Clemons, Q. He, and S. Liu. University of Mississippi.

(8:30 - 8:45)
39
Changes in cardiovascular fitness and muscular strength in females following circuit training. P.E. Mosher, M. Ferguson, R. Arnold, B. Watkins, M. Ervin, M. Newman, and J. Joralemon. University of Tennessee at Chattanooga.

(8:45 - 9:00)
40
Plasma volume shifts during arm and leg resistance exercises in trained females. C.J. Womack, J. Wightman, and R.K. Hetzler. University of Virginia.

8:00 - 9:00 FREE COMMUNICATIONS: **Exercise Epidemiology**
Chair: Bob Moffatt, Florida State University
(Auditorium)

(8:00 - 8:15)
41
Physical activity habits in african-american and white women. V. Schnyder, B. Ainsworth, C. Berry, S. Breedin, and M. Hewitt. Winston-Salem State University and UNC- Chapel Hill.

*This abstract was selected by the reviewers as one of the top 30 abstracts out of 103 submissions

(8:15 - 8:30) 42 **Physical activity habits in lower-and higher-income women.** S. Breedin, C. Berry, B. Ainsworth, M. Hewitt, and V. Schnyder. UNC- Chapel Hill.

(8:30 - 8:45) 43 **Physical fitness characteristics of Florida Forestry Personnel.** L.R. Reider, R.A. Herb, D.L. Spitler, S.N. Prodes, and D. Hunt. University of Florida.

(8:45 - 9:00) 44 **Incidence of low back injuries within the different job physical demand characteristics.** T.W. Ogletree and G.S. Rash. The Rehabilitation Institute, Mobile, AL.

8:00 - 9:00 FREE COMMUNICATIONS: **Metabolic Costs of Exercise**
Chair: Daniel Blessing, Auburn University
(Room E, F, and G)

(8:00 - 8:15) 45 ***Percentage of VO2max utilized during the one-mile run/walk in college men and women.** J.P. O'Bannon, M.A. Sloniger, and K.J. Cureton. University of Georgia.

(8:15 - 8:30) 46 **Metabolic cost and fuel utilization of selected "aerobic" bench stepping maneuvers.** M.S. Olson, H.N. Williford, D.L. Blessing, and R. Greathouse. Auburn University.

(8:30 - 8:45) 47 **Metabolic cost of bench step aerobic activity.** J.C. Rupp, B.F. Johnson, D.A. Rupp, R. Brooks, and C. Dueck. Georgia State University.

(8:45 - 9:00) 48 **Maximal oxygen deficit during one- and two-legged cycling in men and women.** P. Weyand, D. Conley, E. Higbie, K. Cureton. The University of Georgia.

8:00 - 9:00 FREE COMMUNICATIONS: **Exercise Biochemistry**
Chair: Larry Durstine, University of South Carolina
(Ballroom A - Left)

(8:00 - 8:15) 49 ***Vitamin E effects on exercise-induced oxidative stress in blood.** A.H. Goldfarb, M.K. McIntosh, and B.T. Boyer. UNC- Greensboro.

*This abstract was selected by the reviewers as one of the top 30 abstracts out of 103 submissions

(8:15 - 8:30) 50 ***Effect of increased serotonergic activity on endurance performance in the rat.** S.P. Bailey, J.M. Davis, and E. Ahlborn. University of South Carolina.

(8:30 - 8:45) 51 **Lipid, Apoprotein and lipoprotein ratios and their relationships in distance runners.** J.E. Ashton, J.L. Durstine, R.R. Pate, P.B. Sparling, E.E. Shoup, B.P. Bartoli, M. Dowda, and G.E. Wilson. The University of South Carolina.

(8:45 - 9:00) 52 ***Aerobic training intensity and serum lipids in older adults.** J. Graves, T. Lovins, R. Shireman, S. Leggett, M. Welsch, M. Pollock, and D. Lowenthal. University of Florida.

8:00 - 9:00 TUTORIALS: **Clinical Track**
Chair: Daniel Joyce, Lexington Clinic Sports Medicine Center
(Room I)

(8:00 - 8:30) **Optimal practice times for the reduction of risk of heat illness during fall football practice in the southeast United States.** Kennon Francis and Ronald Feinstein. University of Alabama - Birmingham.

(8:30 - 9:00) **Athletic anemia.** Daniel J. Joyce, Lexington Clinic Sports Medicine Center, Lexington, KY.

8:00 - 10:00 **POSTER PRESENTATIONS: Group 4(#96 through 108)**
Authors present from 9:15 - 10:00
See author index to poster abstracts.
Chair: Bob Crawford, Auburn University
(Ballroom B - Left)

9:00 - 10:00 **SPECIAL TOPICS LECTURE**
(Auditorium)

Bob Gregor, Ph.D
Biomechanics Lab
Department of Kinesiology
UCLA
"Biomechanics of Lower Extremity Function During Cycling."

Sponsored by Advanced Mechanical Technology Inc.

*This abstract was selected by the reviewers as one of the top 30 abstracts out of 103 submissions

9:00 - 10:00 TUTORIALS: **Clinical Track**
Chair: David L. Jackson, University of Kentucky
(Room I)

(9:00 - 9:30) **Medical care of the physically challenged athlete.** David L. Jackson and Brett Hynninen. University of Kentucky.

(9:30 - 10:00) **The pre-participation fitness evaluation.** Beven Wooten, Lexington Clinic Sports Medicine Center.

10:00 - 10:15 COFFEE BREAK (Foyer)

10:15 - 11:45 TUTORIALS - **CLINICAL TRACK**
Chair: Jeff Chandler, Lexington Clinic Sports Medicine Center
(Room I)

(10:15 - 11:00) **Epiphyseal plate injuries in the adolescent.** Hap Lutter. Orthopaedic surgeon, St. Paul, MN.

Sponsored by AIRCAST

(11:00 - 11:45) **Bracing of the athletic knee.** Steve Hunter, Hughston Orthopaedic Clinic, Columbus, GA.

10:15 - 11:45 SYMPOSIA

Theory and technique related to the measurement of oxygen uptake: classic vs. computer-based systems. Ed Howley and Don Torok, The University of Tennessee; Hugh Welch, Louisiana State University; Tim Lightfoot. Florida Atlantic University and Dan Martin, University of Florida.
Chair: Barbara Ainsworth, University of North Carolina - Chapel Hill
(Auditorium)

Recent advances in understanding maternal responses to exercise. Robert G. McMurray, University of North Carolina - Chapel Hill.
Chair: Craig Broeder, East Tennessee State University
(Meeting rooms E, F & G)

Recent advances in infrared thermography in sports medicine. D.D. Pascoe and R.C. Purohit, Auburn University. R.T. Herrick, Orthopedic Surgeon, Auburn Alabama.
Chair: Rick Kreider, Old Dominion University
(Ballroom B)

11:45 - 1:45 **SEACSM LUNCHEON**
(Ballroom A)

SEACSM LUNCHEON SPEAKER

Martin L. Collis, Ph.D
Professor
School of Physical Education
University of Victoria
Victoria, B.C.
"Great Expectations: Positive Lifestyle Trends in the Past 20 Years and Their Impact on Professional and Personal Performance."

Sponsored by Auburn University

1:45 - SEACSM EXECUTIVE BOARD MEETING
(Meeting Room H)

1:45 - HAVE A SAFE TRIP HOME! SEE YOU IN NORFOLK!

POSTER SESSION 1

Friday, January 31

7:30 - 10:30
Authors present 9:45 - 10:30
(Ballroom B - Left)

53 **Aerobic metabolic demands of the firefighter instructor.** E.L. Glickman-Weiss, B.S. Cohen, C.M. Hearon, P. Bologna, G. Thompson, and M. Hegsted. Louisiana State University.

54 **Relation of anaerobic capacity and anaerobic energy utilized to one-mile run/walk in college men and women.** M.A. Sloniger, J.P. O'Bannon and K.J. Cureton. University of Georgia.

55 **Oxygen pulse as a predictor of stroke volume during submaximal treadmill exercise.** D. Diboll and T. Boone. University of Southern Mississippi.

56 **Comparison of pre-session maximal and three-min recovery physiological adaptations in biathletes, rugby players, and basketball players.** A.E. Faro,III, R.F. Kowalske, J. Johnson, D. Allen and Y.A. Lim. Life College.

57 **A comparison of formulas to determine mean skin temperature during prolonged cold water immersion.** B.S. Cohen, E. Glickman-Weiss, F.L. Goss, and R.J. Robertson, Louisiana State University, and University of Pittsburgh.

58 ***Agreement between large (15 x 33 cm) and small (12 x 23) cuffs in blood pressure measurement.** C.M. Hearon, Y. Iyriboz and K. Edwards. Louisiana State University.

59 **The validity of a heart watch monitor for measuring heart rate at varying walking velocities.** E.M Haskvitz and A. Weltman, University of Virginia.

60 **The relationship of heart rate response and self-regulated heart rate response during rest: A preliminary study.** Y.A. Lim, T. Boone, C.M. Puglisi, R. Kazelskis and W.R. Thompson. Life College and The University of Southern Mississippi.

61 **Validation of estimated energy expenditure while running with the body watch.** Q. He, S.P. Brown, S. Liu, H. Li and Q. Wu. The University of Mississippi.

62 **The relationship between physical fitness, age and attentional capacity.** Petra B. Schuler, The University of Alabama, Tuscaloosa.

*This abstract was selected by the reviewers as one of the top 30 abstracts out of 103 submissions

Body composition assessment in competitive college football players: estimations of body size and predictions for total body weight. P. Love, M. Cody, and D. Benardot. Georgia Sports Medicine, Atlanta, GA, and Georgia State University.

63

Physiologic validation of stairobic stepping. E.R. Anderson, S.P. Brown, Q. He, S. Liu, Q. Wu, H. Li and R. Whittle. University of Mississippi.

64

A comparison of upper body anaerobic power outputs in young female swimmers and gymnasts. F.J. Servedio and L.C. Colvin. The University of Southern Mississippi.

65

Relationship between the JHAC scale and blood pressure. M. Hewitt, C. Berry, L. Huntley and S.Heartley. Winston-Salem State University.

66

POSTER SESSION 2

Friday, January 31

10:30 - 12:30
Authors present 11:45 - 12:30
(Ballroom B - Left)

***Effect of hydraulic resistance training on children.** J. Smith,The University of Alabama,Tuscaloosa.

67

Performance profiles of a state championship high school football team. D.L. Blessing, H.N. Williford, and M.S. Olson. Auburn University at Montgomery.

68

***Prevalence of elevated cholesterol in a group of african american subjects.** L. Huntley, C. Berry, M. Hewitt and S. Vickers. Winston-Salem State University.

69

***Effects of taper phase training on power outputs and swimming performance in children: a preliminary study.** L.C. Colvin, H.W. Poole and F.J. Servedio. The University of Southern Mississippi.

70

***Relationship between resting blood pressure, treadmill time, and body composition in healthy men.** T. Hortobágyi, R.C. Graves, R.G. Israel, M.R. McCammon, J.A. Houmard, and L.L. Smith. East Carolina University.

71

*This abstract was selected by the reviewers as one of the top 30 abstracts out of 103 submissions

Changes in physical fitness scores of police officers over the first three years of employment. R.W. Boyce, A.R. Hiatt and G.R. Jones. University of North Carolina at Charlotte.

72

Effects of massage on physiological functions during recovery from maximal exercise. T. Boone, B. Mayberry and J. Heimdal. The University of Southern Mississippi.

73

Changes in plasma creatine kinase and CK-MB with increased and decreased training in endurance runners. W.S. Deacon, J.A. Woods, S.P. Bailey, J.M. Davis and R.R. Pate. University of South Carolina.

74

Effects of cross interval training on cardiovascular fitness in middle-aged females. M. Ferguson, P.E. Mosher, B. Watkins, R. Arnold, and M. Scott. University of Tennessee at Chattanooga.

75

Response of the gluconeogenic enzyme alanine aminotransferase to induced hypoglycemia during prolonged exercise. M.C. Washam and W.R. Thompson. The University of Southern Mississippi.

76

Effects of the menstrual cycle on the resting and exercise blood glucose-insulin relationship. M.R. Brammeier, J.Z. Berend and A.C. Hackney. UNC, Chapel Hill.

77

Establishment of guidelines for health and physical fitness standards for the Florida division of forestry fire fighters. D.C. Hunt, D.L. Spitler, G.A. Morse and S.N. Prodes. University of Florida.

78

Effects of the sports massage interspersed between two treadmill VO2max tests. B. Mayberry, T. Boone and J. Heimdal. The University of Southern Mississippi.

79

Health risks appraisals of university faculty and staff. Jim Colligon, University of North Alabama.

80

POSTER PRESENTATIONS Times and Locations

Friday, January 31

7:30-10:30 Session 1
Authors present
9:45-10:30
Ballroom B-Left

10:30-12:30 Session 2
Authors present
11:45-12:30
Ballroom B-Left

3:15-6:15 Session 3
Authors present
5:30-6:15
Ballroom B-Left

Saturday, February 1

8:00-10:10 Session 4
Authors present
9:15-10:00
Ballroom B-Left

POSTER SESSION 3

Friday, January 31

3:15 - 6:15
Authors present 5:30 - 6:15 pm.
(Ballroom B - Left)

81 **Effects of cardiac rehabilitation on CHD risk factors in post-MI patients.** H.W. Cobham and B.E. Ainsworth. University of North Carolina at Chapel Hill.

82 ***Aerobic exercise in older co-morbid individuals.** C.M. Woodard, M.J. Berry, W.J. Rejeski, A.F. Thompson, H.S. Miller, D.B. Bergey and P.M. Ribisl. Wake Forest University.

83 **The effects of cardiac rehabilitation treatment on selected coronary artery disease risk factors following CABG surgery.** B.M. Goebel and B.E. Ainsworth. University of North Carolina at Chapel Hill.

84 **Effect of a phase II cardiac rehabilitation program on blood lipids, physiologic function and capacity of 50 male patients following a 12 wk (36 session) intervention.** J. Heimdal, R. Kazelskis, J.N. Heimdal and W.R. Thompson. The University of Southern Mississippi, and Institute for Wellness and Sports Medicine, Hattiesburg, MS.

85 **Physical working capacity at fatigue threshold (PWCft), aerobic power, and body composition in older adults.** L.B. Panton, J.E. Graves, M.L. Pollock, L. Garzarella, J.F. Carroll, S.H. Leggett, D.T. Lowenthal and G. Guillen. University of Florida.

86 **Ventilatory threshold in elderly obese persons with coronary artery disease.** B.E. Jensen and J.C. Rupp, Georgia State University.

87 **Cardiorespiratory, blood chemistry, and body composition changes in cardiac patients during a 12-month reconditioning program.** J. Mustain and T. Boone. The University of Southern Mississippi.

88 **A computerized KT-2000 system to assess the effect of exercise and muscle hyperemia on knee joint compliance.** J.W. Xerogeanes, S.J. Bonasera, T.P. Branch. Emory University School of Medicine.

*This abstract was selected by the reviewers as one of the top 30 abstracts out of 103 submissions

Acute hemarthrosis of the knee in children. D.W. Boyd, University of Kentucky Sports Medicine. T.M. Matellic, R.L. LaMont, Detroit, MI, and D.D. Aronson, Burlington, VT.

89

Elbow arthroscopy in the Athlete. D.W. Boyd, J.M. Ray and D.N.M. Caborn. University of Kentucky Sports Medicine.

90

The role of flexibility in athletic injuries. S.V. Almekinders and L.C. Almekinders. North Carolina State University and University of North Carolina at Chapel Hill.

91

Arthroscopic repair of displaced avulsion fractures of the tibial spine in children. J.M. Ray, W. Pakan, A. Sears and S. McNew. University of Kentucky Sports Medicine.

92

Injuries in the school-aged athlete: a statistical analysis of injury patterns. J.M. Ray, D. Tewes, C. Kneller, S. McNew, and H. Stiene. University of Kentucky Sports Medicine.

93

Anatomy and Isometric attachments of the posterior cruciate ligament: a cadaveric study. D. Tewes, W. Haynes, and J.M. Ray. University of Kentucky Sports Medicine.

94

Intaoperative pitfalls in arthroscopically assisted anterior cruciate ligament reconstruction using autogenous patella tendon graft. J.M. Ray, A. Smith and M.J. Duby. University of Kentucky Sports Medicine.

95

POSTER SESSION 4

Saturday, February 1

8:00 - 10:10 am
Authors present 9:15 - 10:00 am
(Ballroom B - Left)

Effects of age and aerobic exercise on range of motion. J.L. Moul and R.L. Johnson. Appalachian State University.

96

Thyroid hormone changes during military operations: effects of cold exposure in the arctic. A.C. Hackney, and J.A. Hodgdon. UNC, Chapel Hill and Dept. of Work Physiology, NHRC, San Diego, CA.

97

***Temperature and metabolic responses to exercise in heat wearing different fabrics.** E. Smith, M. Skelton, D. Kremer, R. Purohit and D. Pascoe. Auburn University.

98

*This abstract was selected by the reviewers as one of the top 30 abstracts out of 103 submissions

The effect of exercise on calciotropic hormones, cortical bone mass, and bone turnover analytes in postmenopausal females. R. Fisher, W.R. Thompson, M. Hall, J. Johnson, R. Smith, F. Servedio, H. Ptak and H. Howe. The University of Southern Mississippi.

99

Exercise and hypertension: mediating effects. G.A. Kelley and P. McClellan. Middle Tennessee State University.

100

***Regulation of respiratory drive (RD) during exercise.** N.M. Hommen, R.M. Privette, V.E. Brown, R.E. Esser, J.R. Cade and D.A. Kaufmann. University of Florida.

101

***The effects of varying conditions on sweat iron loss.** M.F. Waller, E.M. Haymes, A. Allithy and G. Horan. Florida State University.

102

Whole blood lactate and serum free fatty acid responses to supramaximal and submaximal cycling bouts. A. Boger, B. Warren, M. Stone and R. Johnson. Appalachian State University.

103

Cytochrome oxidase activity demonstrates regional variability in the neonatal mouse heart. G.S. Morris and T.P. Martin. Louisiana State University. and University of Alberta.

104

Cardiovascular changes during transition from upright to supine to 20 minutes of vertical head-down suspension. S. Brock, T. Boone, Y. Lim and J. Heimdal. The University of Southern Mississippi.

105

The effects of acute anaerobic exercise on immune response. D.C. Nieman, D. Henson, G. Gusewitch, R. Johnson, L. Lebeck, J.M. Davis and S.L. Nehlsen-Cannarella. Appalachian State University.

106

Ventilatory threshold in long term insulin dependent diabetics. S. Khan and J.C. Rupp. Georgia State University.

107

***Postexercise hypotension reduces cardiovascular responses to stress.** James B. Boone, Jr., Manuel M. Probst, Matthew W. Rogers, and Rolando Berger. The University of North Carolina at Chapel Hill, The University of Kentucky and Veterans Administration Medical Center, Division of Pulmonary, Dept. of Medicine, Lexington, KY.

108

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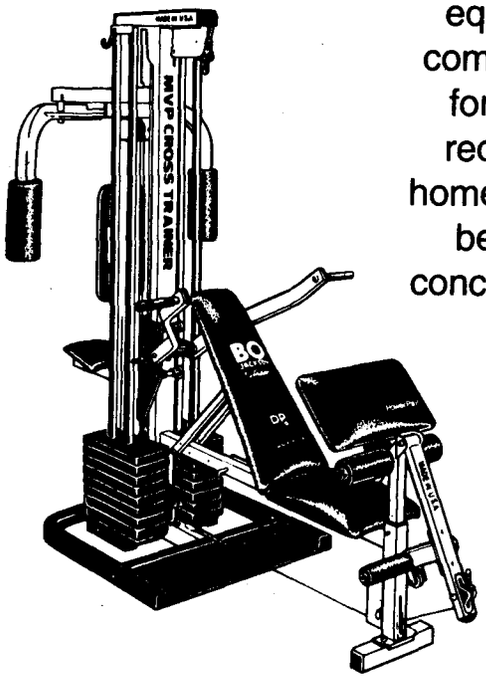

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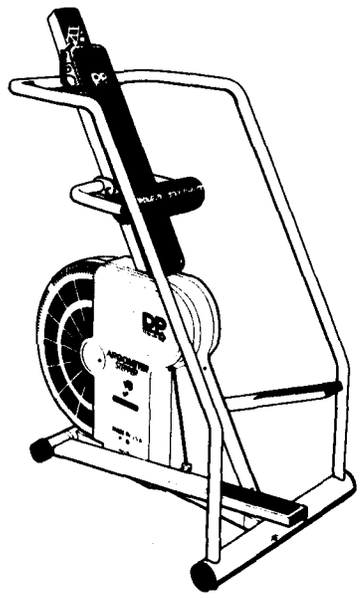

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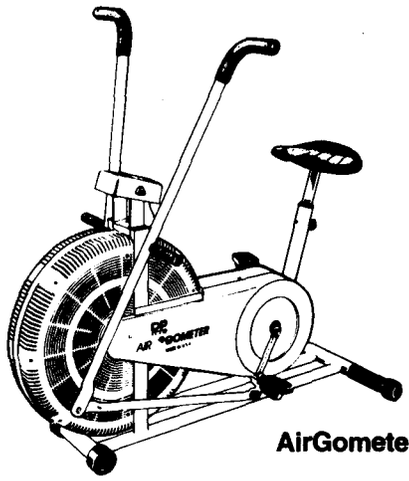

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EFFECTS OF ULTRAENDURANCE TRIATHLON PERFORMANCE ON SERUM ENZYME LEVELS

E. Bertun, R.B. Kreider, M. Mitchell, G.W. Miller, V. Miriel, C.W. Cortes, D. Hill, T. Somma, and S. Sechrist. Human Performance Lab., Old Dominion Univ., Norfolk, VA 23529-0196.

1

Muscle and liver enzymes have been reported to efflux into serum in relation to the mode, intensity and duration of exercise. The triathlon combines swimming, cycling and running into a single endurance event. Therefore, analysis of variations in serum enzyme levels throughout the duration of an ultradistance triathlon may enhance the understanding of the effects of exercise on serum enzyme efflux. Five competitive male triathletes (VO_{2max} 71.8 ml·kg^{-1}·min^{-1}) performed two simulated ultradistance triathlons (2 km swim, 90 km bike, 21 km run) under controlled laboratory conditions (30°C, 60% RH). The athletes maintained an average VO_2 of 3.0 +/-0.6 l·min^{-1} for 5.36 +/-0.4 h with a total energy expenditure of 4,615 +/-583 kcals. Serum creatine kinase (CK), lactate dehydrogenase (LDH), aspartate aminotransferase (AST) and alanine aminotransferase (ALT) levels were determined prior to and following each segment of the triathlon and following 3 days of recovery from the event. Observed serum values were corrected for plasma volume variations. Data were analyzed by repeated measures ANOVA with Scheffe' post-hoc procedures. Data are as follows with $p<0.05$ differences from PRE-SW, POST-SW, POST-B, POST-R and 3 d REC indicated as a, b, c, d and e, respectively:

		PRE-SW	POST-SW	POST-B	POST-R	3 d REC
Time (min)	Mean	-	30	202	321	-
	SD	-	3	15	22	-
CK (IU·l^{-1})	Mean	434 ^{cde}	435 ^{cde}	496 ^{ab}	496 ^{ab}	491 ^{ab}
	SD	76	60	89	73	53
LDH (IU·l^{-1})	Mean	413 ^{cde}	445 ^{cde}	558 ^{abde}	630 ^{abc}	615 ^{abc}
	SD	47	52	41	59	65
AST (IU·l^{-1})	Mean	63 ^{cde}	60 ^{cde}	79 ^{ab}	75 ^{ab}	72 ^{ab}
	SD	44	40	50	42	41
ALT (IU·l^{-1})	Mean	24 ^{d}	23 ^{d}	25	27 ^{ab}	26
	SD	8	10	10	10	11

Results revealed: 1.) serum enzymes were mildly elevated prior to the triathlon; 2.) the triathlon elicited only modest increases in serum enzymes; 3.) the 2 km swim did not significantly increase serum enzyme levels; 4.) serum CK, LDH, and AST levels were significantly increased following the cycling segment; 5.) only post-run LDH levels were increased following the cycling segment; and, 6.) CK, LDH, and AST levels remained significantly higher than pre-event values following 3 days of recovery. Results indicate that although the highest serum enzyme levels were observed following the run segment of the triathlon, the cycling segment elicited the greatest percentage increase in serum enzyme levels.

Supported by ***Advance Sport Nutrition*** of Mundelein, IL., ODURF Grant #703321.

ANALYSIS OF ELECTROLYTE INTAKE AND SERUM ELECTROLYTE LEVELS DURING AN ULTRAENDURANCE TRIATHLON

V. Miriel, R.B. Kreider, M. Mitchell, G.W. Miller, C.W. Cortes, D. Hill, T. Somma, and S. Sechrist. Human Performance Lab., Old Dominion University, Norfolk, VA 23529-0196.

2

Significant alterations in serum electrolyte levels have been reported following ultraendurance exercise. The specific etiology of these variations remains unclear, however sports nutritionist generally recommend that ultraendurance athletes ingest modest amounts of electrolytes during competition in order to maintain electrolyte levels. The purpose of this study was to examine the effects of ultraendurance triathlon performance on serum electrolyte levels in relation to mineral intake during the event. Five competitive male triathletes (VO_{2max} 71.8 ml·kg^{-1}·min^{-1}) performed two simulated ultradistance triathlons (2 km swim, 90 km bike, 21 km run) under controlled laboratory conditions (30°C, 60% RH). The athletes maintained an average VO_2 of 3.0 +/-0.6 l·min^{-1} for 5.36 +/-0.4 h with a total energy expenditure of 4,615 +/-583 kcals. Nutritional intake during each triathlon was quantitatively determined and analyzed for kcals, sodium (Na^+), potassium (K^+), phosphorus (PO_4), and magnesium (Mg^+). Serum Na^+, K^+, PO_4, and Mg^+ levels were determined prior to and following each segment of the triathlon and were corrected for plasma volume variations. Data were analyzed by repeated measures ANOVA with Scheffe' post-hoc procedures. Results revealed that the athletes ingested 1205 +/-552 kcals during the triathlon containing 2411 +/-925 mg of Na^+, 884 +/-497 mg of K^+, 48 +/-52 mg of PO_4, and 45 +/-39 mg of Mg^+. Serum electrolyte data are as follows with $p<0.05$ differences from PRE-SW, POST-SW, POST-B, and POST-R indicated as a, b, c, and d, respectively:

		PRE-SW	POST-SW	POST-B	POST-R
Na^+ (mmol·l^{-1})	Mean	145.0 ^{bd}	137.2 ^{ac}	149.6 ^{cd}	137.1 ^{ac}
	SD	3.2	9.3	11.3	7.8
K^+ (mmol·l^{-1})	Mean	4.49^{cd}	4.48^{cd}	5.45^{abd}	5.03^{abc}
	SD	1.2	1.2	0.9	0.8
PO_4 (mmol·l^{-1})	Mean	0.96^{bcd}	1.64^{a}	1.66^{a}	1.60^{a}
	SD	0.19	0.44	0.32	0.44
Mg^+ (mmol·l^{-1})	Mean	0.81^{bcd}	0.74^{ad}	0.74^{ad}	0.70^{abc}
	SD	0.09	0.11	0.10	0.14

Results revealed that serum K^+ and PO_4 levels were well maintained throughout the triathlon, Na^+ levels declined following the swim and run segments in relation to the amount of sodium ingested during each segment, and Mg^+ levels were reduced throughout the triathlon. Results suggest that additional intake of Na^+ and Mg^+ may be necessary to maintain serum levels during the run segment of the triathlon.

Supported by ***Advance Sport Nutrition*** of Mundelein, IL., ODURF Grant #703321.

3

MARKERS OF MUSCLE DAMAGE FOLLOWING PROLONGED SWIMMING, CYCLING, AND RUNNING AND A TRIATHLON COMPETITION

B.T. Hinson, D.R. Dengel, and K.J. Cureton
Exercise Physiology Lab., University of Georgia, Athens, GA 30602

To determine the effect of an Olympic-distance triathlon and its components on markers of skeletal muscle damage, changes in creatine kinase (CK), lactate dehydrogenase (LDH), and subjective muscle soreness (MS) were assessed in six male subjects before and following a swim (1.5 km), cycle (36.7 km), run (10.0 km) triathlon and its individual components. The individual events of the triathlon failed to significantly increase plasma CK or LDH activities, but significant increases were obtained immediately after the triathlon for LDH activity and 4, 10, and 24 hours after the triathlon for CK activity. MS ratings were not significantly higher following any treatment. The peak changes in plasma CK and LDH activities after the triathlon were greater than the sum of the peak activities following the three individual events. It was concluded that plasma CK and LDH activities are increased following a short-duration triathlon due to a cumulative and/or interactive effect rather than to performance of any one of the three race segments.

4

EFFECT OF VITAMIN E ON SERUM CREATINE KINASE, AND MUSCLE SORENESS IN CYCLISTS COMPLETING A STRENUOUS 100 MILE RIDE.

C.L. Lewis, and A.H. Goldfarb, Exercise Science Dept.
UNC Greensboro, Greensboro, NC 27403

The effect of vitamin E (E) on the time course relationship of serum creatine kinase (CK), and perceived muscle soreness ratings (PMSR) in twenty four (30 ± 2 yr.), age and gender matched, riders who participated in the 1990 Bridge to Bridge Ride was examined. Subjects received placebo or E (800 IU/day) for two weeks prior to the ride. Blood was collected prior, immediately post, 24, 48, 72 and 96 hours post event. At each blood collection, PMSR was rated on a scale of 1 (normal) to 10 (very, very sore). Serum CK was analyzed spectrophotometricly Repeated measures ANOVA ($p \leq 0.05$) was used to determine significance.

Vitamin E		pre	post	24hr	48hr	72hr	96hr
CK IU	$\bar{X}$ =	39.6	89.8*	125.4*	85.1*	72.6*	58.3
	SE =	(±2.4)	(±14.5)	(± 23.2)	(±13.2)	(±11.5)	(±12.5)
Placebo		pre	post	24hr	48hr	72hr	96hr
CK IU	$\bar{X}$ =	37.8	68.1*	101.2*	67.7*	47.8	36.8
	SE =	(±4.8)	(±7.8)	(±18.1)	(±10.0)	(±7.0)	(±7.1)

* statistically significant from pre ride ($p \leq 0.05$)

Immediate post, 24, and 48 hour CK concentrations were significantly increased from pre ride levels for both the E and placebo groups. No significant differences were found between the two groups for serum CK and PMSR. Vitamin E did not alter the CK time course nor did it alter the magnitude of the response. PMSR was unaffected by E. It is concluded that two weeks of 800 IU/day vitamin E does not prevent the elevation of PMSR nor reduce CK efflux in plasma to a strenuous 100 mile bicycle ride.

5

HEMODYNAMIC RESPONSES TO SPONTANEOUS EXERCISE IN RATS

S.L. Yancey and J.M. Overton. Exercise Physiology Lab., University of Louisville, Louisville, KY 40292

The purpose of this study was to determine cardiovascular responses of rats to spontaneous exercise in an activity wheel. Male Sprague-Dawley rats weighing 265 ± 4 gms (N=6) were housed in activity wheels for 2 wks. Moderate food restriction was used to increase running activity which averaged 3734 ± 1231 m/day prior to surgery. Rats were instrumented with Doppler flow probes and a carotid arterial catheter to measure mesenteric blood flow (MBF), iliac blood flow (IBF), heart rate (HR), and mean arterial pressure (MAP) during exercise. Rats were returned to their wheels for one week prior to testing. Measurements were made in a modified activity wheel (Lafayette) which allowed the extension lines and cables to exit the wheel during the experiment. Baseline values were as follows: (x±SE) MAP= 122 ± 5 mmHg; HR= 363 ± 4 bpm; MBF= 5.7 ± 1.2 kHz; and IBF= 4.0 ± 0.5 kHz. During the 30 min testing sessions, rats ran intermittently performing 9 ± 2 exercise bouts (total distance=122 ±31 meters). For each rat we analyzed the exercise bout where pre-exercise HR was closest to baseline (pre-exercise HR= 377± 16 bpm). These spontaneous running bouts consisted of exercise at 45 ± 2 m/min for 17 ± 4 seconds producing the following cardiovascular responses: MAP (+4 ± 3 mmHg); HR (+77 ± 10 bpm); MBF (-35 ± 11%); and IBF (+124 ± 23%). The results indicate that voluntary exercise produces a modest blood pressure response, yet elicits substantial redistribution of blood flow. The rapid nature of the changes in muscle and visceral blood flow may suggest the involvement of central nervous system mechanisms.

Supported by a grant from the Univ. of Louisville Graduate School

6

COMPARISON OF LEFT VENTRICULAR DIASTOLIC FUNCTION DURING TACHYCARDIA INDUCED BY EXERCISE AND AMYL NITRITE

R.F. Percy,D.A. Conetta, A.B. Miller.University of Florida Health Science Center,Jacksonville,FL

To compare the effect on LV diastolic function of increased heart rate(HR) achieved by exercise(EX) and pharmacologic vasodilatation,we studied 10 normal males(ages25-29) in the semisupine position at rest,during bicycle ergometry and after amyl nitrite inhalation(AN).Two D echo short axis images of the LV ,Doppler transmitral flow images,cuff systolic blood pressure(SBP) and EKG were recorded and computer assissted analysis performed.Results are Mean(SD):

	HR	ACF	SBP	LVED	RFI	DC
REST	62(8)	52(4)	114(5)	14(3)	.31(.04)	3.1(1)
EX	104(3)[1]	62(4)[1]	147(14)[1]	14(4)	.45(.03)[1]	5.6(1.6)[1]
AN	97(8)[1]	66(6)[1]	102(16)[1]	12(3)[1]	.43(.03)[1]	4.6(.9)[1,2]

ACF(2 D echo derived)=area change fraction,%;LVED=end diastolic area,cm^2;RFI(2 D echo derived)=rapid filling index,%AC/msec;DC(Doppler derived)=deceleration slope of E wave,m/sec^2; [1]=p<.05 vs REST;[2]=p<.05 vs EX

CONCLUSIONS: Although with increased HR, EX and AN produced similar increased LV systolic performance(ACF),the determinants of LV function were markedly different.Preload(LVED) and afterload(SBP) decreased with AN whereas afterload increased with EX.The 2 D echo derived index of rapid diastolic filling(RFI) increased similarly with EX and AN.In contrast the Doppler derived index of rapid diastolic filling(DC) increased less with AN,possibly related to decreased LV preload and less sympathetic stimulation with AN compared with EX.

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DIFFERENT HEMODYNAMIC RESPONSE DURING SINGLE ARM ISOMETRIC CONTRACTION

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Five males and one female were examined to determine whether different hemodynamics can occur in different body parts simultaneously during single arm isometric contraction. After a 10-hour fast, subjects stood in front of an arm contraction pully device and extended both arms horizontally. Testing consisted of three phases: rest, exercise, and recovery for 5, 6, and 5 min, respectively. The right arm performed isometric contraction holding 2, 4, and 6kg for 2 min each. Throughout the testing period, the subjects were encouraged to relax their left arm. During the entire 16-min testing period, heart rate (HR) and oxygen uptake (VO2) were recorded every minute. Butterfly needles were inserted into the antecubital vein and blood samples were obtained at 4.5, 6.5, 8.5, 10.5, and 15.5 min (2.5 mL) from both arms simultaneously. Hematocrit (Hct) and hemoglobin (Hb) were measured and relative plasma volume (PV) changes were calculated. HR increased during the exercise phase, but only 6kg of weight induced a significant increase ($p < .05$). VO2 was elevated at the onset of exercise and remained elevated throughout the exercise phase. No changes were found in Hb in both arms and in Hct in the left arm while Hct in the right arm showed progressive increases during the exercise phase ($p < .05$). PV during exercise was changed -4.97, -5.33, and -10.36% in the right arm and 1.46, -3.63, and -.10% in the left arm at 2, 4, and 6kg, respectively. Post-hoc analysis revealed PV changed significantly in the right arm and was lower at 6kg than the left arm. These data suggest that several factors might be involved in the hemodynamic response in active and nonactive arm muscles. In particular, redistribution of blood flow may be different not only between the arms but also between intramuscular and cutaneous circulations. In conclusion, different hemodynamics can occur in different body parts at the same time, especially during isometric contraction involving small muscle groups.

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POSTURAL EFFECTS ON CARDIAC OUTPUT AS MEASURED BY IMPEDANCE CARDIOGRAPHY COMPARED TO DOPPLER ULTRASOUND

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To examine postural effects on cardiovascular parameters, comparisons of heart rate, stroke volume, and cardiac output (Q) measurements were made between impedance cardiography and Doppler ultrasound in the seated upright and supine positions, during rest and exercise. Eighteen subjects, aged 18-70 years, underwent a graded cycle ergometer test, and two 20-minute submaximal cycle ergometer tests, in either upright or supine postures. Cardiac output was measured during rest, and during steady state exercise with both techniques. Data were analyzed with a factorial repeated measures ANOVA, standard error of the estimate, and correlation techniques. Both techniques showed good test-retest reliability for Q at rest ($r \geq .76$). During exercise, duplicate impedance cardiography values were highly correlated ($r \geq .78$), whereas Doppler ultrasound correlation coefficients were lower ($r \geq .57$). During upright rest, supine rest, upright exercise, and supine exercise, Q ranged from 2.5-4.6 $l.min^{-1}$, 3.3-4.9 $l.min^{-1}$, 5.0-11.1 $l.min^{-1}$, and 5.5-11.0 $l.min^{-1}$, respectively. During rest and exercise both techniques were found to reflect relative changes in Q, however Doppler ultrasound values were significantly lower than those measured by impedance cardiography, regardless of condition or posture. Posture had no significant influence on the differences found between impedance cardiography and Doppler ultrasound.

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HEALTH, INJURY AND PSYCHOLOGICAL PROFILE OF TRIATHLETES

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There has been a tremendous increase in the popularity of triathlons and with it, a high percentage of overuse injuries (90% Levy, 91% O'Toole). The purpose of this study was to examine the variables commonly associated with athletic injury (training techniques and personality traits). A total of 35 nationally competitive triathletes (17 males, 18 females) completed the study including questionnaires of demographics, training history, injury history, performance level and an Adult Personality Inventory (API). There was a total of 42 injuries in 22 athletes (63%). While there was a significant difference between males and females in a training time (females, 19.6 hrs/wk vs. males, 16.0 hrs/wk; $p < .05$, ANOVA), there was no significant difference between injured and non-injured athletes. The personality traits of these athletes showed significant differences from the normal population, but not between the injured and non-injured. While the female triathletes were found to be more independent, tough-minded, confident and strongly motivated to succeed; the male triathletes tended to be more introverted, independent, uncaring and less sociable than the population averages.

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EFFECTS OF ALCOHOL ON WORK INTENSITY INTERPRETATION USING PERCEIVED EXERTION

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Alcohol is a well known CNS depressent. The purpose of this study was to determine if a legally intoxicating dose of alcohol would interfere with CNS function in interpreting work intensity using Borg's RPE Scale. Twelve male and female college students age = 22.3 +/- .5 years volunteered to participate in this study. Subjects (S) were administered a graded exercise test on a bicycle ergometer. Using double blind techniques S were administered an intoxicating dose of alcohol during the treatment (T) test and no alcohol during the two control tests (c1, c2). The order of presentation of T was random in an attempt to control for sequential effects. In both submaximal T $\bar{x}$=16.4 +/- 1.7; c1 $\bar{x}$=16.3 +/- 1.5; c2 $\bar{x}$=16.4 +/- 1.4) and maximal work T$\bar{x}$=18.9 +/- 1.2; c1 $\bar{x}$=18.6 +/- 1.0; c2 $\bar{x}$=18.6 +/- 1.0) there were no significant differences $p<.05$ in RPE. Neither were there significant differences in VO_2 max ($ml.kg.^{-1}min.$) (T $\bar{x}$=40 +/- 7.9; c1 $\bar{x}$=44.9 +/- 6.4; c2 $\bar{x}$=44.2 +/- 7.4) The data suggest that the interpretation of work intensity using RPE is not interrupted by an intoxicating dose of alcohol.

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PERCEIVED EXERTION MAY BE SUBJECT TO SOCIAL INFLUENCE DURING INTENSE EXERCISE. R. N. Godsen and R. C. Brown. College of Charleston, SC 29424

It has been suggested by Borg and others that the rate of perceived exertion (RPE) is closely bound to such physiological correlates as heart rate, lactate, and ventilation. It is our contention that RPE is also affected by social dictates. Since males are expected to "bite the bullet" when pain occurs, it was our hypothesis that they would be significantly less likely than females to admit to great perceptual distress (GPD) after a maximal treadmill test. We defined GPD as the selection of category 8 or greater on the revised Borg scale. Twenty-eight subjects (14 male, 14 female) volunteered to complete a progressive treadmill test which terminated with voluntary exhaustion. Half were trained runners; half were apparently healthy normals. Heart rates and ventilatory measures were monitored during the test. RPE and blood lactate values were taken at the conclusion of the bout. The table below illustrates that there was essentially no difference in the physical responses of the two genders. Nevertheless, males were significantly less likely than females (21.4% versus 64.3%, chi-square=5.25, $P<0.05$) to admit to great perceptual distress.

GROUP	VO_{2max}	HR	[L]	RER	GPD %
Females	49±3	195±2	10.0±1	0.97±0.02	64.3
Males	60±2	190±2	10.1±1	1.00±0.02	21.4

Values are Means ±SEM through RER
Lactate values are in mmol/liter
VO_2 expressed in $ml \cdot kg^{-1} \cdot min^{-1}$
RER = Respiratory Exchange Ratio

This suggests that perceived exertion may be subject to social influence even during intense exercise.

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EFFECTS OF ULTRAENDURANCE TRIATHLON PERFORMANCE ON PSYCHOLOGICAL PROFILES OF EXERTION, FEELING, AND MOOD

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The purpose of this study was to determine the effects of simulated ultraendurance triathlon performance on Rating of Perceived Exertion (RPE), Feeling Scale (FS), and the Profile of Mood States (POMs) psychological inventory. Five competitive male triathletes competed in two simulated ultradistance triathlons (2 km swim, 90 km bike, and 21 km run) performed under controlled laboratory conditions (30°C, 60% RH). The POMs was administered immediately prior to (PRE) and following (POST) the simulated triathlons. RPE and FS data were recorded following the swim segment, at 8 km intervals throughout the duration of the cycling segment and at 1.61 km intervals throughout the run segment of the simulated triathlons. Data were analyzed by repeated measures ANOVA. Mean (± SD) performance times and VO_2 for each segment were: 30 ± 3 min for the swim segment (VO_2 3.1 ± 0.6 $l \cdot min^{-1}$); 172 ± 12 min for the bike segment (VO_2 2.97 ± 0.6 $l \cdot min^{-1}$); and 119 ± 17 min for the run segment (VO_2 3.05 ± 0.6 $l \cdot min^{-1}$). The triathletes maintained an average VO_2 of 3.0 ± 0.6 $l \cdot min^{-1}$ throughout the 5.36 ± 0.4 h triathlon. Analysis of pre-race POMs data revealed that the athletes began the race with low tension (9.9 ± 3.8), depression (2.6 ± 3.5), anger (5.0 ± 4.6), fatigue (6.2 ± 5.0), and confusion (3.4 ± 1.6) scores and exhibited moderate to high vigor scores (21.1 ± 5.9). Pre-race global mood state disturbance was 6.0 ± 19.1. Following the race, vigor responses (6.0 ± 3.7) were significantly reduced ($p<0.0001$) by 72% while fatigue (20.9 ± 5.2) and depression (11.3 ± 8.4) scores were significantly increased ($p<0.01$) by 237% and 334%, respectively. Confusion scores (8.9 ± 8) tended to higher ($p=0.06$) while no differences were observed in tension (10.0 ± 4.7) and anger (6.7 ± 7.7) responses. Post-race global mood state disturbance was 51.8 +/-31 representing a 737% increase ($p<0.01$) from pre-race values. Analysis of RPE data revealed that post-swim RPE was 14.4 +/-3.9 and that RPE values increased ($p<0.01$) throughout the duration of the cycling segment (13.5 +/-3.1 to 15.8 +/-1.9) and run segment (14.4 +/-1.8 to 17.0 +/-2.0). FS responses were significantly decreased ($p<0.01$) from a feeling state of good to fairly bad throughout the duration of the cycling and run segments. RPE and FS responses did not relate to VO_2 responses in that no significant differences were observed among cycling ($p=0.38$) or run ($p=0.83$) segment VO_2 responses. These findings indicate that the triathletes' perceived increasing psychological stress during the event, yet psychological stress was not related to exercise intensity in terms of VO_2. In summary, results suggest that ultraendurance triathlon performance elicits a mood state profile consisting of depression, low vigor, high fatigue and a relatively high level of global mood state disturbance and that the athletes perceived increased psychological stress not related to oxygen uptake values.

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COMPARISON OF THE 12-MINUTE SWIM AND RUN AS FIELD TESTS OF PEAK AEROBIC POWER IN YOUNG MEN AND WOMEN

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The purpose of this study was to compare the validity of the 12-min swim and run as field tests of $\dot{V}O_{2peak}$ in young male and female recreational swimmers. Thirty-six males and 34 females completed 12-min swim, 12-min run, tethered swimming $\dot{V}O_{2peak}$, and treadmill running $\dot{V}O_{2peak}$ tests within 3 wk. Mean (± SD) values for 12-min run distance (2797 ± 290 and 2313 ± 317m), tethered swim $\dot{V}O_{2peak}$ (50.3 ± 6.2 and 39.2 ± 4.9 ml• kg BW^{-1}• min^{-1}) and treadmill run $\dot{V}O_{2peak}$ (57.2 ± 5.5 and 45.4 ± 6.3 ml• kg BW^{-1}• min^{-1}) were significantly greater for males compared to females, respectively. Mean (± SD) values for 12-min swim distance (581 ± 88 and 597 ± 22) were not significantly different for males and females, respectively. Correlation coefficients and standard errors of estimate for predictions of swimming $\dot{V}O_{2peak}$ from the 12-min swim (.40, 5.7 and .42, 4.5 ml• kg BW^{-1}• min^{-1}) and run (.74, 4.2, and .58, 4.1 ml• kg BW^{-1}• min^{-1}) and for predictions of treadmill run $\dot{V}O_{2peak}$ from the 12-min swim (.34, 6.0, and .38, 5.1 ml• kg BW^{-1}• min^{-1}) and run (.88, 2.6, and .87, 3.2 ml• kg BW^{-1}• min^{-1}) were similar for males and females, respectively. The slopes from the regression equations predicting swim $\dot{V}O_{2peak}$ from the 12-min swim and run $\dot{V}O_{2peak}$ from the 12-min run were not significantly different in men and women, but the intercepts were higher in men by 10 and 5 ml•kg BW^{-1}• min^{-1}. We conclude: (a) that the 12-min run is a more accurate predictor of swim or run $\dot{V}O_{2peak}$ than the 12-min swim, (b) that the 12-min swim has relatively low validity as a field test of peak aerobic power and that it is not an equally-valid alternative to the 12-min run, and (c) that the relation of $\dot{V}O_{2peak}$ to the 12-min swim and run is not the same in young adult male and female recreational swimmers.

COMPARISON OF BIOELECTRIC IMPEDANCE AND NEAR INFRARED INTERACTANCE FOR HUMAN BODY COMPOSITION FOLLOWING EITHER HIGH INTENSITY RESISTANCE OR ENDURANCE TRAINING

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Sixty-four males between 18 and 35 years old were randomly assigned to either a control (C; n=20); resistance trained (RT; n=22); or, endurance trained (ET; n=22) group for 12-weeks in order to compare bioelectrical impedance (BI) and near infrared interactance (NI) body composition assessment techniques to hydrostatic weighing (HW). Following the 12-week treatment period, both training groups showed significant declines in relative body fat (%BF) by either reducing total fat weight and maintaining fat -free weight (FFW)(ET: Pre to Post %BF = 18.4% to 16.5%); or, reducing total fat weight and increasing FFW (RT: Pre to Post %BF = 21.2% to 18.8%) according to the HW results. There were no significant changes in the control group(C: Pre to post %BF = 19.5% to 20.2%) Prior to and following each treatment period, no significant differences in relative body fat assessed between BI and hydrostatic weighing values were found. However, NI significantly underestimated relative body fat prior to and following all treatment periods. Regression analysis performed on the delta changes in relative body fat for all subject's combined indicated that NI could not accurately detect these changes (r=0.09, NS) while BI was only a fair indicator (r=0.33, p<.02) when compared to HW. The inability of NI to accurately detect changes in relative body fat was primarily due to the fact that NI could not accurately determine changes in fat-free-weight (FFW) following training. As a result, FFW changes following RT using the NI technique indicated FFW declined 1.4% in comparison to the 3.3% and 1.8% increase in FFW as determined by HW and BI following training respectively. In summary, these results suggest that NI is not an accurate measure of body composition before and after training. In addition, both BI and NI do not appear to accurately detect subtle changes in body composition parameters that may occur following training (i.e., increases in FFW following resistance training).

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PREDICTING VO_2 MAX IN FEMALES WITHOUT EXERCISE TESTING

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The purpose of this investigation was to evaluate the accuracy of two non-exercise testing models in predicting VO_2 Max of females. At the University of Houston the following regression equations were developed to predict VO_2 Max without exercise testing: N-Ex$_1$ VO_2 Max = 56.363 - (0.381 * Age) - (0.754 * BMI) + (1.951 * Activity Code) and N-Ex$_2$ VO2 Max = 50.513 - (0.289 * Age) - (0.552 * Percent Fat) + (1.589 * Activity Code). In order to determine the accuracy of these equations 118 females were evaluated by a maximal Bruce test and open circuit spirometry. Characteristics of the subjects included: mean VO_2 Max 40.5 ± 10.4 ml · kg^{-1} · min^{-1}; mean age 28.7 ± 8.0 yrs; mean weight 62.4 ± 11.2 kg; mean percent fat 23 ± 7 %; BMI 23.4 ± 3.8 wt / ht^2; and mean RER 1.07 ± 0.08. The following results were found between criterion VO_2 Max (maximal treadmill testing) and each of the respective equations: N-Ex$_1$ R = 0.81 and SE = 6.0 ml · kg^{-1}· min^{-1}, and N-Ex$_2$ R = 0.84 and SE = 5.6 ml · kg^{-1}· min^{-1}. These results were similar to the original Houston data where they found N-Ex$_1$ R = 0.78, SE = 5.7 ml · kg^{-1}· min^{-1} and N-Ex$_2$ R = 0.81, SE = 5.3 ml · kg^{-1}· min^{-1}. This investigation indicates that both non-exercise testing models can predict VO_2 Max with the accuracy similar to that reported with sub-maximal exercise testing models. The non-exercise models provide an alternative method for predicting VO_2 Max in females when exercise testing is not possible.

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RELIABILITY OF PHYSIOLOGICAL PARAMETERS DURING MAXIMAL TREADMILL EXERCISE IN OLDER ADULTS

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To determine the effect of a control period on the reliability of physiological parameters during maximal treadmill testing in older adults, test-retest maximal values for ventilation (V_E), oxygen uptake (VO_2), respiratory exchange ratio (RER), systolic (SBP) and diastolic (DBP) blood pressure, heart rate (HR), and total exercise time (TET) were analyzed in 34 adults ranging in age from 60-82 yrs (x=68±5 yrs). Subjects consisted of non-exercising controls from 3 exercise training studies conducted by the same laboratory; repeated tests occurred at the starting (T1) and finishing (T2) points of 6 month study periods. Two practice sessions on the treadmill preceded each T1 test. Standard criteria for attainment of VO_2max were used to judge the adequacy of the tests.

Variable	T1	T2	Δ	r	SEE	SEE (%)
V_E (L•min^{-1})	66.1 ± 24.5	64.0 ± 25.1	2.1	0.93	8.9	13.5
VO_2 (L•min^{-1})	1.72 ± 0.53	1.66 ± 0.59	0.06	0.94	0.18	10.5
VO_2 (ml•kg^{-1}•min^{-1})	24.6 ± 5.1	23.7 ± 6.0	0.9*	0.90	2.4	9.8
RER	1.14 ± 0.09	1.16 ± 0.13	-0.02	0.30	0.10	8.8
SBP (mmHg)	185 ± 23	185 ± 20	0.4	0.67	16.2	8.8
DBP (mmHg)	89 ± 12	87 ± 11	1.2	0.69	8.1	9.1
HR (b•min^{-1})	160 ± 15	159 ± 18	1.2	0.92	6.4	4.0
TET (min)	10.5 ± 2.0	10.2 ± 2.4	0.15*	0.76	1.4	13.3

*$p < 0.05$

There were no significant differences between T1 and T2 maximal values of V_E, absolute VO_2, RER, SBP, DBP, or HR. Significant differences were found between T1 and T2 in relative VO_2 and TET. However, these differences were only 3.7% and 1.4% of the T1 means for relative VO_2 and TET, respectively. Changes in body weight over the 6 month interval (68.5 kg to 69.2 kg, p = 0.19) may have contributed to the difference in relative VO_2. SEE ranged from 4.0-13.5% of the T1 mean, with HR having the lowest SEE. These data indicate that the results obtained from maximal treadmill exercise testing in older adults are reliable when standardized criteria for the attainment of maximal VO_2 are used.

BIOENERGETIC AND NUTRITIONAL ANALYSIS OF AN ULTRAENDURANCE TRIATHLON

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Event hydration and refueling strategies are important factors affecting ultraendurance performance capacity. The purpose of this study was to determine the bioenergetic demands and nutritional practices of triathletes performing an ultradistance triathlon. Five competitive male triathletes (VO_{2max} 71.8 ml·kg^{-1}·min^{-1}) performed two simulated ultradistance triathlons (2 km swim, 90 km bike, 21 km run) under controlled laboratory conditions (30°C, 60% RH). The athletes performed the 2 km swim in 30+/-3 min with an estimated VO_2 of 3.1+/-0.6 l·min^{-1} and a swim segment energy expenditure of 439+/-5 kcals. The subjects performed the 90 km cycling segment in 172+/-12 min with and average VO_2 of 2.97+/-0.6 l·min^{-1} and a mean respiratory exchange ratio (RER) of 0.86+/-0.08. Based on VO_2 and RER data, the subjects expended 2,438+/-381 kcals during the cycling segment with 52% of cycling segment energy expenditure (1,268 kcals) derived from carbohydrate and 48% of energy expenditure (1,170 kcals) derived from fat. The athletes ingested 917+/-402 kcals (320+/-140 kcals·h^{-1}) during the cycling segment of which 709+/-284 kcals were obtained from 4.45+/-1.4 liters of fluid and 208+/-148 kcals were from solid foods. Cycling segment caloric intake consisted of 93+/-4% carbohydrate, 2+/-2% fat, and 5+/-4% protein and represented 76% of total event refueling. The athletes performed the 21 km run in 119+/-17 min and maintained an average VO_2 of 3.05+/-0.6 l·min^{-1} with a mean RER of 0.81+/-0.05. Based on VO_2 and RER data, the athletes expended 1,738+/-279 kcals during the run segment of the triathlon with 35% of energy expenditure (608 kcals) derived from carbohydrate and 65% of energy expenditure (1,130 kcals) derived from fat. The athletes ingested 288+/-150 kcals (145+/-76 kcals·h^{-1}) during the run from 1.79+/-0.5 liters of fluid consisting of 98+/-2% carbohydrate and 2+/-1% protein. No solid foods were consumed during the run segment of the triathlon. Hormonal and substrate analysis revealed that serum insulin levels decreased by 40%, cortisol levels increased by 76%, glucose levels increased by 28%, non-esterified fatty acid levels increased by 117%, blood urea nitrogen levels increased by 10%, serum ammonia levels increased by 94%, and uric acid levels increased by 27% throughout the triathlon indicating that although blood glucose levels were maintained, fat and protein served as significant contributors to energy metabolism. Results indicate that the athletes: 1.) maintained an average VO_2 of 3.0+/-0.6 l·min^{-1} with a mean RER of 0.84+/-0.05 for 5.36+/-0.4 h; 2.) expended 4,615+/-583 kcals to complete the half Ironman event with 45% (2,077 kcals) of energy expenditure derived from carbohydrate; 3.) ingested 1205+/-566 kcals (225+/-106 kcals·h^{-1}) consisting of 94% carbohydrate during the event which represented 26% of total energy expenditure; and, 4.) experienced an increased fat and protein contribution to total energy expenditure despite the maintenance of blood glucose levels.

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EFFECTS OF RESTRICTED DIET AND EXERCISE ON RESTING METABOLIC RATE AND FAT PAD DISTRIBUTION IN YOUNG FEMALE RATS

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Thirty female Sprague-Dawley rats were randomly assigned to one of four groups (unrestricted diet, sedentary [URS]; unrestricted diet, exercise [URE]; restricted diet, sedentary [RS]; and restricted diet, exercise [RE]) to determine the effects of a 30% restriction of diet accompanied by variably increasing treadmill exercise on resting metabolic rate (RMR) and fat pad distribution (FD) over a 6 wk experimental period. Repeated measures ANOVA for RMR (pre, mid, post experimental period) revealed no significant differences between groups at the pre experimental period; however, RMR post experimental measures for the RE and RS groups were significantly lower than the URS group (48.52±3.2 vs 39.52±1.45 and 33.80±1.23 mL·kg·min^{-1}). The RE group revealed a 7.8% decline in RMR while the RS group demonstrated a decline of 12%. These data suggest that the decline in RMR associated with dietary restriction may be muted by the addition of exercise. Retroperitoneal (R) and parametrial (P) fat pads were excised at sacrifice and results indicated that the RE and RS groups had significantly lower fat pad weights than the URS group [URS =3.38±0.52g (R), 7.47±0.61g (P); RS = 1.35±0.27g (R), 2.98±0.61g (P); RE =0.66±0.22g (R), 1.51±0.47g (P)]. There was no difference between the RS and RE groups in FD. These data suggest that the intervention of a restricted diet negatively impacted FD rather than exercise. There also appeared to be no preferential preservation of either R or P pads suggesting that although female rats appear to utilize fat for energy substrate very efficiently, prolonged and constant dietary and exercise intervention do not preferentially draw on one pad for energy at the expense of others.

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EXERCISE ENDURANCE IS INCREASED BY A COMMERCIAL GLUCOSE POLYMER ELECTROLYTE BEVERAGE

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This research project tested the potential benefits of consuming a commercially-available glucose polymer electrolyte beverage (0 g protein, 19 g carbohydrate, 0 g fat, 230 mg sodium, 65 mg potassium, 76 calories) designed to enhance endurance performance (*STAM-ADE* by *STIM-O-STAM, LTD*). Specifically, 20 human subjects (13 males and 7 females) who, by history, regularly engaged in high intensity, long duration endurance training between the ages of 18 and 30 years volunteered for this study. After screening for overt or latent disease states by self-reported medical history and obtaining written informed consent, the subjects participated in two exercise sessions of submaximal treadmill running (85% of predicted $\dot{V}O_2$ max) to exhaustion under two conditions administered in a double-blind cross-over (randomized block) design. Time to exhaustion (minutes of exercise) and maximal blood lactate were the variables under consideration. Following a 12-hour overnight fast, subjects reported to the laboratory on separate days. Sixty minutes prior to the run, subjects consumed 21 oz. of *STAM-ADE* or flavored sweetened placebo. The speed of the treadmill ranged between 6.3 and 11.5 miles per hour (0% grade) and was at a fixed speed for each subject between conditions. After 10 minutes of exercise, subjects were given another 21 oz. of placebo or *STAM-ADE* to drink ad libitum during the run. Statistical analyses on treadmill time to exhaustion indicated that the administration of *STAM-ADE* significantly improved ($p = .003$) exercise performance in this group of subjects. Maximal blood lactate was the same under both conditions.

Condition	time (min)	lactate (mmol)
placebo	35:05 (± 8:03)	2.55 (± 0.99)
STAM-ADE	38:50 (± 9:29)	2.69 (± 1.57)

(* values are reported as $\bar{x}$ ± SD)

While some of the subjects reported minimal gastric distress as a result of the ingestion of fluid during the treadmill run, there was no difference between the conditions. No subject was forced to discontinue the testing protocol because of stomach cramps, nausea, or diarrhea. Within the limitations of this study, results indicate this product will improve exercise endurance.

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RESTING METABOLIC RATE AND FOOD INTAKE IN TRAINED AND UNTRAINED FEMALES.

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It has been suggested that female athletes chronically maintain an energy expenditure greater than the recommended daily allowance for (RDA) energy intake, without considerable losses of body weight. Given the high energy expenditure incurred as a result of physical training, such an observation would only be possible if caloric intake was higher than the RDA, or resting metabolic rate (RMR) was lower than expected. To examine this proposition, the (RMR) of twelve trained female runners (Rs), twelve trained female swimmers (Ss) and twelve untrained females was measured (UT). In addition, a 24 hour dietary recall was obtained from the Rs and Ss. The RMR data is presented in Table 1 below. When RMR was expressed relative to body weight ($kcal \cdot kg^{-1} \cdot day^{-1}$) there were no differences among the groups. RMR was significantly ($p = 0.03$) different among the three groups when expressed in $kcal \cdot day^{-1}$. Orthogonal contrasts indicated that there were no differences between the T and UT subjects. However, the Rs had a significantly ($p = 0.02$) lower RMR as compared to the Ss. To account for differences in body composition, RMR was expressed relative to the subject's lean body weight (LBW). The contrast between the T and UT indicated that the T subjects had a significantly lower ($p = 0.0002$) RMR as compared to the UT subjects. However, there were no significant differences between the Rs and Ss. There were no differences in food intake between the Rs and Ss. In conclusion, the RMR of female Rs and Ss, may reflect an adaptation to chronic levels of low energy intake against high energy expenditures.

Table 1 Mean values of resting metabolic rate.

Variable	Runners	Swimmers	Controls
RMR ($kcal \cdot kg^{-1} \cdot day^{-1}$)	27.3 ± 3.8	27.1 ± 2.2	27.5 ± 2.0
RMR ($kcal \cdot day^{-1}$)¥	1470.9 ± 204	1661.8 ± 121	1645 ± 227
RMR (kcal·kg LBW-1)*	31.86 ± 3.65	34.19 ± 2.50	37.70 ± 3.28

All values are expressed as the mean ± SD, ¥ $p \leq 0.05$, * $p \leq 0.001$

EFFECTS OF A KARATE TRAINING TECHNIQUE ON AEROBIC TRAINING

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This study determined the effects of a karate training technique (KTT) on selected hemodynamic variables. Measurements of VO_2, cardiac output ($\dot{Q}$), stroke volume (SV), and a-$\bar{v}O_2$ diff were made by the CO_2 rebreathing (equilibrium) method using the Beckman Metabolic Measurement System. Heart rates (HR) were monitored using the Physiocontrol Lifepac 7. Informed consents were obtained from 10 volunteers from a university sponsored karate class. To accustom subjects to the testing apparatus, resting data were gathered while each subject warmed up. Following the 10-minute warm up period, each subject performed a single-side punch-kick-punch-kick routine for 4 minutes at 70% of their age-estimated HR during which data were collected. Means and standard deviations are presented:

$\dot{V}O2$ $L \cdot min^{-1}$	0.87	± 0.29
$\dot{Q}$ $L \cdot min^{-1}$	8.85	± 2.15
SV $mL \cdot min^{-1}$	62.00	±17.40
HR $b \cdot min^{-1}$	143.00	±16.00
a-$\bar{v}O_2$ $mL \cdot dL^{-1}$	9.56	± 1.16

High HR and low SV suggest that KTT may fail to elicit the hemodynamic components that contribute to aerobic fitness.

PREDICTION OF PEAK VO2 IN YOUNGER AND OLDER GIRLS WITHOUT EXERCISE TESTING

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Jackson, et al., (MSSE, 1990) recently observed a non-exercise model which included a physical activity scale (PA-R), % fat or BMI and age to predict peak VO2 in adults (R=0.82). In the present probe study examining the applicability of this model in youth, 17 younger girls (YG) (8.7-10.7 yrs) and older girls (OG) (14.5-18.1 yrs) volunteered to participate. Peak VO2 was measured during treadmill running. A Sensormedics MMC was used for VO2 assessment with heart rate (HR) measured via a POLAR VANTAGE XL monitor. Percent fat was estimated from skinfold data (Slaughter, et al., HUM BIOL, 1988). The PA-R self-report instrument (Ross and Jackson, 1990) ranges from 0 to 7 (least to highest PA level). Peak VO2, HR, RER and PA-R averaged 47.6 ml/kg/min, 204.4 bpm, 0.98 & 4.4 in YG and 47.5, 199.0, 1.04 and 4.9 in OG. Since peak VO2 was similar the groups were combined for statistical analysis. Pearson r's for peak VO2 with PA-R, % fat, BMI and age were: 0.43, -0.51, -0.33 & -0.01. In a forward selection multiple regression model, an R of 0.66 was found with % fat and PA-R as the best predictors of peak VO2. In this model, % fat accounted for 25.7% of the variance with PA-R adding another 16.2%. These probe data indicate that PA-R may be a promising tool that can be used in combination with % fat to estimate peak VO2 in female youth.

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COMPARISON OF A SIMULATED 16.1-KM TIME TRIAL, VO2 MAX AND RELATED FACTORS IN CYCLISTS WITH DIFFERENT VENTILATORY THRESHOLDS

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Coyle, et al., (JAP, 1988) recently reported different physiological responses and time to fatigue in cyclists with similar VO2 max values but different lactate thresholds while cycling at 88% of VO2 max. In the present study, 18 USCF category 3 or 4 cyclists were tested twice for VO2 max, ventilatory threshold (T-vent, % of VO2 max) and 16.1-km time trials (TT) with the mean of the tests used. The method of Wasserman et al., (JAP, 1973) was used to determine T-vent. Two groups were formed based on T-vent with values for the high group (HVT, n=6) averaging 76.9 ± 4.0 and the low group (LVT, n=6) 68.0 ± 2.8. A Velodyne trainer, an apparatus that allows the cyclist to use their own bicycle, was used during TT and VO2 max testing. Two-way ANOVA was used to compare physiological and performance responses between groups during TT with a one-way ANOVA used to compare maximal responses and T-vent. Significant differences ($p \leq 0.05$) were found for T-vent and TT with VO2 max similar between groups. During TT, significant differences ($p \leq 0.05$) were found for percent of VO2 max utilized, cycling speed, pedal rate, power output, O2 pulse and ventilation between groups. HVT completed TT faster, generated more power, pedalled faster and performed at a higher percent of VO2 max. These results suggest that T-vent rather than VO2 max may be a better variable for indicating performance differences in cyclists.

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ANALYSIS OF TEMPERATURE REGULATION AND FLUID HOMEOSTASIS DURING AN ULTRAENDURANCE TRIATHLON

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The purpose of this study was to assess temperature regulation and fluid homeostasis during an ultraendurance triathlon. Five elite male triathletes (VO_2max 71.8 ml·kg^{-1}·min^{-1}) competed in two simulated triathlons (2 km swim, 90 km cycle, and 21 km run) performed under controlled laboratory conditions (30°C, 60%RH). Core (T_{RE}) and skin (T_{SK}) temperatures were measured using rectal and external skin thermistors while thermal gradient (T_{GD}) was calculated as the difference between T_{RE} and T_{SK}. Total water loss for each segment of the triathlon was estimated by adding segment weight loss to fluid intake. Fluid loss rate was determined by dividing triathlon segment total water loss by segment performance time. Data were analyzed by ANOVA for repeated measures with Scheffe' post-hoc procedures. Results revealed no significant differences among cycling or run segment VO_2 responses throughout the 5.36 ± 0.4 h triathlon with a mean VO_2 of 3.0 ± 0.6 l·min^{-1}. Likewise, no significant differences were observed among cycling segment T_{RE}, T_{SK} or T_{GD} values. Mean cycling segment T_{RE}, T_{SK}, and T_{GD} averaged 38.71 ± 0.5 °C, 35.20 ± 1.2 °C, & 3.51 ± 0.85, respectively. T_{RE} and T_{SK} values were significantly greater than cycling segment responses and significantly increased between 3 km and 11 km of the run segment. Mean run segment T_{RE}, T_{SK}, and T_{GD} averaged 39.49 ± 0.7 °C, 35.87 ± 0.8 °C, & 3.62 ± 0.8 °C, respectively. Fluid homeostasis data are as follows with $p < 0.05$ differences from PRE-SW, POST-SW, POST-B, and POST-R indicated as a, b, c, and d, respectively:

		PRE-S	POST-S	POST-B	POST-R	TOTAL
Weight (kg)	Mean	75.7 ^{d}	75.6 ^{d}	75.5 ^{d}	73.8 ^{abc}	-
	SD	3.6	4.0	3.4	3.8	-
Fluid Intake (l)	Mean	-	-	4.45 ^{d}	1.64 ^{d}	6.09
	SD	-	-	1.34	0.50	1.75
Total Water Loss (l)	Mean	-	0.43 ^{cd}	4.99 ^{bd}	3.20 ^{bc}	8.01
	SD	-	0.62	1.95	0.69	1.80
Fluid Loss Rate (l·h^{-1})	Mean	-	1.10 ^{cd}	1.76 ^{b}	1.74 ^{b}	1.50
	SD	-	0.46	0.70	0.44	0.35
Fluid Intake Rate (l·h^{-1})	Mean	-	-	1.57 ^{d}	0.85 ^{d}	1.17
	SD	-	-	0.51	0.31	0.38

Results indicate that the fluid intake of 1.57 l·h^{-1} during the cycling segment was sufficient to maintain total body weight, T_{RE} and T_{SK} values. However, a fluid intake deficit of 0.89 l·h^{-1} was observed during the run segment resulting a 2.3% loss of total body weight and significant increases in T_{RE} and T_{SK}.

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DAILY VARIATION IN STEP LENGTH OF MODERATELY-TRAINED MALE RUNNERS

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While previous research has examined interindividual differences in gait characteristics during running, little is known regarding within-subject variation in running mechanics. The purpose of this study, therefore, was to quantify intra-individual variability in step length, a basic descriptor of the running pattern. Following 60 min of treadmill accommodation, nine trained male subjects ($\bar{X}$ age = 34.18 yrs ± 7.16, $\bar{X}$ $\dot{V}O_2$ max = 57.34 ± 4.82 $ml \cdot kg^{-1} \cdot min^{-1}$) performed daily (Mon-Fri) 6-min treadmill runs at three submaximal speeds (2.68, 3.13, and 3.58 $m \cdot s^{-1}$) over a 4-week period. To minimize extraneous influences, subjects refrained from road racing and completed the 20 running sessions (5 days/week * 4 weeks for each speed) at the same time of day and in the same footwear. For each 6-min running bout, treadmill velocity was obtained from treadmill belt length and photocell determination of the elapsed time for 10 treadmill belt revolutions. During the last 2 min of each run, voltage changes produced with each footstrike were sensed by a low-pass amplifier and converted to digital pulses, which allowed for calculation of step time, or the time interval between successive foot contacts. SL was subsequently obtained by multiplying step time and treadmill velocity. Results indicated that the average SL and coefficient of variation [(SD/$\bar{X}$) * 100] in SL was 0.984 m and 2.50% at 2.68 $m \cdot s^{-1}$, 1.124 m and 2.22% at 3.13 $m \cdot s^{-1}$, and 1.254 m and 2.26% at 3.58 $m \cdot s^{-1}$. Reliability analyses also indicated that the percentage of variation accounted for in SL across all speeds was high and improved very little as test number increased (range = 92%-93% for 2 days vs 98-99% for five days). Taken together, these findings suggest that when testing conditions are controlled, within-subject variability in SL is small in trained subjects performing submaximal exercise, and that criterion SL values can be obtained by averaging duplicate measurements.

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SHORT-TERM EFFECTS OF PROLONGED MAXIMAL RUNNING ON RUNNING ECONOMY AND RUNNING MECHANICS IN WELL-TRAINED RUNNERS

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Previous research on recreationally-trained subjects has shown that running economy (RE) and running mechanics measured during moderate-intensity exercise (56% - 81% $\dot{V}O_2$ max) are unaffected up to four days after 30 min of running at 89% $\dot{V}O_2$ max. Little is known, however, regarding short-term effects of prolonged maximal running in higher-caliber athletes performing subsequent high-intensity exercise. To examine this issue, baseline data were obtained on 10 well-trained male subjects ($\bar{X}$ age = 33 ± 4 yrs; $\bar{X}$ 10 km time = 33.8 ± 1.1 min; $\bar{X}$ $\dot{V}O_2$ max = 71.3 ± 2.6 $ml \cdot kg^{-1} \cdot min^{-1}$) who initially completed two 10-min economy runs at 90% of individually-determined $\dot{V}O_2$ max following 30 min of treadmill accommodation. $\dot{V}O_2$ was determined from a 2-min sample collected during min 6-8. Video recordings made at 60 fps were also obtained during the last min of running in order to quantify 19 temporal, kinematic, and kinetic gait descriptors previously linked with RE. Two to three days following the second run, each subject completed 30 min of running (30MR) at 90% $\dot{V}O_2$ max. One, two, and four days after the 30MR, subjects repeated the 10-min economy runs. A repeated-measures design revealed no significant difference ($p > 0.05$) in RE (range = 200.2 - 201.4 $ml \cdot kg^{-1} \cdot km^{-1}$) following the 30 MR. Examination of biomechanical data also indicated that with the exception of one variable (center of mass power output), gait characteristics remained stable across time. Viewed in concert, these data support earlier findings on less-trained runners and suggest that 30 min of maximal running does not worsen RE or generally perturb running mechanics in well-trained subjects who engage in subsequent high-intensity short-term distance runs.

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A COMPARISON OF GROUND REACTION FORCES IN BENCH STEP AEROBICS WITH OTHER AEROBIC ACTIVITIES

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Seventeen female bench step aerobic instructors with above average aerobic fitness levels were studied performing a standardized 40-minute bench step routine, a walk, a jog, a low impact march and a high impact single-leg double hop. Each subject's vertical ground reaction forces (VGRF) were monitored during the ground phase for each of the activities. The purpose of the research was to determine if statistically different impact forces were created by the group when performing these common aerobic activities. VGRFs were measured with an AMTI Force Platform operating at a sampling rate of 1500 Hz for 2 seconds. Forces were measured during the bench step routine, which was performed at a rate of 30 steps per minute, at 5- and 35-minutes into the routine. A sagittal plane, left leg step-down from the eight-inch bench was measured for all subjects. The low and high impact activities were performed at a rate of 30 steps per minute (music = 120 beats per minute) and the walk and jog at a "normal" pace for the individual subject. The results indicated group mean VGRFs of 1.42 BW, 1.46 BW, 1.13 BW, 2.26 BW, 1.74 BW and 3.14 BW for bench step-5, bench step-35, walk, jog, low impact march and high impact hop, respectively. Utilizing a repeated-measures ANOVA, statistically-different ($p<0.05$) results were found for the group when comparing the two bench step VGRFs with all other activities, however no difference was found between the two bench step VGRFs. It was concluded that bench step aerobics may be a biomechanically "safer" activity due to smaller VGRFs when compared to other common aerobic activities with the exception of walking. These generally smaller VGRFs upon impact, which would be reduced even further by landing on a cushioned floor, should minimize a participant's chances of suffering a lower extremity injury when compared with performing other aerobic activities.

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BODY MASS AS A DETERMINANT OF EXERCISE EFFICIENCY DURING STEADY STATE CYCLING

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Exercise efficiency during cycle ergometer exercise has been shown to be dependent on the work rate and pedal rate and is considered to be independent of body mass. To determine the validity of the assumption that exercise efficiency is independent of body mass, 50 female subjects ranging in body mass from 41.5 to 98.9 kg exercised on an electronically braked cycle ergometer with no load at 60 rpm and at 25, 50, 75 and 100 watts at 60 and 90 rpm. Gross (no base-line correction), and net (resting metabolism as base-line correction) efficiencies were computed at all work rates at 60 and 90 rpm. Work efficiency (no load cycling as base-line correction) was computed at all work rates but only at 60 rpm due to limitations of the cycle ergometer. Gross efficiency was found to be negatively and significantly correlated with body mass at all work rates at both pedal frequencies (r ranged from -.55 to -.69). The use of resting metabolism as the base-line correction resulted in decreases in all the correlations. Net efficiency was still negatively and, in most instances, significantly correlated with body mass (r ranged from -.28 to -.52). The use of no load cycling as the base-line correction resulted in even further decreases in the correlation between efficiency and body mass. Work efficiency was not significantly correlated with body mass at any of the work rates (r ranged from .01 to -.29). The fact that gross and net efficiencies were negatively correlated with body mass demonstrates that increases in body mass are associated with decreases in exercise efficiency. These results would suggest that these computations are inappropriate for the calculation of exercise efficiency during steady state cycle ergometer exercise.

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LOW BACK PAIN -- HIGH SCHOOL FOOTBALL

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HISTORY -- 18 year old male football player presented to his pre-season examination with a six month history of low back pain and intermittent left leg numbness following a "dead-lift of 360 lbs. His pain is worse with forward bending and coughing, but he denies any true leg weakness. He has always been active with football (defensive lineman) and farm work, and wishes to play his final year of high school football.

PHYSICAL EXAM -- This healthy looking 182 lb. young man had normal spinal alignment and full range of motion in the thoracolumbar region, although both flexion and extension were painful. Straight-leg raising test, motor and sensory examination were normal. A small "knot" in the left paraspinal musculature was tender to palpation.

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BACK PAIN -- SOCCER

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HISTORY--19 year old soccer player with an acute complaint of low back pain and stiffness. The pain began during a game, as a result of a direct injury to the lower back sustained while being tackled. The patient was diagnosed with an acute L-S strain and was treated with physical therapy to include high voltage electrical stimulation. Five days into the rehabilitation, the patient slipped while walking, again injuring the back, reproducing marked generalized low back pain and stiffness. The patient also complained of left buttocks and upper posterior thigh pain. The PMH is remarkable for a prior back injury approximately 5 years ago sustained in a car accident. The patient, however, related no history of disability, playing competitive soccer through high school without any back pain.

PHYSICAL EXAM-- He had a loss of the lumbar lordosis with marked bilateral paraspinal tenderness to palpation. The ROM testing demonstrated limitation with flexion to 30° and extension to 10°. The neurologic examination of the lower extremities was normal. Extension of the spine aggravated the patient's pain. Straight leg testing was normal bilaterally. There was no palpable spinous process tenderness or step-off.

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KNEE PAIN - FOOTBALL

J.M. Ray, M.D., D.,Boyd, M.D., W. Mosley, M.D.

HISTORY - 10 year old male football player with a complaint of acute left knee pain. the patient is a quarterback for a local organized tackle football league who sustained a lateral blow to the left knee while eluding a tackler. The patient heard and felt a pop from the knee. The player was unable to continue and was subsequently taken to a local emergency room where x-rays were taken and read as negative for fracture. The patient was given crutches with instructions for rest, ice, and no football for 1 week.

PHYSICAL EXAMINATION - Marked effusion th the left knee. The patient ambulated with crutches with the flexed. He was unable to fully extend or flex the knee without discomfort. Lachman's test was positive, pivot shift was not performed because of hamstring spasm. Tenderness to the lateral joint line was moderate, mild tenderness to the medial collateral ligament femoral attachment, McMurray's test not performed because of pain with passive flexion. Medial collateral ligament testing at 30 degrees flexion was graded + 1, lateral collateral ligament testing at 30 degrees of flexion was graded 0

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KNEE PAIN - WRESTLING

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HISTORY - 16 year old white male with multiple right knee complaints for approximately 6 months. He reports no acute trauma. Over the six month period his pain has steadily increased. Most notably he has pain while participating in wrestling activities. He describes a locking sensation which occurs on a daily basis.

PHYSICAL EXAM - A tense effusion is noted on exam. Pain with palpation along the lateral joint line posteriorly. Patient has flexion to 110 degrees and lacks 10 degrees of full extention. A palpable cyst is noted posteriorly. Lachman's test is negative. Pivot shift test is negative. McMurray's test produces pain in the leateral compartment.

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SHOULDER PAIN - BASKETBALL

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HISTORY - 18 year old black male who is right hand dominant. His injury occurred while blocking a shot against the backboard. The mechanism is described as a motion from abduction, external rotation to adduction, internal rotation across the body. The patient noted an acute onset of pain and weakness in his right upper extremity immediately. He was however, able to continue to play and noted that the pain and weakness improved through the remainder of the game.

PHYSICAL EXAM - The initial exam was at two days post injury. He was noted to be tender to palpation over the greater tuberosity and over the supraspinatus. Active range of motion at that time was abduction; 80 degrees, flexion; 90 degrees, external rotation; 60 degrees, internal rotation; 90 degrees. Impingement test was negative. At 10 days post injury there was significant atrophy of both the supraspinatus and infraspinatus noted. Active range of motion at that time was abduction; 50 degrees, flexion; 45 degrees, external rotation; 30 degrees, internal rotation; 90 degrees.

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SHOULDER PAIN - FOOTBALL

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HISTORY - 19 year old male college football player presented with a complaint of right shoulder pain. The pain began at the end of the previous football season and continued through spring training. The pain was present with tackling but also present with weight lifting especially bench pressing with the weight overhead. The player denied one acute episode of trauma as the cause but reported the onset of discomfort as being over a period of 6 months and was not getting better. At the time of presenting for evaluation he reported a loss in strength especially with benching.

PHYSICAL EXAMINATION - He has full range of motion to the right shoulder. With extreme abduction and elevation he has pain to the right acromioclavicular joint. He has tenderness to palpation at the A-C- joint but no demonstrable instability. His exam is otherwise normal. Impingement sign is negative

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WRIST PAIN - FOOTBALL

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HISTORY - This is a 16 year old football player who fell onto a volar flexed wrist during a football game. The player had immediate pain, limited motion, and was removed from the competition and taken to the emergency room. The patient had minipulation of the wrist performed in the emergency under I.V. sedation.

PHYSICAL EXAMINATION - Marked swelling noted to the wrist dorsally. Tenderness to palpation volarly in the area of the carpal tunnel. Complaints of paresthesia to the thumb, index and middle fingers. Two point discrimination was intact. Radial pulse was palpable.

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HINDFOOT PAIN - HIKING

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HISTORY A 19 year old male complained of chronic right lateral hindfoot pain of 6 months' duration. Before and during that time period he also had sustained several moderate to severe ankle sprains. The initial swelling and pain of each ankle sprain had subsided, however a low grade, chronic pain remained. The pain became worse with prolonged hiking and also was especially bothersome at night. He denied any locking or catching in the ankle.

PHYSICAL EXAMINATION The patient had full ROM of the right tibiotalar joint. Subtalar motion was also symmetrical, however the pain was markedly aggravated by forced inversion. There was local tenderness and minimal swelling in the area of the sinus tarsi. No erythema was noted. The calcaneocuboid joint was also mildly tender to palpation. The peroneal tendons and lateral ankle ligaments were not tender. Neurovascular examination was normal.

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SHORT-TERM HIGH-VOLUME WEIGHT-TRAINING: EFFECTS OF DIFFERENT WORK-REST RATIOS ON STRENGTH, POWER AND ENDURANCE. J.M. Robinson, C.M. Penland, R.L. Johnson, D.L. Lewis, B.J. Warren and M.H. Stone, Appalachian State Univesity, Boone, NC.

This study investigated the effects of a high volume 5 wk weight-training program and different work-rest intervals on maximum strength, power, repeated high intensity exercise (HIEE) and low intensity exercise endurance (LIEE). Thirty-three trained males (20.4±3.5 yr) were divided into 3 groups. Groups used the same exercises and set and repetition scheme. Rest intervals were Gp1 (n=11), 3 min; Gp2 (n=11), 1.5 min and Gp3 (n=11), 0.5 min. Pre-post changes were analyzed using G X T ANOVA. The 1RM squat and peak power and total work, as measured by 15 five-sec cycle rides, increased significantly ($p \leq 0.05$):

		Squat (kg)	Peak Power (W)	Total Work (J)
Gp1	pre	124±27	906±190	4022±866
	post	133±29	950±162	4327±755
Gp2	pre	120±23	956±165	4163±744
	post	127±22	992±145	4424±661
Gp3	pre	125±24	911±225	4003±1002
	post	128±24	1066±122	4479±658

Time to exhaustion at 35% of peak power, vertical jump and vertical jump power did not change. The 1RM squat increased significantly more in Gp1 (7%) compared to Gp3 (2%). Data suggest that, except for maximum strength, adaptations to short-term high-volume training may not be dependent upon rest interval length.

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PREDICTION OF THE CALORIC COST OF THE DEADLIFT

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The purpose of this study was to examine the relationship between work done and energy expended during the deadlift exercise. Forty-six observations of the metabolic cost during a wide variety of deadlifting bouts were made on a heterogeneous sample of 10 male and 14 female subjects whose $\bar{X}$ ± SD age, HT, WT and 1RM were (25.0 ± 4.6 and 25.6 ± 5.5 yr; 182.1 ± 5.8 and 163.7 ± 6.9 cm; 82.8 ± 15.4 and 66.1 ± 13.1 kg; 129.3 ± 29.9 and 77.8 ± 12.6 Kg, respectively). Oxygen consumption was measured by standard open circuit spirometry with conversion to calorie equivalents using nonprotein R values. Reliability of the technique of data collection was determined to be 0.997. A dependent t-test on 4 subjects whose T_1 and T_2 $\bar{X}$ ± SD scores were 28.2 ± 13.8 and 29.9 ± 21.0 Kcals, respectively was nonsignificant. An R of 0.92 for work done and calories consumed indicated that total estimated work during deadlifting can be used to accurately predict energy expenditure. The regression equation calculated was Kcal = 13.92 + 0.04 (Kgm) with a standard error of estimate of 7.40 Kcals.

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CHANGES IN CARDIOVASCULAR FITNESS AND MUSCULAR STRENGTH IN FEMALES FOLLOWING CIRCUIT TRAINING

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In the past few years, there has been considerable interest in the use of circuit weight training to develop over-all physical fitness. Traditional circuit weight training (CWT) includes a series of exercises, done in sequence, in which the participant completes as many repetitions as possible in a short period of time. Previous reserach has shown that moderate increases in cardiovascular fitness may be achieved with CWT; however, it has been suggested that aerobic activity be included with weight training for maximum benefits (Pollock, 1981). In an effort to combine aerobic training training with CWT in one session, an aerobic circuit was designed which included five, 3-minute aerobic intervals along with twenty-five, 30-second weight training or calesthenic exercises. The purpose of this study was to determine the effectiveness of 12-weeks (3x per week) of aerobic circuit training (ACT) on cardiovascular fitness, muscular strength and body composition in college aged females. Subjects included 24 untrained females, ($\bar{X}$ = 20.8 yrs.); 12 participated in the training and 12 served as non-exercising controls. All subjects completed maximal treadmill tests to determine VO_2. Caliper measurements were used to estimate percent body fat and muscular strength was determined with a 1 repetition maximum using 6 stations on the Universal gym. Training included 3, 50-minute sessions for 12 weeks. The statistical analyses indicated there were significant increases in VO_2 ($p<.001$), and muscular strength ($p<.01$) as well as decreases in percent body fat ($p<.01$) following the training. These findings indicate that aerobic circuit training is an effective method of improving fitness in previously untrained females.

Supported by a UT-Chattanooga Provost Student Research Grant.

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PLASMA VOLUME SHIFTS DURING ARM AND LEG RESISTANCE EXERCISES IN TRAINED FEMALES

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Nine females performed ten repetitions of both a single arm biceps curl (BC) and a single legged leg extension (LE) exercise for six sets or until 10 repetitions could not be performed using the correct technique. Both exercises resulted in identical plasma volume losses of 6.5%. Plasma volume remained decreased by 5.6% and 3.4% for BC and LE respectively 5 minutes after exercise. No significant differences were found between BC and LE for either exercise or post-exercise plasma volume ($P<.05$). No significant correlations were found between increases in lactate concentration, mean arterial pressure, heart rate, or rate pressure product and decreases in plasma volume. The results of this study suggests that plasma volume dynamics are identical for exercises that isolate a particular muscle group and are performed at the same relative intensity.

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PHYSICAL ACTIVITY HABITS IN AFRICAN-AMERICAN AND WHITE WOMEN

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The purpose of this study was to compare leisure-time (LTPA) and occupational physical activity (OPA) patterns in African-American and White women. Thirty African-American and 30 White women from the Piedmont area of NC were in the cross-sectional study. Subjects were stratified by race (African-American, White), age-group (25-34, 35-44, 45-55), and income (≤ 300% poverty, > 300% poverty). PA was assessed using a two-week modification of the one-year Minnesota LTPA and the Tecumseh Occupational PA Questionnaires. LTPA was measured in kcal·day^{-1} for total leisure, heavy (≥ 6 METs), moderate (4.5-5.5 METs), light (≤ 5 METs) intensity, and household LTPA. OPA was measured in kcal·day^{-1}. Values were log transformed to account for skewed data and are presented as the geometric mean. Comparisons between groups were made with ANOVA.

ACTIVITY	AFRICAN-AMERICAN	WHITE	P-VALUE
Total Leisure (kcal·day^{-1})	384	624	.06
Heavy Intensity (kcal·day^{-1})	20	37	.23
Moderate Intensity (kcal·day^{-1})	51	92	.25
Light Intensity (kcal·day^{-1})	141	363	.009
Household (kcal·day^{-1})	116	371	.009
Occupational (kcal·day^{-1})	350	371	.29

Both groups expended little energy in heavy intensity activities. Light-intensity and household activities comprised the majority of energy expended per day for both groups with walking and house cleaning listed as the most frequent activities performed. Overall, African-American women were less active in light intensity and household activities than White women. There was no difference in OPA between the groups.

Supported by NIH MBRS S206 RR08040-19 and NSF Collab. Research Grant

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PHYSICAL ACTIVITY HABITS IN LOWER- AND HIGHER-INCOME WOMEN

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Previous studies show differences in leisure-time physical activity (LTPA) in adults of higher- and lower-socioeconomic status (Ford et al., AJE,133:1246). This study compared LTPA and occupational physical activity (OPA) by income levels in 60 adult women from the Piedmont area of North Carolina. Cutpoints for family income were determined using the USDA 1991 poverty guidelines. Poverty level for a family of four is $13,037. Subjects included 30 lower income (≤ 300% poverty, LI) and 30 higher income (>300% poverty, HI) African-American and White women. PA was assessed using the two-week modification of the one-year Minnesota LTPA and the Tecumseh Modified Occupational PA questionnaires. LTPA was measured in kcal·day^{-1} for heavy- (≥ 6 METs), moderate- (4.5-5.5 METs), light- (≤ 5 METs) intensity, total leisure (sum of the intensity groups) and household LTPA. OPA was measured in kcal·day^{-1} for transportation to work and work activities. Values were log transformed to account for skewed data and are presented as the geometric mean kcal·day^{-1}. Group differences were compared using ANOVA. Results showed no difference in total LTPA and OPA between groups (LI = 1249; HI = 1229, $p > .05$). HI expended more energy than LI in total (650 vs 368, $p < .03$) and high-intensity LTPA (78 vs 9, $p < .001$). There were no differences ($p > .05$) between HI and LI for moderate- (87 vs 54), low-intensity (217 vs 235), and household LTPA (174 vs 248), or OPA (405 vs 632). Markers of low cardiorespiratory fitness (high body mass index, high resting heart rate, high blood pressure and high body weight) were higher in LI than in HI. These findings concur with previous studies that LI are less active than HI in total and heavy-intensity LTPA. Future studies are needed to identify factors associated with low LTPA in lower income women and interventions planned to reverse this trend.

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PHYSICAL FITNESS CHARACTERISTICS OF FLORIDA FORESTRY PERSONNEL.

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The purpose of this investigation was to evaluate the current physical fitness levels of Florida Forestry Personnel (FFP) in order to establish fitness guidelines for the Florida Division of Forestry. Initial testing involved 27 subjects representing all regions of Florida. Data collection was conducted at the Center of Exercise Science and consisted of 171 response variables pertinent to all aspects of fitness. These included cardiovascular endurance, muscular strength and endurance, body composition, flexibility, dietary behavior, family history, and psychological surveys. The results from this pilot group were analyzed by factor analysis and used to determine the most salient parameters. Based on these results, seven categories of physical fitness were established, namely: body composition; pulmonary function; back flexibility; muscular power; aerobic capacity; resting blood pressure (BP); and lifestyle habits. Based on these categories, field tests were selected for their ease of administration and ability to exclusively characterize each of the seven categories. This battery of tests was performed at two separate sites in Florida on 86 FFP. The tests consisted of weight and skinfold measurement, $FEV_{1.0}$/FVC, sit and reach, victim pull, submaximal cycle ergometry and bench step, resting BP, and lifestyle appraisal. Mean values for the field tests by age decade were (mean±SD):

Decade	20s	30s	40s	50s
n	29	27	27	3
Weight (kg)	82.0±15.0	90.0±20.0	92.7±19.1	81.4±5.0
Fat (%)	19.1±7.0	24.0±6.0	24.0±6.0	24.9±6.0
$FEV_{1.0}$/FVC (%)	72.5±0.7	72.3±0.8	67.4±0.8	67.5±0.2
Sit&Reach (in)	14.9±4.0	15.1±3.4	13.4±4.2	15.3±1.5
Victim Pull (sec)	5.0±0.7	5.1±1.1	5.2±1.0	5.0±0.3
$V0_2$max (ml/kg/min)	37.3±11.9	36.1±9.6	36.8±11.2	31.4±2.1
SystolicBP (mmHg)	124±12	131±10	132±14	133±14
DiastolicBP (mmHg)	75±10	81±9	84±11	81±17

These data indicate that this representative population of FFP scored average to below average on most response variables. Such levels of fitness do not prevent FFP from performing their duties, however in order to minimize health risks for this population, lifestyle modifications are advised.

This project was funded by a grant from the Florida Division of Forestry, State of Florida.

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INCIDENCE OF LOW BACK INJURIES WITHIN THE DIFFERENT JOB PHYSICAL DEMAND CHARACTERISTICS

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One hundred ninety-eight individuals (152 males, 46 females) with diagnosis of lumbar pain, lumbar strain, or lumbar disc ailments were retrospectively studied to determine if a relationship existed between job physical demand characteristics (PDC) and the incidence of low back (LB) injuries. The current thought in the ergonomic and biomechanics community is the greater the weight lifted, the higher the incidence of LB injury. In this study the percentage of LB injuries for each of the eight PDC categories was as follows: Sedentary (lift ≤ 10 lbs) 1 %, Sedentary-Light (Lift 10-15 lbs) 1 %, Light (Lift 16-20 lbs) 8.1 %, Light-Medium (Lift 21-35 lbs) 5.1 %, Medium (Lift 36-50 lbs) 34.1 %, Medium-Heavy (Lift 51-75 lbs) 13.7 %, Heavy (Lift 76-100 lbs) 28.9 %, Very Heavy (Lift > 100 lbs) 8.1 %. A linear relationship did not exist, however, when the individuals were in a PDC level which required them to lift greater than 35 lbs, the incidence of LB injuries significantly increased. In an effort to further analyze the data, the PDC levels were combined into two groups, one contained all people who lift ≤ 50 lbs (G1), and the other contained people who lifted > 50 lbs (G2). There were no significant differences in the two groups as G1 and G2 were close at 49.3 % and 50.7 % respectively. Therefore, this study indicates that the current thought of ↑ weight lifted = ↑ injury, may not be a true indicator for incidence of LB injury.

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PERCENTAGE OF $\dot{V}O_2$max UTILIZED DURING THE ONE-MILE RUN/WALK IN COLLEGE MEN AND WOMEN

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In development of one-mile run/walk (MRW) criterion-referenced standards for Fitnessgram, it was assumed that the percentage of the $\dot{V}O_2$max utilized during the MRW increased from 80% in children 5-6 years of age to 100% in adolescents and young adults 14 years of age and above. The purpose of this study was to test the validity of the %$\dot{V}O_2$max assumed for the MRW standards in college men and women. MRW performance, $\dot{V}O_2$max and the %$\dot{V}O_2$max utilized during a one-mile treadmill run at the average MRW speed were measured in 32 men and 30 women 18 to 25 years of age. %$\dot{V}O_2$max utilized at the average MRW speed was measured after 4 min of running (%$\dot{V}O_2$max-1) and during the final minute of the one-mile treadmill run (%$\dot{V}O_2$max-2). Means (± SD) for the MRW, $\dot{V}O_2$max, %$\dot{V}O_2$max-1, and %$\dot{V}O_2$max-2 in men and women, respectively, were 6.33 ± 0.76 and 8.25 ± 1.09 min, 56.3 ± 6.1 and 45.6 ± 5.4 ml·kg BW^{-1}· min^{-1}, 94.1 ± 3.9 and 93.1 ± 3.7%, and 99.1 ± 1.8 and 98.5 ± 2.3%. There was no significant difference between men and women in %$\dot{V}O_2$max-1 or %$\dot{V}O_2$max-2. Means for both of the two %$\dot{V}O_2$max estimates were significantly less than 100%. Based on the average of the two estimates of %$\dot{V}O_2$max utilized, the data indicate that following the initial adjustment to exercise, that college men and women utilize an average of 95% $\dot{V}O_2$max during a MRW. If the %$\dot{V}O_2$max utilized during running on a track or field is greater than during treadmill running due to the effects of wind resistance, speed variations and irregular terrain, then somewhat higher values would actually be expected during field testing. We conclude that the average %$\dot{V}O_2$max utilized during a one-mile run/walk test by college men and women is lower, but very close to, the value assumed in the development of the Fitnessgram criterion-referenced standards.

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METABOLIC COST AND FUEL UTILIZATION OF SELECTED "AEROBIC" BENCH STEPPING MANEUVERS

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The purpose of this study was to determine the effects of selected step movements, step heights, and step positions on the metabolic cost of "aerobic" bench exercise. Nine healthy females performed the following four stepping maneuvers on a 20.3 cm step (S1) while being measured for VO_2 and RER: basic step (BS), knee raise (KR), alternate lead (AL), and lunge (L). The BS, KR, and L were additionally performed on 25.4 cm (S2) and 30.5 cm steps (S3). Two bench positions, which required executing BS while straddling the step (SS) versus stepping forward and backward (FB) were also studied. All trials were performed by following a video-tape metered at 120 beats·min^{-1}. The means for VO_2 ($ml \cdot kg^{-1} \cdot min^{-1}$), as obtained via open-circuit spirometry, were:

	Step Movements			
Step	BS	KR	AL	L
S1	28.2	30.3	32.5	36.0
S2	32.5	33.1	---	39.5
S3	34.1	36.8	---	41.9

Significant effects ($p < .05$) were demonstrated for the step movements (L > AL > KR; BS), bench position (SS, 31.6 $ml \cdot kg^{-1} \cdot min^{-1}$ > FB, 28.2 $ml \cdot kg^{-1} \cdot min^{-1}$), and bench height (S3; S2 cm > S1 for BS; S3 > S2 > S1 for KR; S3 > S1 for L). The RER ranged from 0.86 for BS and KR on S1 to 0.94 for L on S3. These data show that the metabolic cost and fuel utilization of "aerobic" bench stepping can be altered significantly with respect to the imposed step movements, step position, and step height.

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METABOLIC COST OF BENCH STEP AEROBIC ACTIVITY

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Fifteen well trained bench step aerobic instructors (mean $\dot{V}O_2max$ = 54.2 ± 6.4) were studied to determine the metabolic cost of bench step aerobic activity. The O_2 cost of walking on a treadmill at 4 mph (T4), and running at 5 (T5), 6 (T6), and 7 (T7) mph was determined using a breath by breath metabolic measurement system. Each 5 minute steady state trial was followed by 8-10 minutes of rest recovery. Heart rate (HR) was monitored using standard electrocardiographic technique. On a separate testing day, subjects completed a 40 minute bench step aerobic routine (BE) on an 8" bench to music which resulted in a stepping rate of 30 lifts · min^{-1}. Gas exchange and HR were continuously measured as previously described. Pre and post BE capillary blood samples were taken from a finger tip and analyzed for blood lactate (LA). Mean $\dot{V}O2$ ± SD during BE was 32.6 ± 2.7 ml · kg^{-1} · min^{-1}. Mean $\dot{V}O2$ for T4, T5, T6, and T7 was 16.0 ± 3.2, 28.8 ± 2.9, 34.0 ± 3.3, 39.1 ± 4.0 ml · kg^{-1} · min^{-1} respectively. No significant difference ($p>.05$) was found between T6 and BE. Mean R ($\dot{V}CO2/\dot{V}O_2$) for BE was .99 ± .04. LA was significantly ($p<.05$) higher after BE (10.8 ± 2.8, 19.4 ± 10.4 mg · dl^{-1}). Mean HR during BE was 159 ± 13.6 b · min^{-1}. It was concluded that bench step aerobic activity performed under these conditions is approximately equivalent to tredmill running at 6 mph. It was also concluded that the use of an 8" bench and/or a stepping rate of 30 lifts · min^{-1} may yield intensities that are inappropriate for untrained individuals.

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MAXIMAL OXYGEN DEFICIT DURING ONE- AND TWO-LEGGED CYCLING IN MEN AND WOMEN

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To determine the effects of body size and composition on anaerobic capacity as estimated from the maximal oxygen deficit (MOD), body weight (BW), fat-free weight (FFW), right and left total (TLV) and fat-free (FFLV) leg volumes, and MOD assessed during one- and two-legged cycling were measured in young physically-active men (n=11) and women (n=9). Means (±SD) for one- and two-legged MOD values were significantly ($p<.05$) higher for males (2.27 ± 0.30 and 4.40 ± 0.62 L) than for females (1.18 ± 0.18 and 2.25 ± 0.28 L). For males and females, the mean MOD for two-legged cycling was significantly ($p<.05$) higher than for one-legged cycling. In males, females and the combined group, two-legged MOD (L) was correlated with BW (.55, .68, .85), FFW (.61, .80, .93), TLV (.58, .56, .76), and FFLV (.55, .83, .90). The relation of MOD for one-legged and two-legged cycling with the respective estimate of active muscle mass (one- or two-legged FFLV) in the combined group of males and females was high (r=.94) and described by a single common regression line (MOD = 0.257 (FFLV) - 0.075). We conclude that there is a strong relationship, which is independent of gender, between the MOD measured during one- and two-legged cycling and the estimated active muscle mass.

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VITAMIN E EFFECTS ON EXERCISE-INDUCED OXIDATIVE STRESS IN BLOOD

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Oxidative stress can result in alterations of cell membranes by lipid peroxidation. Vitamin E (250IU/day) was given for 6 weeks to half of the animals in order to determine if this antioxidant could prevent exercise-induced oxidative stress, and if enzymes associated with controlling lipid peroxidation were effected. Sixty four male rats were individually caged and half received supplement of vitamin E daily in their diet. The animals were then randomly assigned to either a sedentary (n=32) or exercise group (n= 32). The rats were run on a treadmill for one hour at 21 m/min up a 12% grade. Immediately after the run mixed venous blood was collected in prechilled test tubes containing EDTA, spun and the plasma stored in a -70°C freezer until analyzed. Plasma lipid peroxidation as indicated by TBARS increased as a result of the treadmill run. Vitamin E did not significantly attenuate the exercise-induced change in lipid peroxidation. Glutathione peroxidase activity (GPX), both total and selenium dependent, were unaffected by the exercise. Vitamin E did not alter GPX activity but helped to maintain GPX activity when the animals were treated with dehydroepiandrosterone. The results suggest that vitamin E supplementation of 250 IU/day for 6 weeks may not prevent exercise-induced lipid peroxidation but seems to help attenuate oxidative stress when other inducing agents are involved.

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EFFECT OF INCREASED SEROTONERGIC ACTIVITY ON ENDURANCE PERFORMANCE IN THE RAT.

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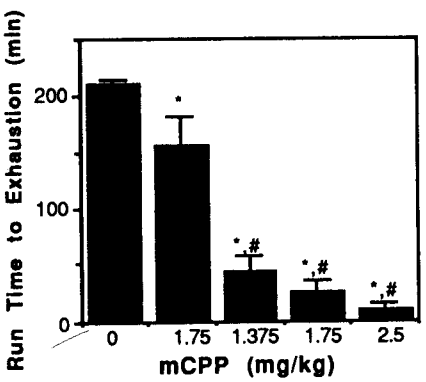
Fatigue, or the inability to maintain power output, during prolonged exercise is traditionally associated with alterations in numerous peripheral variables; such as marked reductions in blood glucose and muscle glycogen concentrations. It has been hypothesized that fatigue during prolonged exercise may be influenced by factors within the central nervous system. Specifically, it has been hypothesized that increased brain serotonergic (5-HT) activity may hasten the onset of fatigue by increasing feelings of lethargy and loss of drive. The purpose of this study was to examine the effects of increased 5-HT activity on run time to exhaustion in the rat. Eight treadmill accomodated female Wistar rats ran to exhaustion (20 m·min^{-1} & 5% grade) on five occasions separated by at least 1 wk. Immediately prior to each run to exhaustion rats were injected (i.p.) with one of the following; 1 mg·kg^{-1} *m*-chlorophenylpiperazine(*m*CPP), 1.375 mg·kg^{-1} *m*CPP, 1.75 mg·kg^{-1} *m*CPP, 2.5 mg·kg^{-1} *m*CPP, or the vehicle (0.9% saline). *m*CPP is a 5-HT agonist that has a high affinity for 5-HT$_{1C}$ receptors. Treatments were administered in a random order and all injections were equal in volume. Run time to exhaustion (T_{exh}) was attenuated in a dose response manner by *m*CPP injection (see figure). Statistical analysis revealed that T_{exh} during the control trial was significantly greater ($p<.01$:*) than T_{exh} in all other trials. Futhermore, T_{exh} during the 1 mg·kg^{-1} *m*CPP trial was significantly greater ($p<.05$:#) than the the three other *m*CPP trials. The results of this experiment support the possibility that increased brain 5-HT activity may be a factor in determining the onset of fatigue during prolonged exercise.



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LIPID, APOPROTEIN AND LIPOPROTEIN RATIOS AND THEIR RELATIONSHIPS IN DISTANCE RUNNERS.

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The ratio of total cholesterol to high-density lipoprotein cholesterol (TC/HDL-C), apoprotein AI to HDL-C (apo AI/HDL-C) and the ratio apoprotein B to apoprotein AI (apo B/apo AI) are associated with risk for coronary artery disease (CAD). However, few studies have examined these ratios in relationship to exercise training. Therefore, the purpose of this study was to evaluate TC/HDL, apo AI/HDL-C, and apo B/apo AI ratios of elite (E) women runners and to contrast these ratios with good women runners (G), recreational women runners (R) and a sedentary (S) reference group. Minutes run per week (mean) for E was 467, G 320, R 158, and S reported no time spent running each week. TC/HDL-C did not differ significantly between the groups (E 2.62 ± 0.53, G 2.64 ± 0.62, R 3.02 ± 1.12, S 3.04 ± 0.71) (mean ± SEM). Apo AI/HDL-C was significantly higher in the elite and good groups ($p<0.004$) than the recreational group (E 3.24 ± 1.59, G 3.06 ± 1.56, R 1.69 ± 0.40, S 2.23 ± 0.63). Apo B/apo AI was significantly lower in the elite and good groups ($p<0.001$) than the recreational and reference groups (E 0.43 ± 0.17, G 0.44 ± 0.26, R 0.83 ± 0.29, S 0.66 ± 0.25). The results from this study demonstrate a positive relationship with minutes run per week and apo AI/HDL-C ($r=0.30$), and a negative relationship with minutes run per week and apo B/apo AI ($r=-0.40$). These results suggest that endurance running may reduce CAD risk, in part, by having a positive influence on the Apo AI/HDL-C and apo B/apo AI ratios.

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AEROBIC TRAINING INTENSITY AND SERUM LIPIDS IN OLDER ADULTS

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To evaluate the effect of moderate (MOD) and high intensity (HI) aerobic exercise training on serum lipids and lipoproteins in older adults, 22 men and 28 women, age=65±4 yr, were initially assigned to walking exercise (WE; n=39) and control (C; n=11) groups. After 13 wks of WE at 50-65% of HRmax reserve (HRR) for 30-40 min, 3X/wk, aerobic power ($\dot{V}O_2max$) increased by 9% and serum concentrations of total cholesterol (TC), high density lipoprotein cholesterol (HDL-C), low density lipoprotein cholesterol (LDL-C) and triglycerides (TG) decreased ($p\leq0.01$) (see table). At 14 wks the WE group was randomized to MOD (n=22) and HI (n=17) groups for 13 more weeks of WE. MOD trained at 60-70% HRR for 45 min and increased $\dot{V}O_2max$ by 17%. HI trained at 75-85% HRR for 35 min and had a greater ($p\leq0.05$) increase in $\dot{V}O_2max$ (24%) than MOD. TC, HDL-C, LDL-C, TG, and the TC/HDL-C ratio were unchanged in both MOD and HI after 26 wks of WE relative to controls. These data indicate that improvement in $\dot{V}O_2max$ in older adults is related to training intensity. Serum lipids were not altered by aerobic exercise training but may have been influenced at 13 and 26 wks by seasonal variation.

		TC[a]	HDL-C[a]	LDL-C[a]	TC/HDL-C	TG[a]
WE	PRE	217	51	137	4.6	146
	13 wks	190*	42*	127*	4.8	108*
	26 wks[b]	226	48	151†	5.0	133
C	PRE	206	50	134	4.4	098
	26 wks	223	49	155†	4.8	100

[a] values are mg/dl; [b] MOD + HI (n=39); * 13 wks < PRE, $p\leq0.01$; † 26 wks > PRE, $p\leq0.05$

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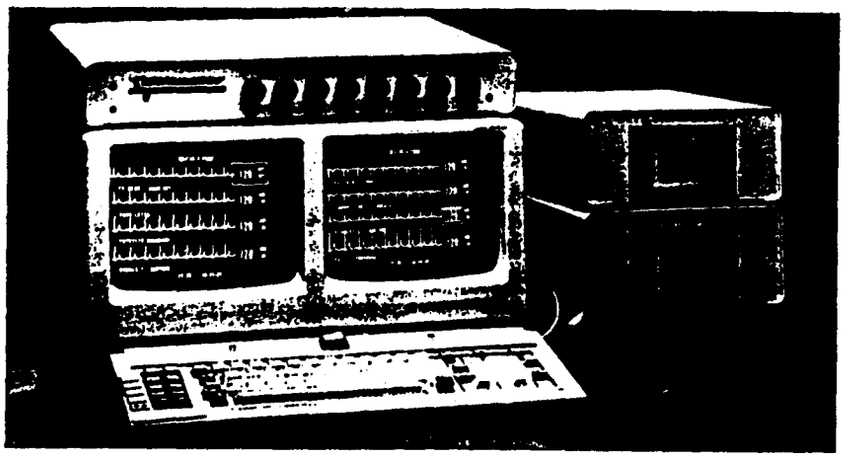

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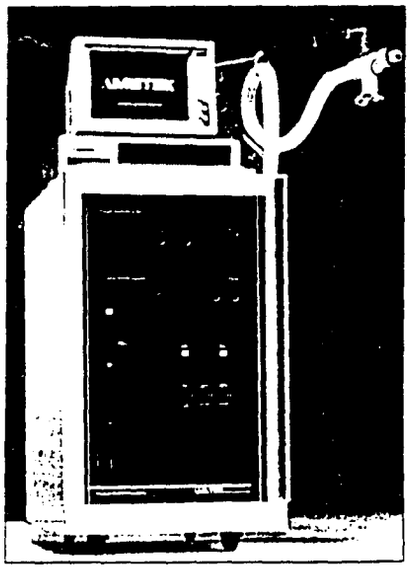

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AEROBIC METABOLIC DEMANDS OF THE FIREFIGHTER INSTRUCTOR

E.L. Glickman-Weiss, B.S. Cohen, C. M. Hearon, P. Bologna, G. Thompson and M. Hegsted, Louisiana State University, Baton Rouge, LA

It has been hypothesized that the morbidity and mortality experienced among firefighters is due to their poor aerobic capacity and sedentary lifestyle. Therefore, the present investigation was designed to determine: 1.) VO_2 max; and 2.) the metabolic, perceptual and hemodynamic responses of firefighter instructors while walking on a motor driven treadmill with (T1) and without (T2) firefighter gear. Eight male firefighter instructors ($\bar{X}$ age = 34.67 ± 3.46 yrs) served as subjects for the present investigation. Data collected during 1.) maximal stress test (without gear), and, 2.) while subjects were walking on the treadmill at 2.4 miles/hr with and without gear is reported as follows:

	VO_2 (ml/kg/min)	RPE	HR (beats/min)
MAX TEST	37.64±4.70	17.14±1.55	184±11.00
T1	17.21±2.19*	10.57±1.40*	126±11.00*
T2	11.51±1.09*	7.29±0.70*	99.00±5.00*

*$p < 0.01$ between T1 and T2

Paired T-tests revealed statistical differences between the 2 treatments (with and without gear) for VO_2, RPE, & HR. From the data reported it may be determined that subjects were working at 44.5% of VO_2 max while walking with gear, and 29.74% of VO_2 max without gear. The results of the present investigation suggest that the firefighter instructor has a low aerobic capacity, and a significantly higher metabolic cost when wearing firefighter gear. This may suggest that the low aerobic capacity of the firefighter instructor and the high work intensity may compromise the performance of the individual.

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RELATION OF ANAEROBIC CAPACITY AND ANAEROBIC ENERGY UTILIZED TO ONE-MILE RUN/WALK IN COLLEGE MEN AND WOMEN

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The one-mile run/walk (MRW) field test is utilized to estimate maximal aerobic power ($\dot{V}O_{2max}$) in fitness test batteries for youth and young adults. Variability in anaerobic capacity and anaerobic energy utilized during the test could potentially affect the validity of the MRW test. The aims of this study were: (a) to determine the percentage of energy supplied through anaerobic processes during performance of a simulated MRW on the treadmill (%AN) and (b) to determine the relation of anaerobic capacity and %AN to MRW performance in college men and women. MRW time, $\dot{V}O_{2max}$, anaerobic capacity (maximal oxygen deficit -MOD), and %AN were measured in 32 men and 30 women 18 to 25 years of age. %AN was estimated from the oxygen uptake and deficit measured during a MRW on the treadmill at the average MRW speed. Means (±SD) for MRW time (6.35 ± 0.78 and 8.25 ± 1.09 min), $\dot{V}O_{2max}$ (56.3 ± 6.3 and 44.2 ± 5.5 ml·kg BW^{-1}·min^{-1}), and MOD (45.1 ± 10.6 and 38.8 ± 8.4 ml·kg BW^{-1}·min^{-1}) were significantly higher ($p < .05$) in men than women, but there was no gender difference in means for %AN (9.5 ± 2.0 and 8.3 ± 2.5). Correlations for men and women of MRW time with MOD (.15 and -.05) and %AN (.12 and -.03) were low and not statistically significant, whereas the correlations between MRW time and $\dot{V}O_{2max}$ (-.81 and -.75) were significant and moderately strong. We conclude: (a) that anaerobic processes account for a relatively small amount of energy used during the MRW and (b) that variability in anaerobic capacity and %AN have no systematic effect on MRW performance in college men and women.

Supported by a grant from the American Heart Association, Georgia Affiliate

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OXYGEN PULSE AS A PREDICTOR OF STROKE VOLUME DURING SUBMAXIMAL TREADMILL EXERCISE

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The purpose of this study was to determine whether oxygen pulse (O_2 pulse, ml/beat) could be used to predict stroke volume (SV) during submaximal treadmill exercise. Fifteen male subjects (mean age - 23.6±2.9 yr, height - 181.5±5.9 cm, weight - 82.2±11.5 kg) completed a 10 min exercise bout at approximately 50% of their VO_2 max to determine their cardiac output (Q) by the carbon dioxide rebreathing (equilibrium) method. Stroke volume was calculated as the ratio between Q and the submaximal exercise heart rate. The results of the regression analysis between SV and O_2 pulse during exercise are summarized below:

Group	r	r^2	SEE	Regression equation
N = 15	.90	.81	1.03	SV = 7.4 x O_2 pulse + 3.7

The correlation observed was significant ($p<.0001$). The results suggest (1) that there is a strong relationship between SV and submaximal O_2 pulse during treadmill exercise (i.e., O_2 pulse was indicative of the subjects' exercise SV), and (2) that 81% of the variance in SV can be predicted by O_2 pulse.

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COMPARISON OF PRE-SESSION MAXIMAL AND THREE-MIN RECOVERY PHYSIOLOGICAL ADAPTATIONS IN BIATHLETES, RUGBY PLAYERS, AND BASKETBALL PLAYERS

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The purpose of this study was to compare the pre-session maximal and three-min recovery physiological adaptations in biathletes (BA), rugby players (RB), and basketball players (BB). Thirty four male athletes (BA = 10, RB = 11, and BB = 13) volunteered to participate in this study. Each subject was instructed to run on the treadmill until exhaustion using Bruce Protocol. Each subjects was then told to remain walking for three additional minutes on the treadmill immediately following maximal exercise. Both maximal and three-min recovery values of oxygen uptake (VO_2), heart rate (HR), oxygen pulse (O_2 pulse), ventilatory efficiency of oxygen uptake (VE_{O_2}) and carbon dioxide produced (VE_{CO_2}) were measured. Statistical significant differences were found (one way ANOVA followed by Scheffe') in maximal VO_2 between BA (72.49 $ml \cdot kg^{-1} \cdot min^{-1}$), RB (55.25 $ml \cdot kg^{-1} \cdot min^{-1}$), and BB (56.43 $ml \cdot kg^{-1} \cdot min^{-1}$); and in 3-min recovery of HR between BA (118 $bts \cdot min^{-1}$) and BB (137 $bts \cdot min^{-1}$), and O_2 pulse between RB ($bts \cdot L^{-1}$) and BB ($bts \cdot L^{-1}$). Results suggest that maximal VO_2, and HR and O_2 pulse during recovery might serve as good indicators for the conditioning status during pre-session in BA, RB, and BB.

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A COMPARISON OF FORMULAS TO DETERMINE MEAN SKIN TEMPERATURE DURING PROLONGED COLD WATER IMMERSION

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Mean skin temperature (Tsk) reflects the application of a differential weighing scale to skin temperature measurements taken at one or more skin sites. It remains unknown as to how the resulting derived Tsk varies when measurements are taken across variable numbers of skin sites. Comparisons were made between equations employing 5, 4, 3 or 1 anatomical site (AS). Twenty-one subjects were immersed in water at 18, 22 or 26°C for 120 min. Skin temperature data was collected at 30 min intervals and employed in the computation of the Tsk based on the formula of Toner (1986, 5 AS), as compared to that of Ramanathan (1964, 4 AS) Burton (1934, 3 AS), and Goss (1989, 1 AS). Analysis involved the calculation of agreement frequencies, (expressed as a percentage) via computation of the number of temperatures in agreement per total number of temperatures. The following are the agreement frequencies as determined within 0.2, 0.5 and 1.0°C:

Equation	% Agreement Within 0.0 -0.2°C	% Agreement Within 0.21-0.50°C	% Agreement Within 0.51-1.0°C	% Agreement > 1.0°C
Ramanathan	100.0			
Burton	98.6	1.40		
Goss		15.52	17.88	66.60

The results of the present investigation reveal that the equation that was in best agreement with Toner (5 AS) was Ramanathan (4 AS) and the equation in least agreement was Goss (1 AS). Therefore, it appears necessary to employ multiple sites to best determine total body surface temperature.

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AGREEMENT BETWEEN LARGE (15 x 33 CM) AND SMALL (12 x 23 CM) CUFFS IN BLOOD PRESSURE MEASUREMENT

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Recent research has supported the routine use of large blood pressure (BP) cuffs (15 x 33 cm) (LC) as opposed to the most commonly used 12 x 23 cm cuff (SC). The reason for this is the standard cuff fails to adequately encircle the average mid-upper arm in the U. S. adult population. However, agreement between LC and SC has not been examined. Therefore, the purpose of the present study was to determine the agreement and difference between BP measurements by LC and SC and to support the hypothesis that correlation coefficients do not accurately reflect agreement between clinical instruments. Eighty-five male and female subjects, clustered to represent the U.S. hypertensive population were tested. Two observers were used and 3 measurements were made by each observer for each cuff. Correlation (Pearson) between SC systolic BP (SBP) and LC SBP was significant ($r=.97$, $p<.0001$). However, graphical analysis of agreement (equality plot) suggested questionable agreement between SC SBP and LC SBP which was supported by a paired t-test where SC SBP yielded significantly higher values (124.39±1.81 mm Hg) than LC SBP (119.64±1.76 mm Hg)($p<.0001$). The limits of agreement (LA) for SC SBP with LC SBP were determined as -12.49 to 3.01 mm Hg which is not acceptable for clinical purposes. Even with a 95% confidence interval, the most optimistic interpretation of SC SBP LA is -11.05 to 1.56 mm Hg which is still not acceptable according to published standards (±5 mm Hg). The SC diastolic BP (DBP) also correlated highly with LC DBP ($r=.94, p<.0001$) but the equality plot again suggested lack of agreement. This was again supported by the fact that SC DBP (75.09±1.04 mm Hg) was significantly greater than LC DBP (71.80±.99 mm Hg)($p<.0001$). The LA for SC DBP with LC DBP were -9.86 to 3.29 mm Hg with the narrow end of the 95% confidence interval being -8.63 to 2.06 mm Hg, neither of which are acceptable for clinical measurement of BP. These data illustrate the lack of agreement between SC and LC for BP measurement. If in fact the LC provides more accurate BP values, as research suggests, SC should not be used due to this lack of agreement. The present study also supports the inaccuracy of correlation coefficients as indicators of agreement between clinical instruments.

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THE VALIDITY OF A HEART WATCH MONITOR FOR MEASURING HEART RATE AT VARYING WALKING VELOCITIES

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The purpose of the present study was to examine the validity of a Heart Watch monitor (Uniq Model 8799, Polar Electro Oy, Kempele, Finland) for measuring the heart rate response to walking. Seven women and 3 men (age = 26.5 ± 5.6 yrs; ht = 171.6 ± 8.5 cm; wt = 71.8 ± 12.5 kg) participated in the present study. All subjects completed 4 incremental exercise bouts at 0 % grade (40 m/min, 67 m/min, 94 m/min and 120 m/min), each 5 min in duration, on a Quinton Q65 treadmill. Criterion heart rates were measured electocardiographically (Quinton Q 3000). Heart rate response was monitored concurrently using the Heart Watch monitor. Results are presented in the Table below:

Velocity	Criterion HR X	(SD)	Heart Watch HR X	(SD)	r	SE
40 m/min	95.1	(13.7)	93.7	(12.8)	0.99	2.0
67 m/min	99.6	(10.7)	100.2	(11.0)	0.99	1.6
94 m/min	111.1	(12.7)	110.5	(12.7)	0.99	1.5
120 m/min	138.2	(21.0)	136.7	(21.9)	0.99	2.0

No significant mean differences were observed at any velocity. The present data suggest that the Heart Watch monitor is a valid device for measuring the heart rate response to walking at velocities ranging from 40 to 120 m/min. These results have application for heart rate monitoring with exercise prescriptions which involve walking.

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THE RELATIONSHIP OF HEART RATE RESPONSE AND SELF-REGULATED HEART RATE RESPONSE DURING REST: A PRELIMINARY STUDY

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Self-synchronized cardiorespiratory regulation (SSCR), a mental training technique which uses the subject's respiratory frequency (F_b) to cue a particular heart rate (HR) response, was investigated to determine the relationship between the recorded HR response and the predicted self-regulated HR response (PSRHRR) during rest. Eighteen college-male (25.56 + 4.67 yrs) students participated in a 30-min group instructional session for twelve alternate days before testing of the treatment effect. The sum total of self-synchronized HR response (TSSHRR) per inhalation and exhalation were recorded before the testing session. Subjects were told to elicit the SSCR procedure during the testing session. Heart rate and F_b were recorded. The predicted self-regulated HR response (PSRHRR) was determined by the product of the recorded F_b and TSSHRR. Recorded HR response and the PSRHRR were highly correlated ($r = .94$; $p < .0001$). This positive relationship suggests that the self-regulated HR response is a voluntary synchronization. However, the actual mechanism that leads to the synchronization is not presently known.

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VALIDATION OF ESTIMATED ENERGY EXPENDITURE WHILE RUNNING WITH THE BODY WATCH. Q. He, S.P. Brown, S. Liu, H. Li and Q. Wu. Center for Health and Human Performance. The University of Mississippi, University, MS 38677

To assess the ability of the Body Watch (Precise International, Orangeburg, NY) device to estimate energy expenditure during running five male (79.7 ± 18.0 kg, 176.8 ± 6.9 cm, 23.2 ± 2.3 yr) and six female (63.4 ± 11.6 kg, 170.0 ± 7.5 cm, 21.8 ± 2.3 yr) subjects each wore the same device during two treadmill running sessions while oxygen consumption was simultaneously measured by standard open circuit spirometry. Running speeds were 6.6 and 10.6 Km/h. Before each session the Body Watch was programmed with subjects' age, sex, weight, stride length and anticipated running pace. Stride length at each speed was determined on an indoor track. After each 5.25 minute run the digital total accumulated calories displayed was recorded. Steady state $\dot{V}O_2$ (l/min) during the final minute of each 5.25 minute run was converted to a calorie equivalent using nonprotein R. The Body Watch significantly underestimated 5.25 min. energy expenditure by 39% at 6.6 Km/h and by 27% at 10.6 Km/h. By using the simple linear prediction model: Y = 18.76 + 0.96 (x) where x is the digital caloric display, the body watch may be able to more accurately estimate caloric expenditure in individual runners.

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THE RELATIONSHIP BETWEEN PHYSICAL FITNESS, AGE AND ATTENTIONAL CAPACITY

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The purpose of this study was to investigate the relationship(s) between physical fitness, cognitive performance and age. Previous evidence suggests that physical fitness may alter the rate of age-related declines in cognitive performance, however, this effect does not seem to be consistent upon all cognitive tasks. It was hypothesized that a model of cognition based on declines in attentional capacity with advancing age would serve as a useful framework for this investigation. Within this framework, high-fit elderly individuals are assumed to experience less profound declines in processing resources and, therefore, should perform better on tasks of attentional capacity. Sixty volunteers, ranging in age from 18-90 years participated in the study. Physical fitness was assessed using an incremetal exercise stress protocol modified for the use with elderly subjects. A modified Stroop paradigm was used to evaluate cognitive performance, consisting of four different tasks with increasing degrees of cognitive effort. Pearson Product Moment Correlations were utilized to evaluate (1) the relation between age and cognitive variables and (2) between physical fitness and cognitive variables. Results revealed significant correlations ($p<.001$) between age and all cognitive variables, with the magnitude of the correlation increasing as the attentional demand of the tasks increased. Correlations between physical fitness and cognitive variables revealed significant ($p<.05$) correlations for two of the four variables. Correlation coefficients indicated that as fitness increased, response time decreased. The magnitude of the correlations increased as the attentional demand of the task increased. These results support the hypothesis that the effect of fitness is magnified in mentally effortful tasks.

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BODY COMPOSITION ASSESSMENT IN COMPETITIVE COLLEGE FOOTBALL PLAYERS: ESTIMATIONS OF BODY SIZE AND PREDICTIONS FOR TOTAL BODY WEIGHT.

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The assessment of body composition and body size for athletes can be used as both a predictor for success at a specific position within a sport and for estimation of energy requirements. Although several researchers have assessed the body composition of football players, no specific position norms have been established to this date. Average caloric expenditures have been reported for college football players, but these have not been correlated with body composition. This study seeks to improve the current understanding of which combinations of anthropometric measurements (body widths, circumferences, or skinfolds) best predict body size (weight/height) for college football players. Mean anthropometric data collected from 185 college football players are compared to U.S.A. norms for males, ages 18-24 years, for both medium and large frame sizes, provided through the National Health and Examination Survey II 1976-1980, and found significant differences at the ($p \leq 0.001$) level for height, weight, triceps skinfold, subscapular skinfold, mid-arm circumference, bitrochanteric width, elbow breadth, and body fat percentage. Position categories within the football team are established based on significant differences between height/weight ratio. Four groupings resulted from smallest size to largest: receivers and specialty team; defensive backs, offensive backs, and quarterbacks; linebackers and tight ends; offensive and defensive lineman. Regression equations for predicting total weight and weight/height ratio by football team position have also been predicted of which, buttocks circumference measurements were the strongest determinant for total body weight. This research demonstrates that when an athletic population is separated by differences in body composition, the resulting groups may be significantly different from the "normal" population. Therefore, energy expenditure predictions, which are in part based on these physiological parameters, will result in increased levels of energy needs for those athletes who have increased levels of muscular weight as compared to those measured in the "normal" U.S.A. population.

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PHYSIOLOGIC VALIDATION OF STAIROBIC STEPPING

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The purpose of this study was to document the oxygen cost of stairobic stepping and to calculate a regression equation to be used to estimate actual mets (AM) in a multiple regression model. Forty-eight observations of the metabolic cost during a wide range of stepping frequencies were made on a heterogeneous sample of eight men and four women whose $\bar{X} \pm$ SD age, HT and WT were (24.1 $\pm$ 3.6 and 20.8 $\pm$ 1.5 Yr; 179.1 $\pm$ 6.8 and 167.6 $\pm$ 6.8 cm; 83.1 $\pm$ 16.7 and 58.6 $\pm$ 6.6 Kg, respectively). Oxygen consumption was measured by standard open circuit spirometry techniques. Stairobic stepping at 0.21m and speeds of 40, 60, 80 and 100 bilateral st/min was performed for five continuous minutes on four different days. The following table shows mean $\pm$ SD values for AM and stairobic mets (SM):

Speed (sd)	AM	SM
40	3.3 $\pm$ 0.40	5.0 $\pm$ 0.0 *
60	4.3 $\pm$ 0.66	5.7 $\pm$ 0.64 *
80	5.6 $\pm$ 1.0	5.9 $\pm$ 0.50
100	8.2 $\pm$ 1.5	7.1 $\pm$ 0.28 *

The SM response was significantly different from the AM response at three stepping speeds ($P < 0.05$). The multiple regression equation calculated for AM was:

AM = -0.567 -0.012 (WT) + 0.063 (sd) + 0.612 (SM) with an adjusted R^2 of 0.82 and a SEE of 0.899.

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A COMPARISON OF UPPER BODY ANAEROBIC POWER OUTPUTS IN YOUNG FEMALE SWIMMERS AND GYMNASTS

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Upper body strength and the concomitant ability to generate power is extremely important in both swimming and gymnastic exercises. This investigation examined anaerobic power ouptuts which were evident when comparing a random sample of age-group swimmers to a matched group of gymnasts. Twelve girls, 6 swimmers (age = 9.7 ± 1.7 yr, ht = 137 ± 9 cm, wt = 32 ± 9 kg) and 6 gymnasts (age = 9.5 ± 1.4 yr, ht = 133 ± 8 cm, wt = 30 ± 4 kg) participated. Average power generated over 30 sec, and peak power generated over any 5 sec period were measured using a modified Wingate anaerobic power test. An arm-crank ergometer was set at 0.05 kg resistance per kg of subject's body weight. The average power and peak power scores ($\bar{x}$ ± SD) are indicated in the table below.

	AVG POWER ($kg \cdot m \cdot min^{-1}$)	PEAK POWER ($kg \cdot m \cdot min^{-1}$)
SWIMMERS	306.8 ± 58.9	374.9 ± 81.4
GYMNASTS	360.1 ± 261.3	448.9 ± 328.2

Statistical analysis revealed no significant differences between the groups in any of the measures. There was, however, a drastic difference in the range of scores between the groups (as evidenced by the large SDs in the gymnast group). More relative variation in the ability to demonstrate power outputs on the arm-crank ergometer was evident in the gymnasts. As these were volunteer subjects, this may be related to the type of youngster who chooses to swim versus participate in gymnastics.

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RELATIONSHIP BETWEEN THE JHAC SCALE AND BLOOD PRESSURE

Hewitt, M., Berry, C., Huntley, L. and Heartley, S. Wellness Laboratory, Winston-Salem State University, Winston-Salem, NC 27110

The purpose of this investigation was to examine the relationship between the John Henryism Active Coping Scale (JHAC) score and blood pressure (BP) in a group of male (31) and female (72) African American employees at a state university. The 12 item Likert type scale was developed by Sherman James to measure a strong personality predisposition to cope actively with psychosocial stressors and has been used to look at the association between socio-economic status and hypertension. Subjects had a mean age of 42±12.2 years, median family income was $30,000 - $39,000 and median education was at the level of some college completed. Data analysis showed no relationship between the JHAC and either systolic blood pressure (SBP) (r=0.24) or diastolic blood pressure (DBP) (r=0.05). For those 25 subjects with elevated BP (either SBP>140 or DBP>90) no relationship was seen between JHAC and SBP (r=0.07) or DBP (r=0.01). The data were separated into gender groups and were dichotomized at the median score (22) into high (H) and (L) JHAC groups. No difference was found (p>0.05) between SBP, DBP, age, percent bodyfat, or education in the H or L JHAC groups in either men or women. Results indicate that the JHAC scale is not related to BP in this group of subjects. However, the median score for the subjects was relatively low possibly suggesting a homogeneous group. Also, subjects were better educated and had a higher income than groups where a strong relationship has been shown between JHAC and blood pressure.

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EFFECT OF HYDRAULIC RESISTANCE TRAINING ON CHILDREN

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This study examined the effects of a hydraulic resistance training program on field tests for muscular strength and endurance (grip, pull-ups, sit-ups), isokinetic strength at the knee (flexion and extension at 60 and 180 deg/s, and motor performance (vertical jump, broad jump, shuttle run, 50 yd dash). The subjects were 20 males and 2 females ($\bar{x}$ age = 12.3 $\pm$ 1.0 yrs; $\bar{x}$ height = 156.2 $\pm$ 9.0 cm; $\bar{x}$ weight = 50.3 $\pm$ 11.9 kg) who trained 45 min/day, 3 days/wk, for 9 wks using a 12 station circuit in which 8 stations utilized hydraulic resistance equipment. The circuit consisted of 20s of exercise at each of the 12 stations with 40s rest between. Subjects performed as many reps as possible during the 20s time period and when 20 or more reps could be completed at a given resistance setting, the setting was increased by one for that station. Three circuits were completed in each training session. The subjects were tested before and after training on each of the variables previously presented. The data were analyzed using a repeated measures multivariate analysis of variance with appropriate follow-up tests. Significant improvement was found the grip strength (+10.5%), pull-ups (+50%), and sit-ups (+20%). Peak torque was significantly increased for flexion and extension for both legs, for the 180 deg/s speed. At 60 deg/s, improvement occurred only for extension on the left side. 50 yd dash improved significantly (+4.8%) but no change occurred for the other motor performance variables. These findings support other work with children in terms of the strength increases with concentric training but add to the mixed results with regard to the effect on motor performance.

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Performance Profiles of a State Championship High School Football Team

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The purpose of this investigation was to evaluate the performance and physiological characteristics of a group of highly successful high school football players. The team won the state high school football championship for the 6-A level of competition (the highest level of competition). For descriptive purposes the players were divided into two groups: backs (N = 8) and linemen (N = 10). Only the starters were evaluated. Maximal aerobic power was determined from a maximal treadmill test and body composition was evaluated by hydrostatic weighing. Maximal strength values were evaluated by a one rep max bench press and squat test, and the sit and reach was used to measure flexibility. Speed and power were evaluated by a 40 yd dash test and a vertical jump test. Results of this investigation found the following mean respective values for backs and linemen: VO_2 Max = 53.9 ± 5.8 vs 49.4 ± 7.2 ml · kg^{-1} · min^{-1}; vertical jump = 61.0 ± 12.1 vs 53.6 ± 5.3 cm; bench press = 109 ± 18 vs 130 ± 28 kg; squats = 154 ± 33 vs 190 ± 32 kg; 40 yd dash = 4.8 ± 0.2 vs 5.3 ± 0.3 sec; flexibility = 32 ± 8 vs 31 ± 8 cm; age 16.1 ± 0.6 vs 16.3 0.9 yrs; height = 180.1 ± 5.3 vs 180.9 ± 2.5 cm; weight = 80.5 ± 7.6 vs 96.0 ± 4.6 kg; and percent fat = 10.2 ± 3.7 vs 15.1 ± 4.6 %. Compared to values reported for college and professional players, as the level of competition increases so does the height, weight, and fat free weight of the players. Percent body fat and VO_2 Max values evaluated in the present study were similar to reported values for college and professional players.

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PREVALENCE OF ELEVATED CHOLESTEROL IN A GROUP OF AFRICAN AMERICAN SUBJECTS

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Cholesterol (CHOL), HDL cholesterol (HDLC), dietary intake and exercise (EX) have been examined in a study of the prevalence of risk factors for cardiovascular disease in a group (n=98) of African American employees of a state university. Serum lipids were obtained by venopuncture and analyzed using a Kodak DT-60. Dietary information was obtained through a self-administered survey which had been validated in African Americans. Exercisers and non-exercisers were determined by self-report. Mean values for the group of 75 women and 23 men for variables of interest were: total calories per day (1668±830); percent of calories from carbohydrates (43±8), protein (15±3), fat (38±9); serum CHOL (187±43); serum HDLC (52±13); CHOL/HDLC (3.8±1.4). Thirty three percent of the subjects reported being engaged in a regular exercise program. Prevalence of CHOL > 200 was 31% and of CHOL/HDL > 5 was 9%. There was some association (r=.7) between those who reported exercising and HDLC levels above the median in both men and women. There was no relationship between CHOL and any of the dietary factors. These findings seem inconsistent with the higher incidence of cardiovascular disease in African Americans but are similar to data reported in the Evans County Cardiovascular Epidemiologic Study.

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EFFECTS OF TAPER PHASE TRAINING ON POWER OUTPUTS AND SWIMMING PERFORMANCE IN CHILDREN: A PRELIMINARY STUDY

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The taper phase of training is a critical component of competitive swimming. It is essential to increase power output and to lower competition swim times. The purpose of this study was to determine if a particular taper training protocol could increase average power (avg. power) and peak power (p. power) along with producing a significant decrease in 100 meter individual medley (I.M.) times. Fourteen (14) year-round age-group swimmers (mean age 9 ± 1.9 years) and five (5) control subjects (mean age 9 ± .08 years) volunteered to participate. The taper training protocol consisted of low yardage, high speed activities. Power outputs were obtained through the use of a modified Wingate arm crank test, with testing occurring before taper training and after the state swim meet. Control participants participated in the anaerobic testing before and after the two week period. Significant differences between pre-taper and post-taper are revealed below.

*significant at p <.05	Treatment Avg. Power ($kpm \cdot min^{-1}$)	Treatment P. Power ($kpm \cdot min^{-1}$)	Treatment I.M. Times (sec)	Control Avg. Power ($kpm \cdot min^{-1}$)	Control P.Power ($kpm \cdot min^{-1}$)
Pre-Test	350.8 ± 184.2	516.8 ± 348.7	97.0 ± 16.8	298.4 ± 64.3	378.9 ± 130.2
Post-Test	415.8 ± 188.1*	573.4 ± 375.4*	93.1 ± 17.8*	300.1 ± 63.2	377.6 ± 128.7

As a result of Student's T-test analysis, the treatment group showed an increase in avg. power, p. power and a decease in I.M. times. The control group demonstrated no differences between pre and post test measurements. This study indicates that the taper phase appears to be a valuable asset in training this group of swimmers.

RELATIONSHIPS BETWEEN RESTING BLOOD PRESSURE, TREADMILL TIME, AND BODY COMPOSITION IN HEALTHY MEN 71

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High blood pressure (BP), inactivity, and obesity are primary risk factors for coronary heart disease (CHD). In 1362 normotensive men (age range 18 to 77 y), the relationships between resting BP and Balke treadmill time (TT), percent fat (%F, densitometry), fat mass (FM), body mass index (BMI), and waist-to-hip ratio (WHR) were examined. Mean (±SD) values were for systolic BP = 123.8 (±12.6) mm Hg, diastolic BP = 80.7 (±9.6) mm Hg, TT = 18.3 (±4.63) min, %F = 23.0 (±6.60) %, FM = 19.9 (±8.3) kg, BMI = 26.5 (±3.70) kg/m^2, and WHR = 0.997 (±0.048). The table shows the Pearson product moment correlation coefficients:

	TT	%F	FM	BMI	WHR
SBP	-.138	.146	.185	.216	.090
DBP	-.210	.222	.273	.308	.155

All values significant at $p < .001$ (N = 1362)

Compared to systolic BP, the r values suggest a tendency for diastolic BP to be more closely related to absolute (FM), relative (%F), fat distribution (WHR) and exercise time. Thus, DBP may be a more important covariant in CHD risk assessment than SBP.

CHANGES IN PHYSICAL FITNESS SCORES OF POLICE OFFICERS OVER THE FIRST THREE YEARS OF EMPLOYMENT 72

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The purpose of this case study was to investigate the changes in police officer physical fitness scores over a three year period beginning with recruit training. The sample was 112 male and 32 female recruits of a large metropolitan police department. Recruit training included 12 to 14 weeks of supervised physical fitness training. No on-duty time was provided for fitness training after the initial recruit training. Annual fitness test results were factors in the promotion and evaluation of the officers. After three years of employment, flexibility, strength, and muscular endurance scores remained significantly higher ($p \leq .05$) than recruit entry scores. Cardiovascular endurance (1.5 mile run) returned to entry levels within one year. Body fat had exceeded the entry level percentages by the end of the third year. Unsupervised fitness programs may help to maintain flexibility, strength, and muscular endurance capacity, but may not have as much effect on maintaining cardiovascular endurance and body fat percent.

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EFFECTS OF MASSAGE ON PHYSIOLOGICAL FUNCTIONS DURING RECOVERY FROM MAXIMAL EXERCISE

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Thirty men were randomly assigned to a Treatment Group (mean age=24±6 yrs) and a Control Group (mean age=21±3 yrs). Each group was then exercised to maximum on the treadmill (maxTM), followed by 10 minutes of rest with either massage of the lower limbs (TG) or no massage (CG). Independent (two-tailed) t-tests were used to determine if significant ($p<0.05$) physiological differences existed between the two groups during recovery. The results indicated no significant differences in oxygen uptake (TG=601±147 vs CG=563±110 ml/min), heart rate (TG=105±8 vs CG=110±13 beats/min), stroke volume (TG=84±24 vs CG=80±26), cardiac output (TG=8.6±2.4 vs CG=8.64±2.2 L/min), arteriovenous oxygen difference (TG=7.2±.2 vs CG=6.71±1.5 ml/100 ml), double product (TG=154 vs CG=150), and systemic vascular resistance (TG=13±4 vs CG=11±3 mmHg/L/min). The sports massage was ineffective in facilitating physiological recovery following the maxTM bout.

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CHANGES IN PLASMA CREATINE KINASE AND CK-MB WITH INCREASED AND DECREASED TRAINING IN ENDURANCE RUNNERS.

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To examine the effects of increased and decreased training on plasma creatine kinase (CK) and CK-MB in competitive male runners (age 30 $\pm$ 5.7 yrs, VO_2max 65.5 $\pm$ 3.8 $ml \cdot kg^{-1} \cdot min^{-1}$). Subjects were randomly assigned to either an increased (INC, n=7), decreased (DEC, n=5), or control group (CON, n=5). Training intensity and distance was increased or decreased by 20%. A control group (CON, n=5) did not change their normal heavy training during the 3 week experimental period. CK and CK-MB were measured under resting conditions on several occasions prior to (3 wk baseline period) and during the 3 wk experimental period. Also, CK was measured before and after a maximal treadmill test and 30 min run at 80% VO_2max prior to and following the experimental period. Results indicated that resting plasma CK was slightly above established norms in all groups during the baseline period. CK was slightly, but significantly, increased (approximately 20%) in all groups 4 days following the preliminary maximal exercise tests. CK was significantly higher during the experimental period in CON and INC compared to DEC. In contrast, CK-MB was within normal ranges in all groups at all times measured. However, the percent total CK made up of the MB fraction (CK-MB%) was above normal ranges at all measurement points in all groups. These data indicate that competitive runners have slightly higher resting CK values during normal heavy training than normals and that decreased training may be associated with lower CK values. The role of CK-MB% remains to be elucidated.

Supported by a grant from the United States Olympic Committee

EFFECTS OF CROSS INTERVAL TRAINING ON CARDIOVASCULAR FITNESS IN MIDDLE-AGED FEMALES

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Cross training has become a popular method of exercise training within the past few years. This training involves the use of several different modes of activity in 1 exercise session. Prior research has shown that it is an effective method for improving fitness in young, healthy adults; however the use of cross training for older adults is not as well documented. The purpose of this study was to determine the effects of 12-weeks of cross-interval training on cardiovascular fitness and body composition of middle aged females. Fifteen females, ($\bar{X}$ = 46.7 yrs.), participated in the training and 10 age matched subjects served as controls. VO_2 and max heart rate were determined during a treadmill test and body composition was assessed by anthropometry. Training included 3 weekly 32-minute training sessions which consisted of 5, 3-minute work intervals followed by equal periods of lower intensity work. During each session the subjects used at least 3 pieces of equipment including bicycles, treadmills, rowers and stair climbers. The results showed an 8% increase in VO_2 as well as a 5% reduction in % body fat. It was concluded that cross training is an effective method for improving cardiovascular fitness in middle-aged females.

Supported by a research grant UT-Chattanooga.

RESPONSE OF THE GLUCONEOGENIC ENZYME ALANINE AMINOTRANSFERASE TO INDUCED HYPOGLYCEMIA DURING PROLONGED EXERCISE

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Serum alanine aminotransferase (ALT) was observed in healthy males aged 18 to 25 years during the course of a one-hour (1-h) bout of cycle ergometry at 75% of maximal heart rate. The subjects were given a carbohydrate supplement solution to maintain blood glucose levels during the first session, and a placebo to induce hypoglycemia during the second session. The data demonstrated a significant ($p<0.05$) increase in ALT during the placebo session, and no increase during the carbohydrate supplemented session. Creatine kinase (CK) was also observed during the course of the two sessions and demonstrated significant increases ($p<0.05$) in each. Blood glucose levels increased significantly ($p<0.05$) during the treatment session, and decreased during the placebo session. These data demonstrate that induced hypoglycemia may have an effect on serum ALT activity levels during long-term cycle ergometry, possibly due to increased utilization of plasma amino acids for maintainance of blood glucose levels.

Alanine Aminotransferase Activity Levels
(means and standard deviations, reported in U/L)

	Rest	Exercise
Control	22.93 ± 31.52	26.13 ± 35.11
Treatment	19.40 ± 31.63	17.60 ± 30.07

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EFFECTS OF THE MENSTRUAL CYCLE ON THE RESTING AND EXERCISE BLOOD GLUCOSE - INSULIN RELATIONSHIP

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Recent studies have shown exercise metabolism varies across the menstrual cycle. The physiological mechanism for this effect is uncertain, but thought to be directly/indirectly due to the cyclical fluctuations in estrogen (E_2) and progestogen (P) hormones. This study examined the effect of E_2 and P on the blood insulin (IN) and glucose (GLU) relationship at rest and during exercise. Nine eumenorrheic women completed experimental trials at the midfollicular (MF; low E_2 and P) and midluteal (ML; high E_2 and P) phases of their menstrual cycle. Trials consisted of consuming an oral glucose load (OGL; 1 g/kg body weight), waiting 45 min, then exercising for 60 min at ~70% VO_{2max}. GLU was assessed at 15 min intervals throughout each trial while IN was measured pre-OGL (-45 min), pre-exercise (0 min), and post-exercise (60 min). The OGL significantly ($p<0.01$) increased GLU and IN, but no difference between the MF and ML trials was noted for GLU. However, the ML IN level (45.6±5.4 mIU/l) was greater than the MF level (38.4±4.6 mIU/l; $p<0.05$) at 0 min. Likewise, the IN/GLU ratio was significantly greater at 0 min in the ML than MF trial (4.49±0.62 vs 3.07±0.68 mIU/l/mM). Exercise resulted in a significant ($p<0.01$) decrease in IN, GLU, and the IN/GLU ratio, but no differences ($p>0.05$) between the MF and ML trials were noted for the responses. These findings suggest that pancreatic sensitivity to GLU varies across the menstrual cycle, but blood GLU homeostasis seems to be maintained at both rest and during exercise. This maintenance of GLU homeostasis may be due to; 1) alterations in the target tissue sensitivity to IN, and/or 2) antagonistic actions of other hormones that vary throughout the menstrual cycle.

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ESTABLISHMENT OF GUIDELINES FOR HEALTH AND PHYSICAL FITNESS STANDARDS FOR THE FLORIDA DIVISION OF FORESTRY FIRE FIGHTERS

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Due to the hazardous, arduous nature of forest fire fighting, the Florida Division of Forestry (FDF) was interested in developing guidelines for health and physical fitness that will help fire fighters (FF) attain and maintain performance without extreme fatigue or injury. The purpose of the study was to aid the FDF in developing these guidelines based on the specific needs of Florida FF. A pilot study of 27 volunteer FF (ages 18-52) was implemented to establish a basis by which a field test would be derived. The FF were a representative sample including all ages except 60 years or greater, and one woman. Comprehensive testing in health and performance categories yielded 107 variables per FF. All data underwent statistical analysis and grouping by correlational techniques, and tested by factor analysis for components best describing the pilot sample of FF. From this five components were identified. Fifteen tests validated to measure these components were administered as field tests to two separate units of FF. The final health and fitness model developed was based on these data of current FDF fire fighters. It is concluded that annual testing of FF with the proposed battery is a cost efficient way for the FDF to evaluate health and fitness and to predict success in the line of duty.

Supported by a grant from Florida Division of Forestry

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EFFECTS OF THE SPORTS MASSAGE INTERSPERSED BETWEEN TWO TREADMILL VO_{2max} TESTS

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Thirty men were randomly assigned to two groups. The Treatment Group (n=15; mean age=24±6 yrs) exercised to maximum on the treadmill (TM), rested for 10 minutes in the supine position while the lower limbs were massaged, followed by a second maximum TM test. The Control Group (n=15; mean age=21±3 yrs) did the same but did not receive the massage. VO_{2max} was defined as the subjects' highest rate of VO_2 measured beyond an RER of 1.0, and the indication that the subjects could not continue due to fatigue. Two-tailed independent t-tests indicated no significant ($p>0.05$) differences between the two groups' second maximum TM test values for VO_{max} [Treatment = 54±12 vs Control = 55.3±12 $ml \cdot kg^{-1} \cdot min^{-1}$], heart rate [Treatment = 189±9 vs Control = 190±19 $beats \cdot min^{-1}$], O_2 pulse [Treatment = 23.9±6 vs Control = 21.9±6], and double product [Treatment = 278±36 vs Control = 277±36]. These data indicate that the 10-minute sports massage interspersed between the two maximum TM tests was ineffective in allowing the subjects in the Treatment Group to physiologically differentiate themselves from the subjects in the Control Group.

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HEALTH RISK APPRAISALS OF UNIVERSITY FACULTY AND STAFF

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Health Risk Appraisals of seventy (N=70) faculty and staff members (men=32, women=38) were completed based on wellness scores determined from Wellsource's Lifestyle Inventory and Fitness Evaluation (LIFE). The wellness score was a composite score based on an individual's health practices, heart health, fitness level, nutritional habits, stress management, safety practices, and wellness attitude. The purpose of this study was to determine whether or not the current lifestyle of these men and women is consistent with a reduced risk of lifestyle-related diseases believed to be associated with these wellness factors. Each subject completed: (1) Wellsource's LIFE Survey Questionnaires; (2) a blood lipid analysis; and (3) a physical fitness evaluation. Wellness factor scores, a composite wellness score, and current and expected longevity ages were calculated using Wellsource's computerized software program. The data was analyzed using the t-test for single samples and the t-test for dependent samples. The significance level was set at 0.05. The results of this study revealed: (1) men had significantly HIGHER scores for the wellness composite score, safety practices, and wellness attitude but significantly LOWER scores for fitness and nutrition when compared to their recommended values; (2) women had significantly HIGHER scores for the wellness composite score, heart health, safety practices, and wellness attitude but significantly LOWER scores for fitness, nutrition, and stress management when compared to their recommended values; and (3) expected longevity ages for men and women were significantly HIGHER than their current longevity ages. Based on these findings, it was concluded that: (1) with the exception of fitness, nutrition, and stress management (women only), the scores for men and women are consistent with their recommended values and (2) men and women could significantly improve their expected longevity (men = 5.1 years, women = 3.6 years) if appropriate changes were made in their lifestyle with respect to an improvement in physical fitness levels, nutritional habits, and stress management techniques.

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EFFECTS OF CARDIAC REHABILITATION ON CHD RISK FACTORS IN POST-MI PATIENTS

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The purpose of this study was to determine the effects of six months of cardiac rehabilitation (CR) on CHD risk factors and to determine the relationship between concurrent changes in CV fitness and CHD risk factors in post-MI patients. Subjects included 53 MI patients (43 men and 10 women) enrolled in the Orange Cardiovascular Foundation and Wake Forest University CR programs from 1979 to 1991. CR included nutrition and CHD risk factor reduction counseling plus supervised aerobic exercise (3 days/week, 30-40 min, at 60 - 80% of symptom-limited HR max). Data were abstracted from patient records and included: 1) anthropometric: body weight in lbs (WT), percent body fat (% fat). 2) blood: total cholesterol (TC), high density - (HDL), and low density lipoprotein cholesterol (LDL) in mg/dl, fasting glucose in mg/dl, resting systolic (SBP) and diastolic blood pressure (DBP) in mmHG, and 3) maximal treadmill exercise data: MET capacity (METs), rate pressure product (RPP), peak heart rate (PHR), ST-depression (ST), and angina (ANG). Comparison of the values before and after 3 and 6 months of CR (change scores) was done using repeated measures ANOVA. Associations between changes in METs and CHD risk factors were tested with partial correlations adjusting for race, gender, and 6 months change in body weight. Results showed a dec in body weight at 3 months (- 4 lbs, $p < .05$), dec in % fat at 6 months (- 2%, $p < .05$), inc in HDL at 6 months (+ 3 mg/dl), and an inc in METs at 3- (+ 1.3 METs, $p < .05$) and 6 months (+ 1.9 METS, $p < .05$). Significant associations were observed for the 3-month change scores between METs and ANG ($r = - 0.38$, $p < .05$) and the 6 month change scores between METs and ST ($r = -0.34$, $p < .05$). There were no significant differences ($p > .05$) in the scores for the remaining variables following 3- and 6-months CR or for other partial correlaton coefficients. In summary, 3 months of CR is sufficient to change body weight and MET capacity and that 6 months of CR is necessary to change % body fat and HDL. It is unknown if the remaining CHD risk factors are modified with a longer duration of CR. The inverse association between the change in MET capacity and ANG and ST depression suggests that CR is effective in improving exercise tolerance in post-MI patients.

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AEROBIC EXERCISE IN OLDER CO-MORBID INDIVIDUALS

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To determine whether individuals with co-morbid (CM) conditions could successfully increase their aerobic capacity, a study of middle to older individuals (60.1 yr, range 52-71 yr) was conducted. Subjects were classified into two groups: (a) 14 subjects with the CM conditions of arthritis of the knee and cardiovascular disease (CVD) and (b) 14 matched controls with only CVD. Subjects were matched on age and CVD status (i.e., ejection fraction, number of diseased vessels, and duration of disease). Both groups participated in a 6 month aerobic fitness program of supervised exercise sessions 3 times per week at an intensity of 50 to 85% of their symptom-limited heart rate reserve (HRR). A 2X3 ANOVA (CM and CVD) X (0, 3 and 6 months) was used to analyze the changes in aerobic capacity (METs) that occurred with training. Results demonstrated that both groups improved their functional capacity with training (CM: 5.96, 6.10, 6.88 METs vs CVD: 7.10, 7.99, 8.02 METs at 0, 3, & 6 mo). There was a trend for the CVD group to make more rapid progress than the CM group. Compliance data showed both CM and CVD groups maintained similar attendance rates at 3 (87.2 and 83.3%, respectively) and 6 (70.6 and 71.1%, respectively) months. In addition, both groups exercised at comparable intensities (CM: 80% HRR vs CVD: 78% HRR) throughout the training program. These results indicate that individuals with CM conditions can participate effectively in a structured aerobic exercise program and can significantly improve their aerobic capacity. However, while final MET gains were comparable (+0.92 METs) in both groups, the initial improvements in the CM group took longer than those seen in subjects with only one disease.

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THE EFFECTS OF CARDIAC REHABILITATION TREATMENT ON SELECTED CORONARY ARTERY DISEASE RISK FACTORS FOLLOWING CABG SURGERY

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The purpose of this study was to determine the effects of cardiac rehabilitation treatment (CR) on selected coronary artery disease (CAD) risk factors in coronary artery bypass graft (CABG) patients. Six men (M age = 63 ± 7 years) and 4 women (M age = 66 ± 6 years) self-selected themselves into treatment (T) and comparison (C) groups at 8 weeks following surgery. The CR group participated in 12 weeks of CR which included information about CAD risk factor reduction, supervised exercise for 3 days a week, and usual care from their physician. The C group received usual care only from their physicians. Subjects were measured at the beginning of the study (pre) and 12 weeks later (post). Measurements included: treadmill maximal MET capacity (METs), Total Cholesterol (TC), HDL-C, and LDL-C in mg·dl-1, TC/HDL-C ratio, three-month leisure time physical activity history in kcal·day-1 (TM-LTPA), and dietary food frequency (D). Analyses were performed using ANCOVA, adjusted for age, gender, and pre-study values. Results showed significant differences ($p < .05$) in post-test scores between the T and C groups for METs, HDL-C, total- and household TM-LTPA. Comparisons between the groups for TC, LDL-C, heavy-, moderate-, and light-intensity TM-LPTA, and D were not statistically different ($p > .05$). These findings suggest that CR, in addition to usual care, is associated with a reduction in selected CAD risk factors compared to usual care treatment alone in CABG patients following surgery.

Support by a grant from the UNC Smith Fund.

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EFFECT OF A PHASE II CARDIAC REHABILITATION PROGRAM ON BLOOD LIPIDS, PHYSIOLOGIC FUNCTION AND CAPACITY OF 50 MALE PATIENTS FOLLOWING A 12 WK (36 SESSION) INTERVENTION.

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The purpose of this investigation was to determine the effect of Phase II cardiac rehabilitation intervention on 50 post coronary artery bypass graft (CABG) surgery or myocardial infarction (MI) patients (mean age, 62 yrs.). Physiologic function (PF) and physiologic capacity (PC) were assessed by determination of double product (HR x SBP = DP x 10^{-2}) and estimated treadmill maximal oxygen consumption ($\dot{V}O_{2max}$), respectfully. Blood lipid and lipoprotein analyses included total cholesterol (TC), high density lipoprotein cholesterol (HDL), low density lipoprotein cholesterol (LDL), and total triglycerides (TRIG). The data (mean ± SD) were analyzed pre- and post-intervention by correlated t tests. Determination of significance was at the $p < 0.05$ level. The results indicate PC significantly increased ($\dot{V}O_{2max}$ increased from 20 ± 7 ml • kg^{-1} • min^{-1} to 28 ± 6 ml • kg^{-1} • min^{-1}). Physiologic function did not indicate a significant increase (DP increased from 209 ± 49 to 217 ± 56). The blood chemistry analyses indicated no significant change for any parameter (TC 211 ± 41 mg • dl^{-1} to 211 ± 38 mg • dl^{-1}, HDL 30 ± 9 mg • dl^{-1} to 33 ± 10 mg • dl^{-1}, LDL 148 ± 37 mg • dl^{-1} to 146 ± 34 mg • dl^{-1}, TRIG 171 ± 79 mg • dl^{-1} to 162 ± 82 mg • dl^{-1}). These data indicate a positive physiologic adaptation due to a significant increase in $\dot{V}O_{2max}$ without a corresponding increase in DP, which suggests an improvement in myocardial efficiency. A lack of change in the blood lipid profile suggests additional intervention during the course of this Phase II cardiac rehabilitation program is warranted.

PHYSICAL WORKING CAPACITY AT FATIGUE THRESHOLD (PWC_{ft}), AEROBIC POWER, AND BODY COMPOSITION IN OLDER ADULTS

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Physical working capacity at the fatigue threshold (PWC_{ft}) is closely correlated with the lactate threshold and improves with aerobic training in older adults (deVries *et al.*, Ergonomics 32(8):967, 1989). The purpose of this study was to evaluate the relationship between PWC_{ft} and traditional indicators of physical fitness [maximal aerobic power ($\dot{V}O_2max$) and body composition] in untrained older adults. Twenty-five men and 41 women, 60 to 82 yrs of age ($\bar{X}$=68.4±5.3 yrs) were given a discontinuous incremental cycle ergometer test (2 min stages; 12.5 W increments) with an end point defined as the lowest power output producing an EMG voltage-time relationship that had a slope significantly greater than zero ($p \leq 0.05$; single tail t-test). A symptom limited graded exercise treadmill test following a modified Naughton protocol (2 min stages) was used to determine $\dot{V}O_2max$. Relative fat (% fat), fat free mass (FFM), and right leg lean mass (RLM) were obtained from dual energy X-ray absorptiometry. The PWC_{ft} ranged from 18.8 to 131.3 W ($\bar{X}$=54.8±26.6 W). Means, standard deviations, and correlations with PWC_{ft} for the parameters measured are presented in the table. All correlations were significant at $p \leq 0.01$.

	$\dot{V}O_2max$ ($l \cdot min^{-1}$)	Body Weight (kg)	% Fat	RLM (kg)	RLM (kg)
mean	1.58±0.48	65.9±12.7	35.7±8.8	42.3±10.4	7.4±1.8
r	0.50	0.30	-0.52	0.55	0.58

$\dot{V}O_2max$, % fat, FFM, and RLM were moderately correlated with PWC_{ft}. Although PWC_{ft} has been shown to be a valid parameter related to lactate threshold, it is only moderately related to traditional parameters of physical fitness in untrained older adults.

VENTILATORY THRESHOLD IN ELDERLY OBESE PERSONS WITH CORONARY ARTERY DISEASE

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Elderly obese persons with coronary artery disease (CAD) were recruited to determine the ventilatory threshold (VT), and whether 12 weeks of aerobic exercise (AE) or aerobic plus circuit weight training exercise (CWT) could alter the VT in this population. Eighteen previously sedentary subjects (11 men, 7 women) with stable, documented CAD underwent a symptom-limited graded exercise test with continuous, breath-by-breath gas exchange measurements. The VT was determined by the V-slope method: plotting $\dot{V}CO_2$ production versus $\dot{V}O_2$ The ventilatory equivalents (V_EO_2 and V_ECO_2) were also plotted versus time. The VT was selected as the point where V_EO_2 began to increase without a corresponding increase in V_ECO_2. The latter method was used to select the VT when there was no clear slope change by the V- slope method. After initial testing, subjects were counterbalanced to either AE or CWT exercise groups. After 12 weeks of training, 3 days per week at 60-80% of $\dot{V}O_2max$, subjects were re-tested. For the group as a whole, VT increased 8% from 1.24 ± 0.28 to 1.34 ± 0.31 L $\cdot$ min^{-1} (P=.05). There was no significant difference between AE and CWT with respect to effect of training on VT. Expressed as a percent of $\dot{V}O_2max$, VT decreased from 66.7 ± 13.5% to 64.8 ± 12.3%. However, the individual range varied from 46-90%. We conclude that VT can be improved by 12 weeks of aerobic only or aerobic plus resistive training in this population. Care should be taken when prescribing exercise among the elderly with CAD, as exercise above the VT is associated with lactate buildup, leading to fatigue.

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CARDIORESPIRATORY, BLOOD CHEMISTRY, AND BODY COMPOSITION CHANGES IN CARDIAC PATIENTS DURING A 12-MONTH RECONDITIONING PROGRAM

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Sixty-three cardiac patients (mean age = 50.4±7.6) were comprehensively studied during a one year triweekly low intensity (60% HHR) walk/jog program. Symptom-limited maximum oxygen uptake (VO_2 max), MET, fasting blood cholesterol (CHOL), triglycerides (TRIG), and glucose (GLUC), body weight (BW), and percent body fat (%BF) were determined at 0, 3, 6, and 12 months. Statistical analyses (ANOVA for repeated measures followed by Scheffe comparisons for treatments) indicated significant ($p<0.05$) changes across the four data collection periods. The results (mean ±SD) indicate: (1) significant increases in VO_2 max (1.71±.5 to 1.86±.5 to 1.87±.5 to 1.97±.5 L/min) and METS (6.29±1.5 to 6.97±1.6 to 7.01±1.5 to 7.41±1.6) from 0 months to 3, 6, and 12 months, respectively; (2) significant decreases in CHOL (241±35 to 231±32 to 223±43 to 227±33 mg/dL), TRIG (210±137 to 188±127 to 182±137 to 186±133 mg/dL), BW (78±11 to 76±10 to 76±11 to 76±9 kg), and %BF (19±4 to 17.75±4 to 17.25±4 to 16.79±4 %) from 0 months to 3, 6, and 12 months, respectively; and (3) no significant changes in GLUC (86±16 to 85±20 to 87±30 to 90±25 mg/dL) from 0 months to 3, 6, and 12 months, respectively. Hence, the reconditioning program favorably modified the patients' cardiorespiratory, blood lipid, and body composition profiles.

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A COMPUTERIZED KT-2000 SYSTEM TO ASSESS THE EFFECT OF EXERCISE AND MUSCLE HYPEREMIA ON KNEE JOINT COMPLIANCE

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Ten healthy male subjects (age 19-31) underwent a 30 minute running period followed by cyclic isokinetic exercise (repetitions until 50% of initial peak torque) of their dominant leg to determine the effect of exercise and muscle hyperemia on knee joint compliance. Knee joint compliance in the anterior/posterior (AP) plane was measured pre-run, post-run, and post-isokinetic exercise using a KT-2000 knee arthrometer with a computerized data collection system developed by the authors. Statistical analysis did not demonstrate significant changes in knee compliance resulting from either exercise or muscle hyperemia. In the dominant leg, compliance (mm/lb) values were .080 pre-run, .090 post-run and .099 post-isokinetic. In the non-dominant leg compliance values were .216 pre-run, .100 post run and .185 post-isokinetic. Our results question the positive effect of exercise on AP knee laxity reported by several studies using a similar protocol but employing a KT-1000 and Stryker knee arthrometer with manual data acquisition. Separate comparisons between the computerized data acquisition system and manual data acquisition showed the computerized KT system to yield more consistent values during clinical tests of AP knee laxity. We conclude that while exercise and muscle hyperemia may have a small effect on knee compliance, the change is not clinically significant and should not be a factor when using AP knee compliance or laxity to assess the integrity of the anterior cruciate ligament in the actively performing athlete.

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ACUTE HEMARTHROSIS OF THE KNEE IN CHILDREN

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Acute traumatic hemarthrosis frequently represents a significant injury to the knee joint. Reports in adults of acute traumatic hemarthrosis show an incidence of ACLinjuries up to 72% as reported by Noyes. In children, ligamentous injuries are reported less frequently in association with acute hemarthrosis. A prospective study was established to evaluate injuries associated with acute hemarthrosis seen at our institution.
Over a twenty-eight month period from 1988 to 1991, twenty-one children age ten to seventeen years underwent arthroscopic evaluation following acute traumatic hemarthrosis. Nineteen males and two females were included in the study group. Post-traumatic radiographs and arthroscopic findings were documented and reviewed.An osteochondral fracture was found in thirteen of twenty-one patients. Two patients had two osteochondral fractures in separate locations. There were six osteochondral fractures involving the patellar facets, and nine of the femoral condyles. Other findings were: one ACL tear; three medial meniscal tears; five lateral meniscal tears; and two cases of osteochondritis dissecans. One patient had no arthroscopic evidence of pathology. Post-traumatic radiographs were reported as negative in seven of the fifteen osteochondral fractures.In conclusion, acute hemarthroses in children are associated with a high incidence of osteochondral fractures. These fractures represent a significant injury to the knee joint. Therefore; we recommend arthroscopic evaluation of all post-traumatic hemarthroses in children.

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Elbow Arthroscopy in the Athlete

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Elbow Arthroscopy is a useful diagnostic and surgical technique for limited intraarticular pathology in the athletic elbow. The use of elbow arthroscopy for selected athletic injuries can result in improvement of motion, strength, resolution of symptoms, as well as, early return to athletics. We reviewed the treatment of eighteen athletic elbow injuries which were presented to the University of Kentucky, Section of Sport Medicine.Over approximately a three year period, February 1988 to January 1991, eighteen athletes underwent elbow arthroscopy. Diagnosis at arthroscopy consisted of loose bodies in thirteen elbows, osteophyte impingent in three, osteochondritis diseases in three, degenative joint disease in one, synovitis in one, and lateral epicondylitis in one elbow.Mean time from operation to sports return was four months. Range of motion, Biodex strength testing of the elbow was performed upon follow-up examinations. Subjective finding were also noted.All patients returned to their pre-injury sport. Subjective improvement was noted in all but one patient.
In conclusion, when the appropriate indications are adhered to, arthroscopy provides a safe and reliable procedure for diagnosis and treatment of intraarticular elbow pathology. Elbow arthroscopy may also provide early return to pre-injury level of activity in athletic patients.

THE ROLE OF FLEXIBILITY IN ATHLETIC INJURIES

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Flexibility is thought to be an important factor in athletic performance and injury prevention. Although some studies support this assumption, the majority of scientific evidence remains largely equivocal. This study investigated the role of flexibility in subsequent musculoskeletal injuries in a prospective manner.

METHODS Seven flexibility measurements (four upper extremity and three lower extremity measurements) and an injury history were obtained in 246 college students (60 controls and 186 varsity athletes). Subsequently all varsity athletes were followed prospectively for injuries in the season following the initial evaluation. Every significant injury (unable to practice or compete for more than 24 hours) was recorded during the season.

RESULTS The flexibility scores revealed lower scores in the male varsity athletes compared to male non-varsity students and all female athletes ($p<0.05$). In varsity students, flexibility measurements were in general not predictive of subsequent musculoskeletal injuries. A history of athletic injuries was not associated with a significant change in the flexibility scores. However, a positive history of an injury was strongly associated with new injuries ($p<0.001$).

DISCUSSION Flexibility as measured in this study did not play an important role in subsequent athletic injuries. The strong association of previous injuries with new injuries suggests that other factors may play a more important role.

ARTHROSCOPIC REPAIR OF DISPLACED AVULSION FRACTURES OF THE TIBIAL SPINE IN CHILDREN

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At the University of Kentucky we have identified 19 patients under the age of 16 who sustained cruciate ligament injuries. Five patients presented with avulsion fractures of the tibial spine, four involving the anterior cruciate ligament attachment, one involving the posterior cruciate ligament attachment. The average age was 13 years (9 -15). Four patients gave a history of a valgus twisting motion to the knee with the exception of the patients with the postierior cruciate injury which reported a direct blow to the flexed knee. Radiographs demonstrated the tibial spine fractures. All patients were examined pre-operatively and demonstrated positive Lachman's tests and drawer tests. The patients were taken to surgery where the knees were examined under anesthesia and arthroscopy was used to confirm the intra-articular fracture and aid in suture repair of the avulsed fragments. Standard arthroscopic portals were used. Intra-articular pathology was identified in 2 as having incomplete tears of the peripheral lateral meniscus on the upper surface which were not repaired. One patient had an associated medial collateral ligament unjury that was treated conservatively. Post-op radiographs demonstrated reduction of the avulsed fragments. Post-operatively the patients were place in braces with the knees in extention. Weight bearing in the brace was begun on post-op day one. Active reange of motion was instituted at 3 weeks. All patients were released to activity at 2 months. Follow-up has averaged 14.4 months (2-25).

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INJURIES IN THE SCHOOL-AGED ATHLETE:A STATISTICAL ANALYSIS OF INJURY PATTERNS

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The school-aged athlete has become one of the largest groups of organized competitors. Social and athletic trends have the school-aged athlete selecting particular sports at earlier ages. Sports related injuries in children and adolescents are being identified more frequently. With the emphasis on free play decreasing and organized training and competing increasing a number of injuries common to adults have been identified in this younger age group. All patients who were younger than 15 years of age that presented with an athletic injury involved with an organized athletic event were included in this retrospective review. Over a two year period, January 1988 to December 1990, 229 participants in organizedathletic activities were treated by the sports medicine service at the University of Kentucky. The sex, specific sport, and injury typewere identified. Injury types were identified as microtrauma (overuse) or macrotrauma (acute, major injuries). Chi-square and Fisher's T-test were used to determine dependence of variables ininjury patterns of this school age population. The microtrauma injuries totaled 103, and the marcotrauma injuries 126. Results showed no statistical relationship between sex and macrotrauma or microtrauma ($p = 0.10$). Sex was significant when related to location of injury, upper versus lower extremity ($p = 0.001$). In basketball all upper entremity injuries were male and was significant ($p = 0.002$). Upper extremity injuries were more likely to be macrotrauma as opposed to mircotrauma ($p = 0.001$). The clinical relevance of this paper should help the sportsmedicine physician identify injury patterns as they pertain to sex, sport, and type of injury in this age group.

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ANATOMY AND ISOMETRIC ATTACHMENTS OF THE POSTERIOR CRUCIATE LIGAMENT: A CADAVERIC STUDY

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The purpose of this study was to identify the femoral and tibial attachment sites of the posterior cruciate ligament, determine isometric points, and document intra-articular spatial relationships to aid in reconstruction procedures. Twenty cadaveric specimens were available for study, 8 fresh specimens and 12 preserved. Dissection of all specimens demonstrated an intra-articular free segment of ligament to be consistent in length of 25 mm. (Proximal tibial attachment to distal femoral attachment). A-P dimensions of the ligament were 20 mm below the joint surface, was 12 mm in width with a extracapsular portion of attachment extending 5 mm below the capsule. Appearance of the ligaments of wrisberg and Humphrey were variable and were present in 55% of the specimens. Isometry was determined in 10 specimens by direct measurement of 7 femoral points paired with 4 tibial points for a total of 280 measurements using a medmedritic isometer while moving the knee through a range of motion of 0 - 120 degrees. These points were confirmed using radiographic markers to indirectly measure the distance between the 7 femoral points and the 4 paired tibial points. Indirect measurements were made using fluoro-centered X-rays of the knee specimens in full extention and 90 degrees of flexion. A measuring standard was used for each film to correct for magnification and change in length was determined for each set of points. Tibial point selection was not critical for isometric placement however thefemoral points most consistent with a change in length of 2 mm or less were found on the proximal border of the femoral attachment of the posterior cruciate ligament. This confirms previous reported computer analyses on the posterior cruciate ligament isometric regions. The relevance of this study is to aid in identifying appropriate placement of PCL grafts during arthroscopic assisted reconstruction procedures.

INTAOPERATIVE PITFALLS IN ARTHROSCOPICALLY ASSISTED ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION USING AUTOGENOUS PATELLA TENDON GRAFT

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Arthroscopic assisted anterior cruciate ligament reconstruction using autogenous patella tendon graft is the treatment of choice for patient with anterolateral knee instability. Between October 1987 and March 1989, 104 anterior cruciate ligament reconstrucrtions were performed (76 males and 28 females) using arthroscopic assisted isometric graft placement technique. We have divided the arthroscopic procedure into 18 steps. Five steps have been identified as extremely critical and are associated with a number of pitfalls. These steps are (1) Arthroscopic portal placement, (2) Autogenous patella tendon graft harvesting, (3) Isometric assesment, (4) Graft passage, and (5) Graft fixation. Pitfalls identified in these steps include: Inappropriate arthroscopic portal placement, patella fracture and bone block fracture, identification of femoral and tibial isometric points, inappropriate bone block size and graft impigement, and failure of interference screw fixation. Solutions include: increased awareness of knee anatomy for arthroscopic portal placement, appropriate bone cuts for bone block harvest, adequate debridement of femoral intercondylar notch for careful selection of isometric points, bone block sculpting and use of intra-articular guide systems for tibial and femoral tulnnel placement and use of larger diameter interference screw for fixation after graft placement. The awareness of these critical steps and avoidance of these pitfalls have improved the technique of this procedure.

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EFFECTS OF AGE AND AEROBIC EXERCISE ON RANGE OF MOTION

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The present study examined the effects of age and aerobic exercise on range of motion (ROM). Forty females were grouped according to age and participation in organized aerobic classes as follows: old active [(OA) $\bar{x}$ age= 75.1±1.2 yrs]; old sedentary [(OS) $\bar{x}$ age=74.9±1.5 yrs]; young active [(YA) $\bar{x}$ age=19.8±1.3 yrs]; and young sedentary [(YS) $\bar{x}$ age= 20.3±1.1 yrs]. Each group contained 10 subjects. Active ROM measurements were obtained from the right side utilizing a Standard SFTR Goniometer and the protocols described by Norkin and White. ROM's measured in degrees included: 1) knee flexion and extension; 2) hip flexion and extension; 3) shoulder flexion, extension, and abduction; and 4) ankle plantar flexion and dorsiflexion. An ANOVA on the average of three measurements from each site followed by a Tukey post hoc analysis revealed the following ($p \leq .05$): 1) OS knee flexion (98.9±5.38) was significantly less than YA(140.5±2.53), OA(127.4±5.06), and YS(133.7±1.90); 2) OA hip flexion (88.2±3.29) was significantly less than YA (102.4±2.19) and YS(92.4±2.18); 3) OS hip flexion (86.7±4.14) was significantly less than YA, OA, and YS; 4) OS hip extension (19.4±2.69) was significantly less than YA (23.7±1.10) and OA(23.2±1.51); and 5) OS shoulder abduction (113.3±9.21) and flexion (136.7±8.55) were significantly less than YA (167.5±2.66, 167.2±1.99), OA(162.2±6.54, 162.7±3.72), and YS(168.9±2.44, 165.8±2.57). These data suggest that activity may reverse the decrements in ROM that occur with age.

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THYROID HORMONE CHANGES DURING MILITARY OPERATIONS: EFFECTS OF COLD EXPOSURE IN THE ARCTIC

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This study examined the impact of prolonged physical activity in a cold environment on circulating thyroid hormone levels. Military personnel (n=33) exposed to 10 days of field operations in the arctic region of Norway had blood samples collected before (day 1), on day 5, and day 10 of the operations. Levels of total (t) thyroxine (T_4), free (f) T_4, total triidothyronine (T_3), free T_3, and thyroid binding globulin were assessed in all blood samples. The operations consisted of ski/snow shoe marches, and warfare/survival training for 6 to 10 hr per day. Temperature range over the 10 days was +5 to -20 °C with another 5-10 °C wind-chill daily. The hormonal results (mean±SE) were as follows:

Measure	Day 1	Day 5	Day 10
tT_4 (ug/dl)	6.2 ± 0.3	5.9 ± 0.2	4.6 ± 0.2
tT_3 (ng/dl)	197.9 ± 10.9	162.9 ± 5.0	150.2 ± 5.1
fT_4 (ng/dl)	1.15 ± 0.04	1.08 ± 0.03	1.23 ± 0.04
fT_3 (pg/ml)	3.73 ± 0.11	4.09 ± 0.11	3.66 ± 0.10
$\%fT_4$ (%)	18.9 ± 0.6	18.6 ± 0.5	27.4 ± 0.9
$\%fT_3$ (%)	2.03 ± 0.11	2.56 ± 0.08	2.50 ± 0.09

Statistical analysis indicated a significant ($p<0.01$) decrease in tT_4 and tT_3 levels occurred by day 10; while, increases ($p<0.01$) in the relative (%f = f/t x 100) free fractions of the hormones occurred by day 10. However, no significant changes were noted in the binding globulin levels. The hormonal alterations noted are possibly brought about by the combined effects of physical activity and cold exposure acting synergistically to alter thyroid physiology (e.g., possibly the protein carrier binding affinity).

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TEMPERATURE AND METABOLIC RESPONSES TO EXERCISE IN HEAT WEARING DIFFERENT FABRICS

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The purpose of this investigation was to determine the efficacy of two fabrics during exercise in the heat. Ten recreationally fit, college aged men performed three randomly assigned trials (cotton-C, radiator-R, nude-N) with one week between each trial. The cycling bouts (90 mins., 61% VO2 max) were performed under carefully controlled room conditions (26 °C, 55% RH, no convective air currents). Shirt and skin (wet and dry) temperatures were determined using infrared thermographic detection (Agema 870) on an area approximating 25% of the total back surface. VO2, RPEs, core temperatures, and HR were recorded every 15 minutes throughout all trials. No significant differences ($p < 0.05$) in exercise VO2 (l/min) between C, R, and N trials (2.18 ± 0.1, 2.21 ± 0.1, 2.17 ± 0.1, respectively) indicated similar workloads between trials. RPEs and core temperatures increased significantly over time, with no significant differences between trials. HR (bpm) increased significantly over time, as well as between trials C and N (155.8 ± 4.6 and 150.3 ±4.8), while no significant differences existed between either C or N when compared to R (152.8 ± 4.6). Fabric temperatures (°C) in C and R (31.9 ± 0.3 and 31.9 ± 0.1) were significantly different than dry skin temperatures in both C and R trials (33.1 ± 0.3 and 33.3 ± 0.2). Additionally, wet skin temperatures (33.0 ± 0.3) were significantly greater than dry skin temperatures (32.7 ± 0.3) during the N trial. Significant differences between shirt and dry skin temperatures, as well as between wet and dry skin emphasis the need to recognize emissivity implications when reporting thermographic results.

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THE EFFECT OF EXERCISE ON CALCIOTROPIC HORMONES, CORTICAL BONE MASS, AND BONE TURNOVER ANALYTES IN POSTMENOPAUSAL FEMALES

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The purpose of this study was to ascertain the effects of long-term, aerobic exercise on bone homeostasis maintained by calciotropic hormone levels, cortical bone mass (CBM), and bone turnover analytes. The volunteer subjects in this study consisted of 41 postmenopausal female, confirmed by follicle-stimulating hormone (FSH) and luteinizing hormone (LH) levels aged 50 to 85 years. The subject population was separated into two groups on the basis of chronic physical activity levels. Group 1 (active) consisted of 21 subjects who had participated in an organized fitness program for one year or longer prior to the study. Group 2 (inactive) were 20 subjects who had no such participation and were not engaged in any regular physical exercise. Further validation for group membership was determined by scores on a physical activity scoring questionnaire. Serum samples were collected following a 12-hour fast in order to determine parathyroid hormone (PTH), calcitonin (CAL), alkaline phosphatase (ALKP), osteocalcin (OST), calcium (Ca^{++}), FSH, and LH. A radiograph (X-ray) of the non-dominant hand was taken on or about the same day as serum collection to determine CBM. An independent t test analysis revealed no significant differences ($p > .05$) in means for PTH (active 35.9 ± 17.9 pg • ml^{-1} vs. inactive 31.8 ± 9.3 pg • ml^{-1}), CAL (active 8.2 ± 5.6 pg • ml^{-1} vs. inactive 6.7 ± 3.2 pg • ml^{-1}), ALKP (94.7 ± 28.4 U/L vs. inactive 90.6 ± 21.1 U/L), OST (active 10.4 ± 4.6 ng • ml^{-1} vs. inactive 9.5 ± 4.1 ng • ml^{-1}), Ca^{++} (active 9.4 ± 0.27 mg • dl^{-1} vs. inactive 9.6 ± 0.27 mg • dl^{-1}), CMB (active 4.1 ± 0.65 mm vs. inactive 4.5 ± 0.20 mm), FSH (active 69.2 ± 19.9 mIV • ml^{-1} vs. inactive 89.6 ± 52.4 mIV • ml^{-1}), and LH (active 65.7 ± 31.6 mIV • ml^{-1} vs. inactive 61.5 ± 26.2 mIV • ml^{-1}) between the groups. The results of this study indicate chronic physical activity does not alter the calciotropic hormones, CBM, and bone turnover analytes in these postmenopausal women.

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EXERCISE AND HYPERTENSION: MEDIATING EFFECTS

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The purpose of this study was to determine, through meta-analysis techniques, the relationship between initial resting blood pressure levels, age, and length of training programs on changes in resting systolic and diastolic blood pressure as a result of lower extremity aerobic exercise. The results of 25 human training studies (673 exercised subjects) published in English and conducted over the past 25 years were obtained through manual and computer (ERIC, Medline) searches, coded and analyzed. Calculated effect sizes, evaluated for statistical significance (r) revealed a positive and significant relationship between initial resting diastolic blood pressure levels and decreases in resting diastolic blood pressure post-exercise ($r=.49$ $p<.01$). 87 percent of the experimental groups experienced this statistically significant relationship. There were no statistically significant relationships between initial resting systolic blood pressure levels, age, or length of the training programs on post-exercise changes in resting systolic or diastolic blood pressure. It was concluded that absolute decreases in resting diastolic blood pressure as a result of lower extremity aerobic exercise is greater in those individuals who have higher initial levels pre-exercise. Initial resting systolic levels, age, and length of the training program do not appear to be related to changes in resting blood pressure post-exercise.

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REGULATION OF RESPIRATORY DRIVE (RD) DURING EXERCISE

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In healthy subjects at rest arterial pCO_2 ($PaCO_2$) is the principle regulator of RD while pO_2 and pH are of minor importance except in disease or at altitude. While the relationships between $PaCO_2$, pO_2, pH and RD at rest have been well delineated few studies have been done to examine the factors affecting RD during exercise; accordingly, we have studied 15 healthy young men at rest, during passive exercise and during active exercise at 50, 100, and 150 watts (W) on a stationary cycle. Measurements of $PaCO_2$, $PvCO_2$, $\dot{Q}_C$, $\dot{V}O_2$, volume expired ($\dot{V}_E$), rectal temperature (RT), covered and uncovered skin temperature (TSK_C & TSK_U) were made during continuous exercise allowing 5 min. to reach equilibrium at each work load. When the 150W load was reached, exercise was continued at that intensity to the end of the experiment. With passive exercise $\dot{V}_E$ increased by approximately 20% above resting while $PaCO_2$ and usually $PvCO_2$ declined indicating that something other than CO_2, presumably proprioceptive impulses from joints and muscle, was driving respiration. During active exercise $\dot{V}_E$ rose progressively with increasing work load. While $\dot{V}_E$ increased in predictable fashion $PaCO_2$ fell progressively so that a negative correlation existed between $PaCO_2$ & $\dot{V}_E$ suggesting that chemoreceptors in the lung reacting to $PvCO_2$ were the principle mechanism regulating RD. This relationship between $PvCO_2$ & RD held until core temperature exceeded 37.5°C. When this occurred $\dot{V}_E$ rose progressively in proportion to the rise in temperature while both $PaCO_2$ & $PvCO_2$ fell progressively. Our data indicate that $PaCO_2$ has little to do with RD during exercise, and that proprioceptive impulses from joints and muscle, $PvCO_2$ detected in the lung, and finally body temperature are the determinants of RD during exercise.

THE EFFECTS OF VARYING CONDITIONS ON SWEAT IRON LOSS

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Arm sweat was collected from nine men and nine women, sitting in a hot environment (H=40°C, 64% RH) and exercising at 50% VO_2 max in a neutral (NE=25°C, 75% RH) and a hot environment (HE=35°C, 70% RH) to compare the amount of iron loss. Whole body sweat rate was determined for consecutive 30 min intervals. Sweat was collected in polyethylene arm bags throughout H and for consecutive 30 min intervals in NE and HE. Sweat iron concentration of males (.26 mg/L) and females (.13 mg/L) did not differ significantly, but sweat rates were higher for males (482 vs 330 $g/m^2/hr$) resulting in greater iron loss(.18 vs .06 mg/hr). Sweat iron concentration during HE (.14 mg/L) was significantly less than NE (.22 mg/L) and H (.22 mg/L). Sweat rates differed significantly across all environments (HE=639, NE=394, H=184 $g/m^2/hr$), but the exercising environments (HE=.14, NE=.15 mg/hr) produced a greater iron loss than H(.07 mg/hr). Sweat iron concentration (.26 mg/L) was greater and sweat rate (374 $g/m^2/hr$) was lower during the first 30 min of exercise as compared to the second 30 min (.11 mg/L, 660 $g/m^2/hr$) with no significant difference noted in iron loss (1=.17 mg/hr, 2=.11 mg/hr). These data indicate that sweat iron loss is greater in males than females during rest in a hot environment and during exercise in mild and hot environments, that iron loss is greater during exercise in mild and hot environments than while resting in the heat, and that sweat iron loss is consistent throughout an hour of exercise in mild and hot environments.

WHOLE BLOOD LACTATE AND SERUM FREE FATTY ACID RESPONSES RESPONSES TO SUPRAMAXIMAL AND SUBMAXIMAL CYCLING BOUTS

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Seven highly trained cyclists ($\bar{x}$ age = 31.1 ±3.8 yrs; $\bar{x}$ BM = 73.2 ±2.2 kg; $\bar{x}$ mi/wk = 239 ±16; $\bar{x}$ $\dot{V}O_2$ max = 54.97 ±4.15 ml · kg · min^{-1}) were studied while performing six 1 min bouts of cycling exercise at ~120% $\dot{V}O_2$ max followed by 5 min of rest and a 30 min cycling bout at ~63% $\dot{V}O_2$ max. Oxygen consumption and RER values were recorded every 20 s to ensure that subjects were performing at appropriate work intensities. Blood samples (10mL) were taken at six time periods:

	Rest	3rd sprint	6th sprint	5 min recovery	15 min submax	30 min submax
LA ($mmoL \cdot L^{-1}$)	3.0 ±0.3	16.6 1.5	19.3 1.4	19.8 2.0	10.0 1.6	7.4 1.2
FFA ($mg \cdot L^{-1}$)	47.5 ±4.4	42.1 3.3	36.8 5.1	44.9 6.2	33.5 1.8	47.2 3.6

A repeated measures ANOVA yielded significant differences across time periods for [LA] but not for [FFA]. Data suggest that [FFA] decreased 23% while [LA] increased 543% during the 6 sprints reflecting increased glycolytic involvement; however, both [FFA] and [LA] increased (22% and 2%) during the 5 min recovery. From 15 min to 30 min in the submaximal ride, [FFA] increased 41% and [LA] decreased 26% suggesting enhanced dependence on aerobic processes. It should be noted that [FFA] increased during recovery from high intensity exercise despite increasing [LA]. This response suggests that increases in [LA] do not necessarily inhibit FFA mobilization or decrease [FFA].

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CYTOCHROME OXIDASE ACTIVITY DEMONSTRATES REGIONAL VARIABILITY IN THE NEONATAL MOUSE HEART.

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Regional variability in the activity of several metabolic enzymes has been demonstrated in the adult but not the neonatal mammalian heart. Therefore, this study was undertaken to determine if a gradient of cytochrome oxidase activity (CO) occurred between the base and the apex of the left ventricle (LV) of neonatal mice. A quantitative histochemical assay for CO was developed in which histochemically processed tissue sections were digitized as gray level pictures and the optical density determined (OD) using a computer enhanced image analysis system. CO activity (OD/MIN) was then assayed in 10 u thick tissue cross sections of the LV taken at 300 u and 500 u intervals along the base-to-apex axis of 3 and 9 day old mice respectively. In the LV of the 3 day old mice, CO activity was similar at both extremes (base and apex) and was 12% lower in the mid portion. Relative to the 3 day LV, CO activity remained unchanged at the extremes of the LV of 9 day old mice, but was approximately 20% lower in the mid portion, resulting in a further accentuation of the gradient in CO activity. These data suggest that 1) regional variation in CO activity and hence oxidative capacity may exist in the neonatal heart and 2) maturation may accentuate these regional differences.

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CARDIOVASCULAR CHANGES DURING TRANSITION FROM UPRIGHT TO SUPINE TO 20 MINUTES OF VERTICAL HEAD-DOWN SUSPENSION

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Fifteen men (mean age = 23 yrs) were monitored for 3 minutes in the upright position (URp) and the supine position (SUp), and for 20 minutes in the head-down position. Systolic blood pressure (SBP) with the arms alongside the body, oxygen uptake (VO_2), heart rate (HR), stroke volume (SV), arteriovenous oxygen difference (a-vO_2 diff), and cardiac output (Q) by the CO_2 rebreathing procedure were measured. ANOVA for repeated measures followed by the Tukey test indicated: (1) no significant changes in VO_2 and SBP from the URp to the SUp or from either position versus the 20 minutes of suspension; (2) significant decreases in HR from the URp to the SUp and from either position versus minutes 5, 10, 15, and 20 during suspension; (3) significant increases in SV from the URp to the SUp and from either position versus minutes 5, 10, 15, and 20 during suspension; (4) significant increases in Q from the URp to the SUp and from the URp versus minutes 5 and 15 during suspension; and (5) significant decreases in a-vO_2 diff from the URp to the SUp and from either position versus minutes 5, 10, 15, and 20 during suspension. These data indicate the time course of reflex adjustments in circulation as well as significant alterations in left ventricular function.

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THE EFFECTS OF ACUTE ANAEROBIC EXERCISE ON IMMUNE RESPONSE

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Appalachian State University, Boone NC 28608

The purpose of this study was to measure changes in circulating leukocyte and lymphocyte subset counts, lymphocyte proliferative response, serum immunoglobulin levels, and plasma catecholamine concentrations in response to the Wingate anaerobic test. Ten healthy males (22.3±0.8 years) pedaled with maximal effort for 30 sec against a workload adjusted prior to the start of the test to 0.1 kp/kg of body mass. Blood samples were collected before, and 3 min and 1 hr following the anaerobic exercise bout. Peak and average power mean values from the Wingate anaerobic cycle ergometer test were 1020±51 and 738±34 watts, respectively. Total leukocytes increased 40% in response to the anaerobic exercise bout, and then fell 16% after 1 hr of recovery when compared to pre-test values ($F=123$, $p<0.001$). Neutrophils and lymphocytes represented approximately 60% and 30% of the leukocytosis, respectively. Lymphocytes increased 30% 3 min following the test, and then fell 36% 1 hr later ($F=56.4$, $p<0.001$). The post-test lymphocytosis can be explained primarily from the 176% increase in natural killer-cytotoxic T cells (NKCT) and 28% increase in cytotoxic/suppressor T cells (CD8), while the 1-hr recovery lymphopenia occurred because of a sharp decrease in total T cells and a moderate decrease in NKCT cells. No significant changes in lymphocyte proliferative response or serum immunoglobulin levels were found when appropriate adjustments for changes in plasma volume or lymphocyte subset changes were made. Plasma epinephrine increased 264% in response to the Wingate test, and best explains the measured changes in circulating levels of lymphocyte subsets. These results demonstrate that changes in circulating levels of leukocyte and lymphocyte subsets, especially NKCT, occur rapidly in response to 30 sec of heavy anaerobic exercise, but are of a lower magnitude than those found following longer duration, high-intensity exercise.

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VENTILATORY THRESHOLD IN LONG TERM INSULIN DEPENDANT DIABETICS

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Six long term insulin dependant diabetics (D) and six age and sex matched non-diabetic controls (NDC) underwent a cycle ergometer test and lipid profile to determine the effect of diabetes on the ventilatory threshold (VT) and lipid values. Three non-invasive methods were used to determine VT: $\dot{V}O_2$ at the point of 1) non-linear increase in $\dot{V}_E$, 2) non-linear increase in $\dot{V}CO_2$, 3) an increase in $\dot{V}_E/\dot{V}O_2$ without a simultaneous increase in $\dot{V}_E/\dot{V}CO_2$. VT regardless of method was not significantly different between the groups ($p=.23$). No significant difference was found between D and NDC in $\dot{V}O_2max$ (29.8, 26.6 $ml \cdot kg^{-1} \cdot min^{-1}$), LDL (102, 114 $mg \cdot dl^{-1}$), triglycerides (94.3, 101 $mg \cdot dl^{-1}$), HDL-C (58.1, 51.3 $mg \cdot dl^{-1}$), TC (179, 186 $mg \cdot dl^{-1}$), LDL/HDL (1.5, 2.4), VT as a percent of $\dot{V}O_2max$ (64.1, 59.5). There was a significant difference in glucose (150, 89.3 $mg \cdot dl^{-1}$). In this subject population there was a trend in the D group toward having a higher VT. Results indicate that D subjects have VT's at least as high as would be found in healthy individuals.

POSTEXERCISE HYPOTENSION REDUCES CARDIOVASCULAR RESPONSES TO STRESS

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Psychological stress is thought to be a factor in the development of hypertension. Exercise is purported to have a prophylactic effect on stress. Further, research has demonstrated that immediately following a single bout of aerobic exercise there is a transient decrease in systolic blood pressure of 8-12 mmHg in normotensive and 20-30 mmHg in hypertensive humans. Therefore, the purpose of this investigation was to examine the effect of an acute bout of exercise on cardiovascular responses to a psychological stressor given postexercise. Subjects were eight non-medicated borderline hypertensive men and women (mean resting blood pressure was 137/85 mmHg). Each subject participated in 3 randomly assigned experimental trials: Stroop Color-Word Task without prior exercise (STROOP); Stroop Color-Word Task administered 10 min after 60 min of treadmill exercise at 60% of VO_{2max} (Ex+STROOP); and 60 min of treadmill exercise at 60% of VO_{2max} followed by 20 min of seated recovery (Ex). Blood pressure and heart rate were monitored at the start and end of exercise, and at 5, 10, 15 and 20 min of recovery. The Stroop Color-Word Task was administered at 10 min of recovery and lasted 5 min, e.g. min 10-15 of recovery. Trials were separated by a minimum of one week. During STROOP there was a 17 mmHg increase in systolic blood pressure to 154 mmHg, $p \leq 0.01$. The EX trial caused a mean decrease in systolic blood pressure of 10 mmHg, 137 mmHg to 127 mmHg, $p \leq 0.05$. The combination of Ex+STROOP resulted in an increase of in systolic blood pressure in response to the Stroop Color-Word Task was only 11 mmHg, 127 mmHg to 138 mmHg, $p \leq 0.05$. Compared to the STROOP, the increase in systolic blood pressure during the Ex+STROOP was significantly less, $p \leq 0.05$. Further, systolic blood pressure after Ex+STROOP was only 1 mmHg above the resting level. There were no significant differences in diastolic pressure and heart rate in response to the Stroop Color-Word Task during any of the trials. These results suggest that an acute bout of exercise attenuates the systolic blood pressure response to a psychological stressor. Thus, exercise may be an effective non-pharmacological tool for reducing stress responses.

Four-Year Calendar

1991

JANUARY

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FEBRUARY

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1992

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Four-Year Calendar

1993

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1994

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SEPTEMBER

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OCTOBER

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NOVEMBER

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DECEMBER

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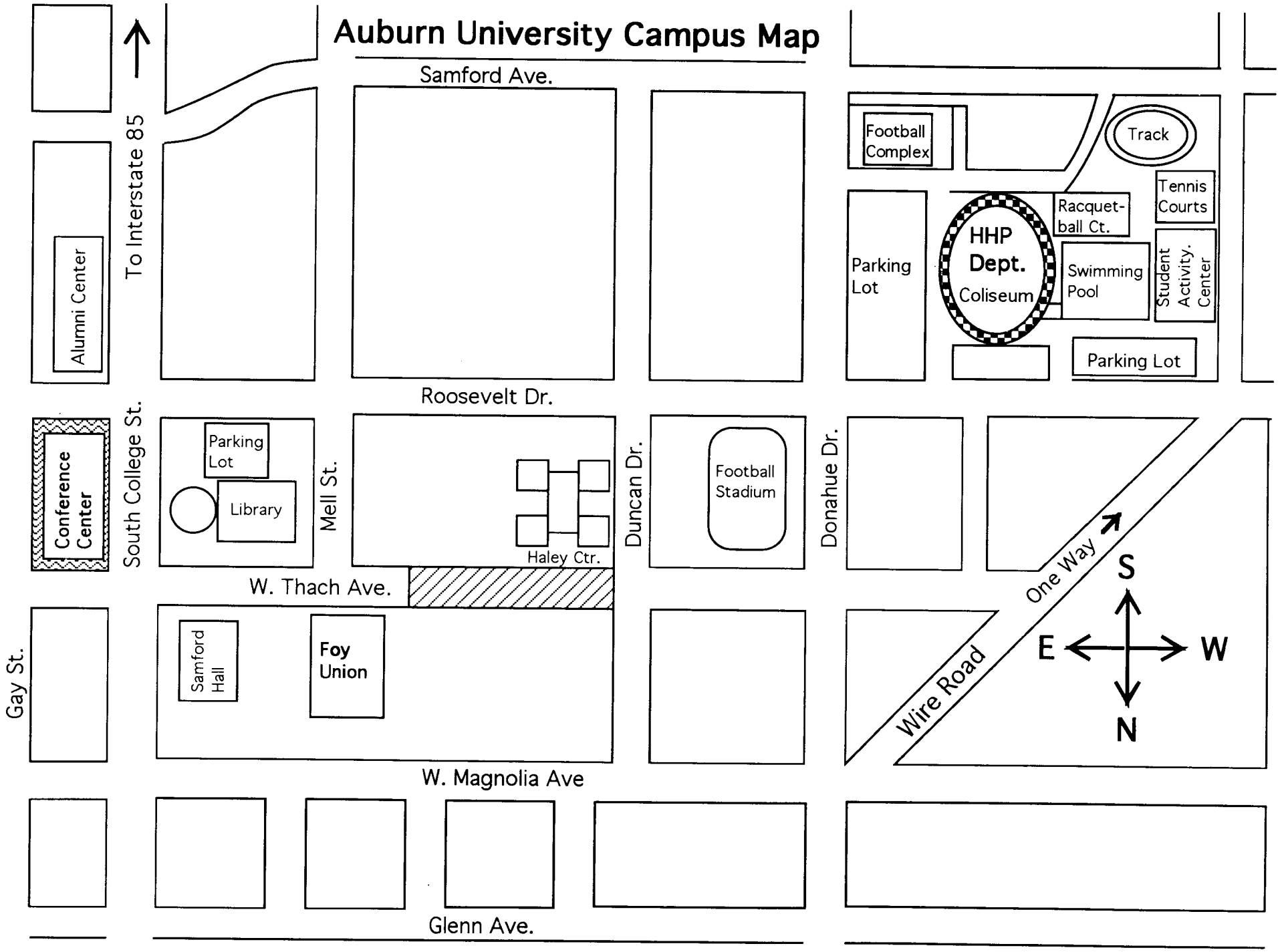
Auburn University Campus Map
Samford Ave.
To Interstate 85
Alumni Center
Football Complex
Track
Tennis Courts
Racquet-ball Ct.
Parking Lot
HHP Dept.
Coliseum
Swimming Pool
Student Activity. Center
Parking Lot
Roosevelt Dr.
Conference Center
South College St.
Parking Lot
Library
Mell St.
Haley Ctr.
Duncan Dr.
Football Stadium
Donahue Dr.
One Way
S
E
W
N
Wire Road
W. Thach Ave.
Gay St.
Samford Hall
Foy Union
W. Magnolia Ave
Glenn Ave.