AMERICAN COLLEGE of SPORTS MEDICINE

Southeast Regional Chapter

January 20-22, 1994
22nd Annual Meeting
Holiday Inn Four Seasons and
Joseph S. Koury Convention Center
Greensboro, North Carolina

ABSTRACTS

Key

BC = Business Center
CC = Coat Check
D1-6 = Convention Desks
E = Elevators
E I = Elevators to Tower I
E II = Elevators to Tower II
WC = Restrooms
= Public Corridors

Restaurants

Joseph's Restaurant
Stingers Seafood Bar and Grill
Skylite Cafe & Deli

Bars & Lounges

The Connection
The Brass Bar
The Bar Down Under

Entertainment

Club Fifth Season

FIRST FLOOR

Auditorium I
Auditorium II
Auditorium III
Biltmore
Blandwood
Cardinal
Carolina
Gate City
Guilford Ballroom
Imperial Ballroom
Morehead
Old North
Piedmont

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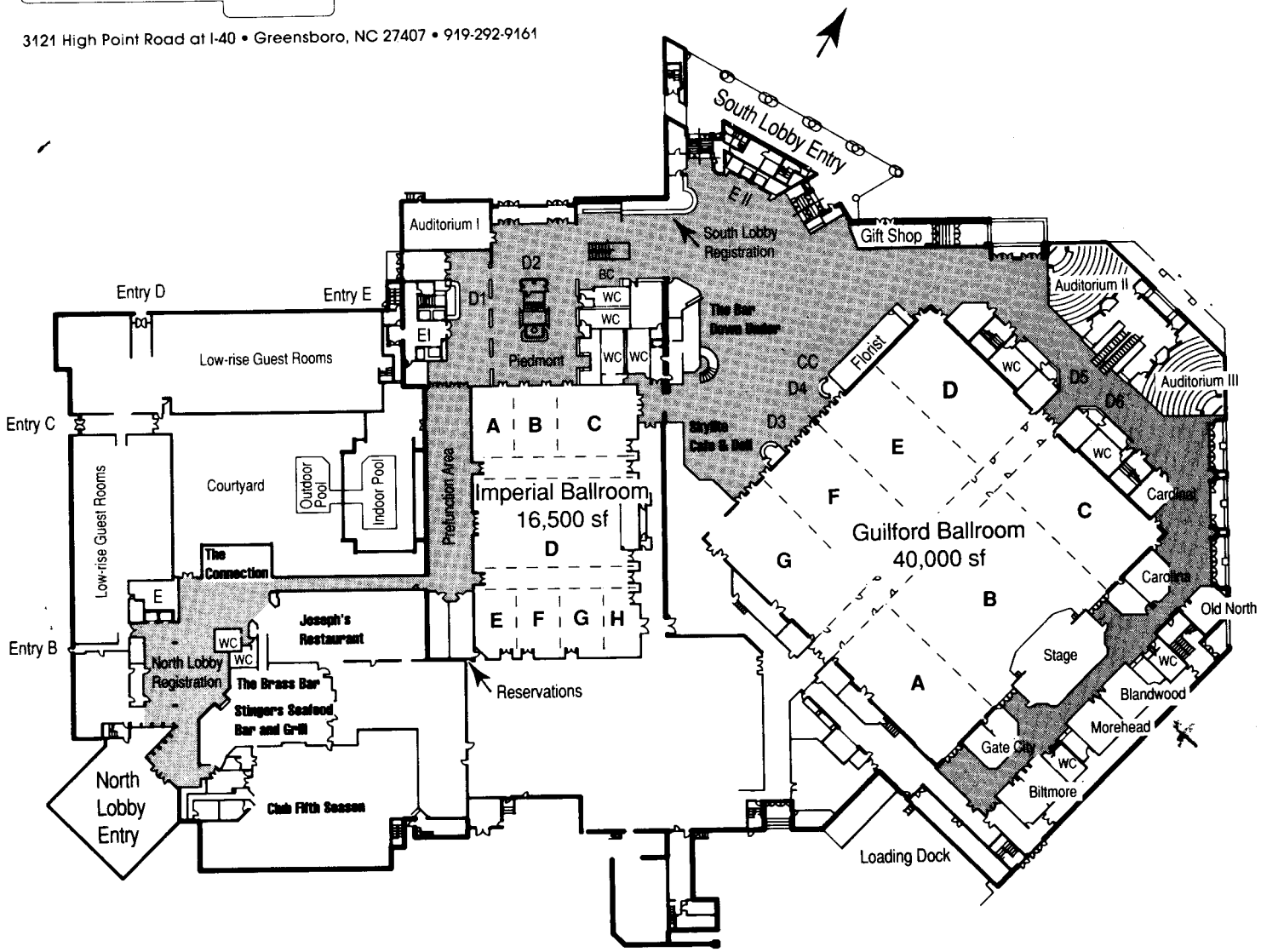
To Four Seasons Town Centre



FIRST FLOOR

Meeting Room Floor Plans

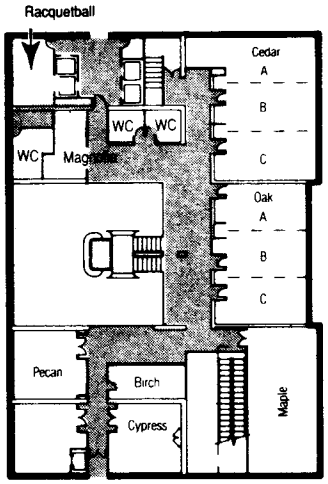
SECOND FLOOR

Birch
Cedar
Cypress
Magnolia
Maple
Oak
Pecan

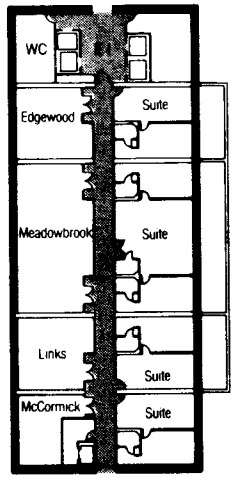
THIRD FLOOR

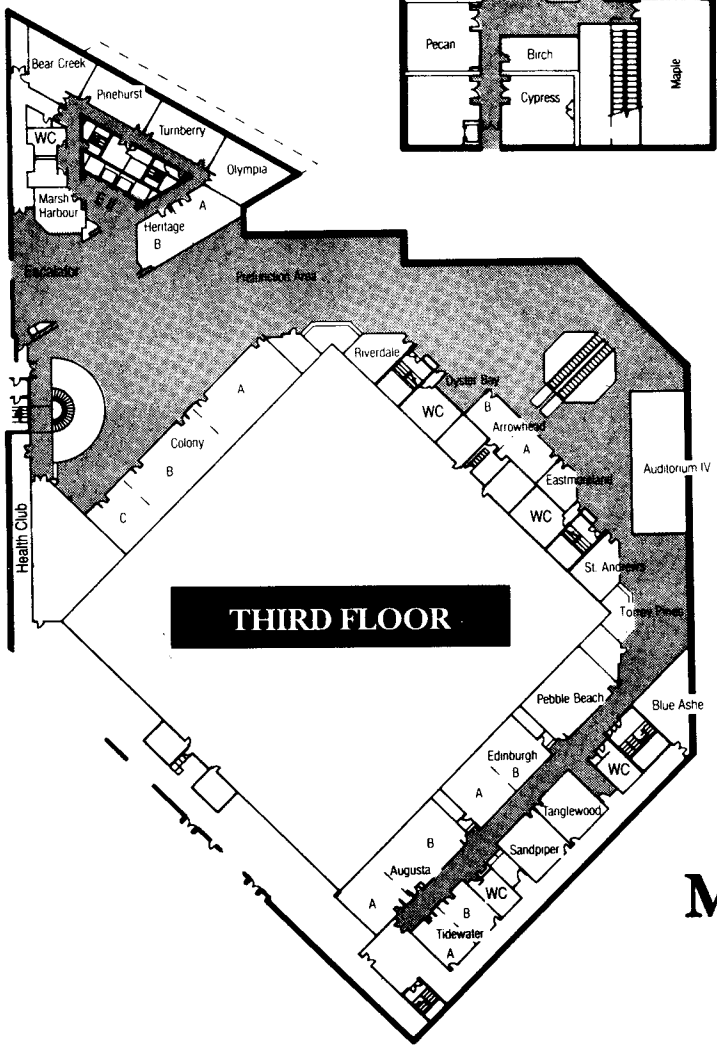
Arrowhead
Auditorium IV
Augusta
Bear Creek
Blue Ashe
Colony
Eastmoreland
Edgewood
Edinburgh
Heritage
Links
Marsh Harbour
McCormick
Meadowbrook
Olympia
Oyster Bay
Pebble Beach
Pinehurst
Riverdale
Sandpiper
St. Andrews
Tanglewood
Tidewater
Torrey Pines
Turnberry

SECOND FLOOR

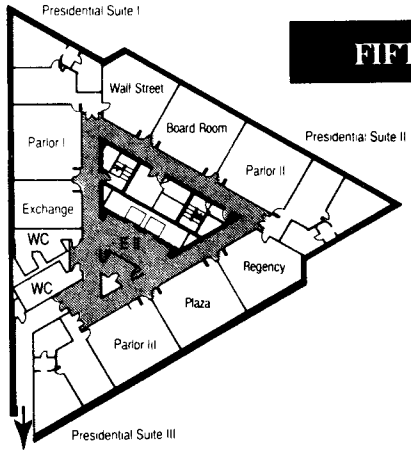


THIRD FLOOR





FIFTH FLOOR



To 5th Floor
Tower I

FIFTH FLOOR

Board Room
Exchange
Plaza
Regency
Wallstreet

Twenty-Second Annual Meeting

SOUTHEAST REGIONAL CHAPTER AMERICAN COLLEGE OF SPORTS MEDICINE

Holiday Inn Four Seasons and Joseph S. Koury Convention Center
Greensboro, North Carolina

January 20-22, 1994

Officers

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Gay Israel, East Carolina University

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Meeting Host: University of North Carolina at Greensboro
Allan Goldfarb
Regina Hopewell
William Karper
Don Morgan

Publisher and Editor:
Kent Johnson, David Lipscomb University

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

Janet Walberg-Rankin, Program Chair
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Jeff Chandler, Clinical Track Chair
J. Mark Davis
Beverly Warren
Michael Berry
Gay Israel
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Shala Davis

List of Reviewers

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Ron Bos
Craig Broeder
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Shala Davis
Harry Duval
Tony Hackney
Emily Haymes
Robert McMurray
Bob Moffatt
Scott Powers
Alan Rogol
Lucille Smith
Phil Sparling
Michael Stone
Dianne Ward
Jay Williams

Chronology of SEACSM Meetings & Officers

	Date/Place	Pres./PastPres/PresElect	Executive Board
1st	Fall 1973 Gattlinburg, 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	Fall 1978 Columbia, SC	Russ Pate	
7th	Feb. 16-17, 1979 Atlanta, GA	Dennis Wilson Ed Howley Ron Byrd	Earl Allen Thad Crews Art Weltman
8th	Feb. 8-9, 1980 Charlotte, NC	Ron Byrd Dennis Wilson Paul Ribisl	Bruce Gladden Jay Kearney Russ Pate
9th	Feb 6-7, 1981 Charleston, SC	Paul Ribisl Ron Byrd Bill Herbert	Joe Chandler Tom Chronan Kirk Cureton
10th	Feb 5-6, 1982 Blacksburg, VA	Bill Herbert Paul Ribisl Russ Pate	Harvey Murphy (ES) Kirk Cureton Joe Chandler Harvey Murphy Tom Cronan Jon MacBeth (ES)
11th	Feb 4-5, 1983 Gainesville, FL	Russ Pate Bill Herbert Kirk Cureton	David Cundiff Scott Powers Earl Allen Jon McBeth (ES)
12th	Feb 3-4, 1984 Auburn University	Kirk Cureton Russ Pate Chris Zauner	Emily Haymes Phil Sparling Mike Stone Ron Bos (ES)
13th	Jan 31- Feb 2, 1985 Boone, NC	Chris Zauner Kirk Cureton Robert McMurray	Harry Duval J.W. Yates John Billings Diane Spitler Ron Bos (ES)
14th	Jan 23-25, 1986 Athens, GA	Robert McMurray Scott Powers	Diane Spitler John Billings Terry Bazzarre Larry Durstine Russ Pate (N) Ron Bos (ES)

	Date/Place	Pres./PastPres/PresElect	Executive Board
15th	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)
16th	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)
17th	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)
18th	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)
19th	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)
20th	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) Ron Bos (ES)
21st	Jan. 28-30, 1993 Norfolk, VA	Gay Israel Steve Messier Mark Davis	Bob Moffatt Michael Berry Barbara Ainsworth Mindy Millard-Stafford Kevin Tipton (S) Shala Davis (S) Vaughn Christian (ES) Jeff Chandler (CC) Alan Rogol (MD) Phil Sparling (N)

	Date/Place	**Pres./PastPres/PresElect**	**Executive Board**
22nd	Jan. 20-22, 1994 Greensboro, NC	J. Mark Davis Gay Israel Janet Walberg-Rankin	Barbara Ainsworth Michael Berry Allan Goldfarb Beverly Warren Shala Davis (S) Victoria Schnyder(S) Vaughn Christian(ES) Jeff Chandler (CC) Phil Sparling (N)

ES = Executive Secretary
N = National Representative
CC = Clinical Consultant
S = Student Representative
MD = Physician Representative

Chronology of SEACSM Award Winners

	Scholar Award	Service Award	Student Award
1989	Hugh Welch	Ron Bos	
1990	Russell Pate	Harvey Murphy	
1991	Wendell Stainsby	Paul Ribisl	Paul Davis
1992	Robert Armstrong	Phil Sparling	Brian Hinson
1993	Michael Pollock	Dennis Wilson	Steve Bailey

* *

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Annual meeting Attendees!

Thursday, January 20

NOTE: * indicates that this abstract was selected as one of the TOP 30

12:00 - 6:00 REGISTRATION

12:00 - 6:00 Ballot box open for SEACSM elections

12:00 - 2:00 EXECUTIVE BOARD MEETING
(Riverdale)

2:00 - 6:00 VISIT EXHIBITS

12:00 - 7:00 SPEAKER READY ROOM
(Arrowhead A)

4:00 - 6:00 POSTER PRESENTATIONS: **Environment, Endocrinology, Epidemiology**
Authors present from 5:00 - 6:00
(Level 3 foyer)

1 **Body build as a heat tolerance predictor for workers wearing chemical protective clothing.** J Beaird, T Bauman, J Leeper, P Bishop. University of Alabama.

2 **The effects of caffeine consumption upon performance while running in the heat and humidity.** BS Cohen, AG Nelson, M Prevost, G Thompson. Louisiana State University.

3 **Relationship between blood testosterone and body composition in physically active, young adult men.** KD Johnston, AC Hackney. University of North Carolina- Chapel Hill.

4 **The salivary cortisol response to maximal exercise in highly trained female distance runners.** D Torok, R Cox, R Claytor, D Brown. Florida Atlantic University and Miami University.

5 ***Reproducibility of low resting testosterone levels in endurance trained males.** TA Gulledge, AC Hackney. University of North Carolina- Chapel Hill.

6 ***Metabolic substrate responses to submaximal exercise in the mid-follicular and mid- luteal phases of the menstrual cycle.** AC Hackney, M McCracken, BA Ainsworth. University of North Carolina- Chapel Hill.

7 **The effect of exercise and/or preload on subsequent eating of restrained and unrestrained eaters.** RE Keith, RE Carson, SJ Weese. Auburn University.

8 **Exercise characteristics of mall walkers.** T Waggener, A Waggener, W Thompson, R Smith, F Servedio, H Ptak, R Kazelskis. University of Southern Mississippi.

9 **Physical activity and fitness in African American college students with health-related and other majors.** J Rodean. Clark Atlanta University.

10 **Health, fitness, and wellness needs of health-care professionals.** JL Drummond, WR Thompson. University of Southern Mississippi.

4:00 - 5:00 FREE COMMUNICATIONS: **Heart Disease Risk Factors**
Chair: Barbara Ainsworth
(Aud.II)

11 (4:00 - 4:15) ***Fatness, physical activity, and lipids in African-American women.** M Brown, B Ainsworth, C Berry, L Musselman, M Irwin. University of North Carolina- Chapel Hill

12 (4:15 - 4:30) ***Lipoprotein profiles of male non-smokers exposed to environmental tobacco smoke at the work-site.** KD Biggerstaff, RJ Moffatt, & BA Stamford. Florida State University and University of Louisville.

13 (4:30 - 4:45) **Relationships between blood pressure and body composition in black and white females.** LJ Brandon, MB Elliott. Georgia State University.

14 (4:45 - 5:00) ***Childhood obesity enhances blood pressure and total cholesterol independent of physical activity levels.** RG McMurray, JS Harrell, SA Gansky, SI Bangdiwala. University of North Carolina- Chapel Hill.

4:00 - 5:00 FREE COMMUNICATIONS: **Biomechanics**
Chair: Kathy Simpson
(Aud.III)

15 (4:00 - 4:15) **Effects of trial duration on stability measures.** TD Royer, SP Messier, WH Ettinger. Wake Forest University.

16 (4:15 - 4:30) ***Comparison of calculated and measured forces of the erector spinae muscles and compressive forces at L5/Si during static and quasi-dynamic lifts.** T Hortobagyi, R. Jensen, W. Boda, H. Lear, R. Andres. East Carolina University, University of North Texas, University of Massachusetts.

(4:30 - 4:45) **A two dimensional cinematographic analysis of fastballs and curveballs of youth league pitchers.** TA Ziegler, DL Blessing, T Wang, G.D. Wilson. Auburn University.

17

(4:45 - 5:00) ***3D Kinematics of the women's shot put performance at the Barcelona olympic games.** KM Mustian, JR Stevenson, RW McCoy. East Carolina University and College of William and Mary.

18

4:00 - 5:00 FREE COMMUNICATIONS: **Cardiovascular and Pulmonary Physiology**
Chair: William Herbert
(Aud.IV)

(4:00 - 4:15) **Entrainment of breathing frequency to stride frequency in trained runners.** MJ Berry, CL Pittman & CJ Dunn. Wake Forest University.

19

(4:15 - 4:30) **Cardiovascular adaptations to one-leg training.** MJ Turner, RC Claytor, RH Cox, DJ Cole. Miami University.

20

(4:30 - 4:45) ***Tolerance to lower body negative pressure (LBNP) in a healthy population.** KM Tsintgiras, JT Lightfoot. Florida Atlantic University

21

(4:45 - 5:00) **Comparison of female vs male max arm cycling responses in two postures.** P Reneau, K Thayer, P Bishop, J Smith. University of Alabama.

22

4:00 - 5:00 FREE COMMUNICATIONS: **Predicting Fitness**
Chair: Jeff Ocel
(Guilford C)

(4:00 - 4:15) **Prediction of peak VO2 in obese children during leg cycling.** M Loftin, M Sothern, S Schultz, E. Esteban & K Carlisle. University of New Orleans and LSU School of Medicine.

23

(4:15 - 4:30) **Evaluation of estimates of aerobic capacity from submaximal and non-exercise models.** MT Mahar, DA Rowe, J Gagnon, J Rock. East Carolina University, University of Georgia, and Springfield College.

24

(4:30 - 4:45) **Prediction of peak VO2 in obese children and adolescents without exercise testing.** M Sothern, M Loftin, B Warren, E. Esteban, S Schultz, K Carlisle. University of New Orleans and LSU School of Medicine.

25

(4:45 - 5:00) ***Can parents and teachers predict physical activity levels and aerobic power in children?** VD Parrish, RG McMurray, JS Harrell. University of North Carolina- Chapel Hill.

26

5:00-5:10 BREAK

5:15-6:15 TUTORIALS

Fitness, Fatness, and Cardiovascular Health in Children.
B Gutin. Medical College of Georgia.
Chair: Diane Ward
(Aud. II)

Electromyography in Exercise Science: Principles and Applications.
R Bulbulian. University of Kentucky
Chair: Jay Williams
(Aud. III)

A Multi-level Understanding of the Metabolic and Physiological Interrelationships of Disease Development, Prevention and Treatment.
CE Broeder. East Tennessee State University.
Chair: Gay Israel
(Aud. IV)

Ergogenic Aids in Endurance Sports.- Clinical Tract
DL Jackson. University of Kentucky Sports Medicine
Chair: George Wortley
(Guilford C)

6:15 - 7:45 DINNER

7:45 - 9:00 KEYNOTE ADDRESS
(Guilford B)

David Lamb, Ph.D.
School of Health, Physical Education, and Recreation
The Ohio State University
Columbus, OH

"The Mysterious Association between Dietary Carbohydrate and Athletic Performance"

SPONSORED BY GATORADE SPORTS SCIENCE INSTITUTE

BUSINESS MEETING
Mark Davis, President, SEACSM

9:00 - 11:00 SEACSM SOCIAL
(Guilford D/E)

Friday, January 21

NOTE: Remember to vote by 5 pm today!

8:00 - 12:00 REGISTRATION

8:00 - 6:00 SPEAKER READY ROOM
(Arrowhead A)

8:00 - 6:00 VISIT EXHIBITS

8:00 - 10:00 POSTER PRESENTATIONS: **Methodology Validation**
Authors present 9:00 - 10:00
(Level 3 foyer)

27 ***How well do pedometers estimate walking distances?** T Mendez, R Godsen, T Waggener, A Perdue. College of Charleston.

28 **Validation of Vacumed's Vista metabolic system.** J Blevins, C Broeder. East Tennessee State University.

29 **Electrically braked ergometers may have substantial errors.** J Smith, W Anderson, F Bishop, C Ashley, R Farley, P Reneau. University of Alabama.

30 **Risk of injury during one repetition maximum (1-RM) strength testing in elderly subjects screened for previous orthopedic injuries.** E Fish, CJ Brown, JF Carroll, BR Abadie, R Boling, D O'Nan. Mississippi State University.

31 **The reliability of bioelectrical impedance for assessing body composition during the menstrual cycle.** S Hensley, B Leutholtz, RB Kreider, E Hooker, H Jewett. Old Dominion University.

32 **Subcutaneous fat thickness as measured by magnetic resonace imaging and skinfold calpier.** LC Colvin, FJ Servedio. Valdosta State University and University of Southern Mississippi.

33 **Stability of trial curves during repeated hydrodensitometry assessments.** CL Standard, G Tyndall, RG Israel, T Hortobagyi, KF O'Brien, East Carolina University.

34 **A comparison of calculated LDL-cholesterol values using venous and capillary blood.** R Godsen, R Greer, C Frick. College of Charleston.

8:00 - 9:00 TUTORIALS

Weight Cycling in an Athletic Population: Implications for Health and Performance. B Warren. Appalachian State University.
Chair: Mindy Millard-Stafford
(Aud. II)

Exercise and Psychoneuroimmunology in Chronic Disease.
A La Perriere. University of Miami.
Chair: Lucille Smith
(Aud. III)

The Female Triad: Disordered eating, amenorrhea, osteoporosis.
BE Ainsworth. University of North Carolina- Chapel Hill.
Chair: Emily Haymes
(Guilford D)

* **Submaximal Estimations of VO_2max: Assumptions, Uses, and Pitfalls**
ET Howley. University of Tennessee.
Chair: Bob McMurray
(Aud. IV)

Clinical Tract:
Exercise Prescription for Children with Chronic Diseases: Cardiac and Pulmonary Diseases.
TA Kaplan. University of Miami.
Chair: G. Lon Morgan
(Pebble Beach)

9:00 - 9:15 COFFEE BREAK

* 9:15-10:15 **SEACSM SPECIAL TOPIC LECTURE**
(Guilford D)

James O. Hill, Ph.D.
Center for Human Nutrition
University of Colorado Health Science Center
Denver, CO

"The Role of Exercise in Obesity Treatment"

SPONSORED BY SEACSM

10:15 - 10:30 BREAK

10:15 - 12:00 POSTER PRESENTATIONS: **Competitive Athletes/Perceived Exertion**
Authors present 11:00 - 12:00
(Level 3 foyer)

35 **Anabolic steroid use among secondary school athletes.** AC McGill, JF Smith. University of Alabama.

36 **Body composition, power, and speed changes during the course of a competitive football season.** JB Hammett, GM Gillam, KM Johns. Jacksonville State University.

37 **The effects of swim-fin training on swimming and cycling performance.** MP Kelly, T Breen, KJ Finn. University of New Orleans.

38 **Low volume high intensity exercise and its impact on blood lactate in trained runners.** JE Ashton, DA Jackson, RR Pate, JL Durstine. University of South Carolina.

39 **Effects of warm-up upon cardiovascular responses to sudden strenuous exercise in competitive distance runners.** M Amaral- Melendez, E Glickman-Weiss. Louisiana State University.

40 **Development of a scale to measure perceived discomfort associated with routine physical activity of pregnant women.** C Osman, KF Burnett, A Perry, S Marquez-Sterling, JF Signorile. University of Miami.

41 **Effect of viewing music vidoes during exercise on ratings of perceived exertion.** BR Adabie, MK Chance, D O'Nan, M Lay. Mississippi State University.

42 **Effect of scale visualization on the ability to rate ratings of perceived exertion (RPE).** CJ Brown, BR Abadie, R Person, H Gentry, R McGilbra, B Jeffers, E Fish, A Brown, T Lebengood, A Mallory, S Scott, D Chewning, R Winton. Mississippi State University.

10:30 - 12:00 SYMPOSIA

Do Alterations in the Sarcoplasmic Reticulum Function Mediate Muscle Fatigue.
CW Ward, JH Williams. Virginia Tech.
Chair: Scott Powers
(Aud. II)

Student Symposium in Biomechanics.
SP Messier. Wake Forest University.
Chair: Tibor Hortobagyi
(Aud. III)

Health Care Reform and the Future of Cardiac Rehabilitation.
WG Herbert, PM Ribisl, DR Southard. Virginia Tech and Wake Forest University.
Chair: Don Bergey
(Aud. IV)

Post Exercise Hypotension: Mechanisms and Significance. JM Overton. Florida State University.
Chair: Michael Berry
(Guilford D)

Clinical Tract:
Overuse Injuries in Triathletes.
DL Jackson. University of Kentucky Sports Medicine.
Chair: David Richards
(Pebble Beach)

12:00 - 1:00 LUNCH

WOMEN IN SEACSM LUNCHEON
(Augusta)
Sign up for box lunch at registration desk

1:00 - 2:00 **SEACSM BASIC SCIENCE LECTURE**
(Guilford D)

Gary Dudley, Ph.D.
Department of Exercise Science
University of Georgia
Athens, GA

"Activity History and Skeletal Muscle Function"

SPONSORED BY SEACSM

2:00 - 4:00 POSTER PRESENTATION: **Cardiovascular Physiology/ Exercise Evaluation**
Authors present 3:00 - 4:00
(Level 3 foyer)

43 **Differences in maintenance of target heart rate during three different modes of exercise: water jogging, running, and step aerobics.** LE Thomas, MC Washam. Northeast Louisiana University.

44 ***Effects of beta-blockade on the slow component of VO_2 kinetics during high-intensity constant-load exercise.** SE Davis, CJ Womack, A Weltman, E Barrett, GA Gaesser. University of Virginia.

45 **Comparison of blood pressure responses in black and white females following different modes of exercise.** MB Elliott, LJ Brandon. Georgia State University.

46 **Cardiovascular and metabolic responses to an iyengar hatha yoga routine.** LJ DiCarlo, PB Sparling, BT Hinson, TK Snow, LB Rosskopf. Georia Institute of Technology.

47 **Effects of step distance and bench height on intensity of bench step exercise.** M Bronstein, J Smith, P Bishop, M Conerly. University of Alabama.

48 **Effect of widely varying stepping rates on physiological responses during stairmaster 4000™ (SM) exercise.** JF Carroll, E Fish, RA McGilbra, BR Abadie. Mississippi State University.

49 **Ground reaction forces in bench aerobics.** RD Moses, DL Blessing, T Wang, H Williford, M Olson. Auburn University, University at Montgomery & Huntingdon College.

50 **The energy cost of selected slide board exercise movements.** M Scharff-Olson, HN Williford, N Wang. Auburn University at Montgomery and Huntingdon College.

2:00 - 2:15 BREAK

2:15 - 3:15 FREE COMMUNICATIONS: **Aging**
Chair: Joe Houmard
(Aud. II)

51 (2:15 - 2:30) ***Oxygen uptake and heart rate responses between on land and head-out water immersion walking in the elderly.** N Takeshima & ML Pollock. Nagoya City University and University of Florida.

52 (2:30 - 2:45) **Age- related decline of fitness parameters in male firefighters.** BW Findley, LE Brown, M Whitehurst, R Gilbert. Florida Atlantic University.

53 (2:45 - 3:00) ***Influence of age and fat mass on the decline of maximal oxygen uptake in men and women.** MD Weidner, JA Houmard, MR McCammon, & D Zheng. East Carolina University.

54 (3:00 - 3:15) ***Circuit weight training effects on body composition and neuromuscular function of male and female senior athletes.** FM Powell, ME Hawkins, MC Chambers, Furman University, Greenville Athletic Club.

2:15 - 3:15 FREE COMMUNICATIONS: **Skeletal Muscle**
Chair: Bruce Gladden
(Guilford D)

55 (2:15 - 2:30) ***Exercise and beta-adrenergic modulation of cardiac myosin isoforms in the rat myocardium.** ME Wade, SK Powers, RA Herb, D Criswell. University of Florida.

56 (2:30 - 2:45) ***Lactate and mannitol have different capillary permeabilities in cat skeletal muscle.** PD Watson, MI Lindinger, MT Hamilton, DS Ward. University of South Carolina.

57 (2:45 - 3:00) ***Blood markers after two bouts of eccentrics.** JA Bond, LL Smith, D Holbert, MR McCammon, JA Houmard, K Nohammadali, RG Israel. East Carolina University.

58 (3:00 - 3:15) ***The impact of exercise training on cardiac metabolic and contractile properties of the obese Zucker rat.** GS Morris, Q Zhou, JL Ivy. Louisiana State University and University of Texas.

2:15 - 3:15 FREE COMMUNICATIONS: **Immunology and Endocrinology**
Chair: Arthur LaPerriere
(Aud. III)

59 (2:15 - 2:30) **Natural killer cell cyotoxic activity in weight lifters and sedentary controls.** DC Nieman, DA Henson, J Herring, C Sampson, J Suttles, M Conley, MH Stone. Appalachian State University.

60 (2:30 - 2:45) ***Exercise and alveolar macrophage antiviral function.** ML Kohut, JM Davis, A Ghaffar, EP Mayer, DA Jackson. University of South Carolina.

61 (2:45 - 3:00) **Opioid antagonism alters glucose homeostasis during dynamic exercise in man.** MS Hickey, SW Trappe, AC Blostein, MD Vukovich, BW Craig. Ball State University.

62 (3:00 - 3:15) **The effect of training and epinephrine infusion on potential mediators of RPE.** CJ Womack, SA Davis, E Barrett, J Blumer, AL Weltman, GA Gaesser. University of Virginia.

2:15 - 3:30 CLINICAL TRACK: **Physicians Case Abstracts**
Chair: Alan Rogol
(Pebble Beach)

(2:15 - 2:27) **Chest trauma with syncope -- football** TA Kaplan. Children's Sports and Exercise Medicine Center. **Discussor:** G. Lon Morgan, M.D.

(2:27 - 2:39) **Heel pain - triathlete** DL Jackson. University of Kentucky Sports Medicine. **Discussor:** George Wortley, M.D.

(2:39 - 2:51) **Foot pain -- football lineman** JL Moul, AN Massey. Appalachian State University. **Discussor:** David Richards, M.D.

(2:51 - 3:03) **Foot and ankle pain -- basketball** GC Wortley. Lynchburg Family Practice Residency. **Discussor:** Craig Roberts, M.D.

(3:03 - 3:15) **Painful knee effusion -- baseball player** D Richards. Lexington Clinic Sports Medicine Center. **Discussor:** David N.M. Caborn, M.D.

(3:15 - 3:27) **Acute lateral hip pain -- water skiing** CS Roberts, MG Siegel, A Mikhail, J Botsford. University of Louisville. **Discussor:** David Jackson, M.D.

2:15 - 3:15 SYMPOSIUM

Injuries, Footwear, Orthotics and Rearfoot Motion. K Simpson, B Donahue, M Pettit. University of Georgia.
Chair: Ron Bos
(Aud. IV)

3:15 - 3:30 BREAK

3:30 - 4:30 **ACSM PRESIDENTIAL ADDRESS**
(Guilford D)

Russ Pate, Ph.D.
Department of Exercise Science
University of South Carolina
Columbia, SC

"Physical Activity and Fitness in American Youth: Directions for the 21st Century"

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4:30 - 4:45 BREAK

4:45 - 6:00 **SEACSM STUDENT SYMPOSIUM**
(Guilford D)

David Hurt
Director, Holy Redeemer Hospital Wellness Center
Meadowbrook, PA

B. J. Willard, M.S.
Director, The Heart Center
Radford Hospital
Radford, VA

"Job Opportunities Outside the University Setting"

6:00 - 7:00 **SEACSM STUDENT MIXER**
(Check your registration packet for information about location)

Saturday, January 22

6:45 - 7:45 Past Presidents Breakfast (invitation only)
(Biltmore)

8:00 - 10:00 POSTER PRESENTATIONS: **Biomechanics/Skeletal Muscle**
Authors present 9:00 - 10:00
(Level 3 foyer)

69 ***Eccentric versus concentric strength training induces greater muscle hypertrophy.** JP Hill, T Hortobagyi, JA Houmard, DD Fraser, D Zheng, RG Israel. East Carolina University.

70 **Peak torque and angle specific torque knee extension and flexion bilateral deficit in females.** LE Brown, M Whitehurst, R Gilbert, BW Findley. South Palm Orthopedics.

71 ***Myotatic stretch reflex responses of the contralateral leg during ipsilateral isometric, concentric and eccentric contractions.** K Scott, T Hortobagyi, S Westbrook, J Lambert. East Carolina University.

72 **Effects of knee pain on maximal exercise blood pressure responses.** JL Taylor, ML O'Toole, JA Soberman, R Burns. University of Tennessee-Memphis.

73 **The effect of gender on load range during isokinetic knee extension and flexion exercise.** R Gilbert, LE Brown, M Whitehurst, BW Findley. Florida Atlantic University.

74 **Trunk musculature strength and chronic low back pain.** C Ashley, S Nicholson, P Bishop, J Smith. University of Alabama.

75 ***Predictors of functional lifting and carrying tasks.** S McKenzie, H Williford, J Badenhop, G Hartley, C King, D Smith, N Wang. Montgomery Rehabilitation Hospital.

76 ***The effects of intermittent ischemia and run training on the morphology of rat soleus muscle fibers.** IS Vrabas, DS Stetson, KM Norenberg, SL Dodd, JM Eason. University of Florida.

77 ****Morphological and phenotypic alterations in the soleus muscle of adult rats following clenbuterol treatment.** DS Criswell, SK Powers, RA Herb. University of Florida.

** Winner of the SEACSM Student Award (Advisor: Scott K Powers)

8:00 - 9:00 TUTORIALS

"Healthy People 2000: Objectives for Physical Activity and Fitness.
BA Ainsworth. University of North Carolina- Chapel Hill.
Chair: Jim Wright
(Aud. II)

Clinical Track:
"Nerve Injuries in Athletes"
DL Jackson. University of Kentucky.
Chair: W. Ben Kibler
(Pebble Beach)

8:00 - 9:00 FREE COMMUNICATIONS: **Clinical Exercise Programs**
Chair: Carl King
(Aud. III)

78 (8:00 - 8:15) ***Effects of aerobic exercise in normotensive adults: a meta-analytic review of clinical trials.** GA Kelly. Johnson C. Smith University.

79 (8:15 - 8:30) **Efficacy of long term participation in cardiac rehabilitation.** DG Edwards, PH Brubaker, JG Warner, BC Collier, HS Miller, PM Ribisl, DM Herrington. Wake Forest University.

80 (8:30 - 8:45) **Examination of hypertension and hypercholesterolemia as possible predictors of silent myocardial ischemia.** JA Stewart, JC Rupp. Georgia State University.

81 (8:45 - 9:00) **Effect of summer camp on physical activity patterns of patients with cystic fibrosis (CF).** TA Kaplan, G Moccia, RM McKey. University of Miami.

8:00 - 9:00 FREE COMMUNICATIONS: **Fitness and Body Composition**
Chair: Art Weltman
(Aud. IV)

82 (8:00 - 8:15) **A comparison of serum lipoprotein and body composition in college students undergoing strength versus endurance resistance training programs.** K Kwiatkowski, A Perry, F Kam, D Ferris. University of Miami.

83 (8:15 - 8:30) **The use of bioelectrical impedance to determine body fat composition in children.** CB Bradley, RG McMurray, JS Harrell. University of North Carolina- Chapel Hill.

84 (8:30 - 8:45) **Influence of water-run training on running performance and body composition.** BE Scott, RL Wilber, RJ Moffatt. Florida State University.

85 (8:45 - 9:00) * **The effects of exercise on weight gain and body image in sedentary pregnant females.** S Marquez-Sterling, A Perry, K Kwiatkowski, JF Signorile. University of Miami.

8:00 - 9:00 FREE COMMUNICATIONS: **Nutrition and Sport**
Chair: Robert Moffatt
(Guilford D)

86 (8:00 - 8:15) **Effect of increased swim training on nutrient intake and caloric balance of male and female collegiate swimmers.** GL Tynall, JA Houmard, R Kobe, D de la Sierra, M Weidner, C Standard. East Carolina University.

87 (8:15 - 8:30) ***Anaerobic capacity and performance of cyclists: effects of dietary carbohydrate manipulation.** DI Carrasco, KJ Cureton, MA Sloniger, RW Thompsom. University of Georgia.

88 (8:30 - 8:45) ***Effects of carbohydrate supplementation during intense field hockey training on dietary patterns, psychological status & performance.**RB Kreider, D Hill, G Horton, M Downes, S Smith, B Anders. Memphis State University and Old Dominion University.

(8:45 - 9:00) ***A comparison of body fat distribution and nutritional intake between highly trained and sedentary young women.** CH Adkins, BJ Warren, DC Nieman, VK Christian. Appalachian State University.

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9:00 - 9:15 BREAK

9:15 - 10:15 **SEACSM SCHOLAR LECTURE**
(Guilford D)

Kirk Cureton, Ph.D.
Department of Exercise Science
University of Georgia
Athens, GA

"Body Composition, Metabolism, Gender, and Human Performance"

SPONSORED BY SEACSM

10:15 - 10:30 BREAK

10:30 - 11:30 TUTORIALS

"Predicting Compliance and Strategies to Improve Adherence in Clinical Exercise Programs"
WR Thompson. University of Southern Mississippi.
Chair: Shala Davis
(Aud. II)

"Autonomic Adjustments to Exercise: Insights from Microneurographic Recordings."
C Ray. University of Georgia.
Chair: Ron Bulbulian
(Aud. III)

"Looking for Jobs and Funding? Look at Industrial Applications of Exercise Physiology"
P Bishop, JW Yates. University of Alabama and University of Louisville.
Chair: Laura Craft
(Aud. IV)

Clinical Track:
"The Physiology and Biomechanics of the Shoulder" B Kibler. Lexington Clinic
Chair: Alan Rogol
(Pebble Beach)

10:30 - 11:30 FREE COMMUNICATIONS: **Testing and Training of Athletes**
Chair: Joan Carroll
(Guilford D)

90 (10:30 - 10:45) **The relationship between VO_2max, using an indoor trainer with the triathlete's own bike, and sprint thiathlon performance.** FJ Servedio, R McCalip. University of Southern Mississippi.

91 (10:45 - 11:00) ***High intensity tapering improves physiologic determinants of performance in distance runners.** DA Jackson, JE Ashton, RR Pate, JM Burke, JL Durstine. University of South Carolina.

92 (11:00 - 11:15) **Reliability and practicality of the conconi running test.** BA Frishberg, T Ford, A Thornton, D Williams. South Carolina State University.

93 (11:15 - 11:30) **The relationships between three sprint exercises and performance in a sprint distance triathlon.** R McCalip, FJ Sevedio. University of Southern Mississippi.

11:30 - 1:30 **SEACSM LUNCHEON**
(Guilford B)

SEACSM LUNCHEON SPEAKER

Liz Applegate, Ph.D.
Nutrition Department
University of California
Davis, CA

"Feeding Frenzy: Athletes' Views on Nutrition"

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1:45 - 3:45 SEACSM EXECUTIVE BOARD MEETING
(Riverdale)

1:45 - HAVE A SAFE TRIP HOME!
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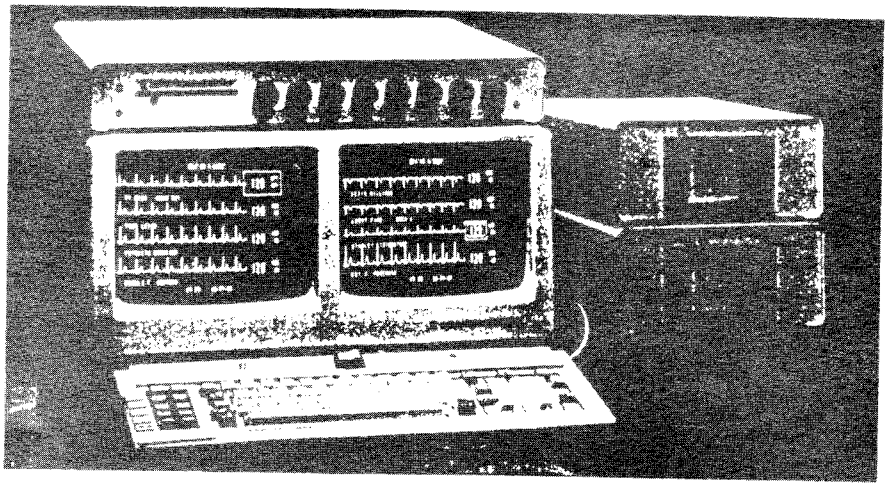

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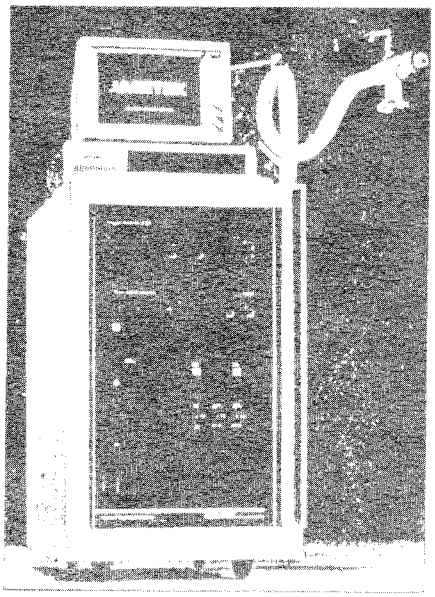

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1

BODY BUILD AS A HEAT TOLERANCE PREDICTOR FOR WORKERS WEARING CHEMICAL PROTECTIVE CLOTHING

J. Beaird, T. Bauman, J. Leeper and P. Bishop. Human Performance Lab, University of Alabama, Tuscaloosa, AL 35487-0312

Investigations by Shvartz et. al. (JAP 34: 6, 1973) and Armstrong et. al. (ASEM 62, 1991) suggested that body build might be a useful predictor of heat tolerance. The purpose of this investigation was to see if body build would correlate with work tolerance in chemical protective clothing (CPC). The Heath-Carter Somatotyping scale was used to rate 20 volunteers on endomorphy (fatness characteristics), mesomorphy (musculoskeletal development), and ectomorphy (height/weight linearity). Of these, 4 were highest in the endomorphic category, 12 were highest in the mesomorphic category, and 4 were highest in the ectomorphic category. All subjects walked on a treadmill at 1.3m/sec with a grade setting that would produce an oxygen consumption of 1.3 L/min. Subjects walked continuously until: volitional fatigue or rectal temperature of 39°C was reached (i.e., one work cycle). Subjects rested in CPC 48 min and repeated the walk until again limited by fatigue or rectal temperature. Work and rest continued until absolute fatigue or 4 hours were completed. Mean walk time was 98 min. Δ heart rate (HR), Δ rectal temp (Tre), Δ mean skin temp (Tsk), work time of the first work cycle, and total work time all failed to significantly correlate with endomorphic and ectomorphic ratings ($p \geq .05$). Correlations are shown below:

	Δ HR	Δ Tre	Δ Tsk	1st Cycle Time	Total Time
ENDOMORPY	-.34	.03	-.08	.05	.03
MESOMORPHY	.09	-.08	.51*	.23	.39
ECTOMORPHY	-.21	-.07	-.38	-.07	-.17

* significant ($p \geq .05$)

Only Δ Tsk correlated ($p \geq .05$) with mesomorphic ratings. Apparently the interaction of the many physiological responses to work in CPC precludes the use of body type categories as a good heat tolerance indicator.

2

The Effects of Caffeine Consumption Upon Performance While Running in the Heat and Humidity

Barry S. Cohen, Arnold G. Nelson, Mike Prevost, Gerald Thompson
Department of Kinesiology, Louisiana State University, Baton Rouge, LA 70803

The influence of caffeine consumption on exercise performance has remained controversial. When ingested prior to exercise, caffeine has been reported to delay the onset of exhaustion due to a stimulation of free fatty acid mobilization leading to a glycogen sparing effect. On the other hand, caffeine has been shown to exhibit diuretic effects which will stimulate the formation of urine and removal of water from the body, thereby influencing the rise in core body temperature. To examine the influence of both caffeine ingestion and heat and humidity on running performance, 7 endurance trained subjects between 23 and 51 years (5 males, 2 females) performed three 13 mile runs outdoors in a hot and humid environment (mean temp = 26°C, mean relative humidity = 88%). Anhydrous caffeine, randomly assigned in a double blind fashion, consisted of either 0, 5, or 9 mg/kg body weight. Each run was separated by 2 weeks. During each run, subjects were encouraged to ingest fluid *ad libitum* at each 3.25 mile water station. The self-reported intensity of each run by the subjects was considered to be of a near-maximal effort. Blood samples were obtained immediately before and after each run and analyzed for changes in Na^+, K^+, glucose, and hematocrit (hct). Pre and post data was collected for body weight, tympanic membrane temperature (T_{tym}), and water intake.

Means and standard deviations of physiological responses to various dosages of caffeine.

Variable	0 mg/kg	5 mg/kg	9 mg/kg
run time (minutes)	88.74 (11.66)	88.51 (9.90)	88.99 (13.04)
T_{tym} change* (°C)	0.89 (1.13)	0.68 (0.95)	0.85 (1.14)
weight change (kg)	-2.32 (0.48)	-2.22 (0.52)	-2.16 (0.55)
Na^+ change (mEq/l)	3.57 (3.26)	2.25 (5.12)	3.86 (3.98)
K^+ change (mEq/l)	-0.51 (0.56)	-0.48 (0.19)	-0.59 (0.56)
glucose change (mEq/l)	3.43 (22.68)	10.67 (15.63)	18.14 (24.53)
hct change (%)	0.58 (1.72)	2.64 (2.33)	2.73 (0.92)

* - change values represent post - pre run differences

In summary, there were no significant differences between the 3 drug treatments for any of the variables measured. Therefore it is concluded that caffeine did not exhibit beneficial or harmful effects during prolonged running in the heat and humidity.

Supported by a Gatorade Sports Science Institute Student Research Award and the Baton Rouge Clinic.

RELATIONSHIP BETWEEN BLOOD TESTOSTERONE AND BODY COMPOSITION IN PHYSICALLY ACTIVE, YOUNG ADULT MEN.

K.D. Johnston and A.C. Hackney, *FACSM*. Applied Physiology Laboratory, Dept. of P.E., Exercise & Sport Sciences, and Dept. of Nutrition, University of North Carolina, Chapel Hill, NC 27599.

The purpose of this study was to evaluate the relationship between blood testosterone levels and body composition parameters in normal, physically active, young adult men. All subjects (n = 92) in the study were competitive collegiate or recreational athletes who were of a relatively high level of physical training (i.e., > 1 hour per day spent in training). Morning resting blood samples were obtained by veni-puncture and treated appropriate to separate serum. Serum was analyzed for testosterone concentration via radioimmunoassay procedures. On the same testing day, body composition analysis was conducted using standard hydrostatic weighing procedures. Subsequently, the formulae of Brozek et al. (1963) were used to calculate the percentage of body fat, lean body mass, and fat weight of the subjects. Statistical analysis consisted of zero-order correlation's calculated between individual testosterone concentrations and body composition parameters. Results of the hormonal and body composition analysis (mean $\pm$ SEM) were as follows;

Testosterone	736.5 $\pm$ 36.5 *ng/dl*
Body Fat (%)	11.3 $\pm$ 0.5 *%*
Lean Body Mass	67.01 $\pm$ 0.89 *kg*
Fat Weight	8.80 $\pm$ 0.46 *kg*

Correlation analysis revealed a positive relationship between blood testosterone and lean body mass ($r = +0.302$, $p < 0.01$). Blood testosterone and fat weight were shown to be negatively correlated ($r = -0.203$, $p = 0.053$). The relationship between blood testosterone and percentage body fat was also negative ($r = -0.244$, $p < 0.02$). These findings suggest there are significant statistical relationships between the blood concentration of testosterone and the body composition of physical active, young adult males. In particular, the strongest relationship seems to exist between the lean body mass component of body composition, which is comprised to a large degree of skeletal muscle. However, it should be noted that while these relationships are statistically significant, the magnitude of the correlation coefficients suggest relatively weak relationships exist.

3

THE SALIVARY CORTISOL RESPONSE TO MAXIMAL EXERCISE IN HIGHLY TRAINED FEMALE DISTANCE RUNNERS.

D. Torok[1], R. Cox[2], R. Claytor[2], and D. Brown[2], [1] Florida Atlantic University, Boca Raton, FL 33431 and [2] Miami University, Oxford, OH 45056

The purpose of this study was to assess the salivary cortisol response to maximal treadmill exercise in highly trained (T) female distance runners ($\dot{V}O_{2\,max}$ 60.2± 1.0 $ml \cdot kg^{-1}\ min^{-1}$)(N=7) and female control (C) subjects ($\dot{V}O_{2\,max}$ 41.8± 0.6 $ml \cdot kg^{-1} \cdot min^{-1}$)(N=8). A graded running test (speed ≥161 m/min, 2.5% per 2 min.) was used for the T group, while a modified Balke test was used for the C group. Three maximal treadmill tests to volitional exhaustion were performed over a nine month period: Test-1-at the start of the first semester, Test-2-one month before the end of the first semester, and Test-3-at the conclusion of the second semester. The three tests were used to examine the reliability of the cortisol response to maximal exercise. Subjects were postprandial for a minimum of two hours before the maximal exercise test and performed each test at the same time of day. Before and after testing, the subjects provided a salivary cortisol sample (~2-3 mL). All samples were analyzed at the completion of test-3 and run in triplicate. The salivary cortisol response of the control group was significant greater than the trained group during tests 1 & 3 ($p<0.05$), while test 2 showed similar responses in both groups. The results of this study point to the variability of the cortisol response to the same stressor (maximal exercise) and the apparently attenuated response in highly trained distance runners.

4

5

REPRODUCIBILITY OF LOW RESTING TESTOSTERONE LEVELS IN ENDURANCE TRAINED MALES. T.A. Gulledge and A.C. Hackney, *FACSM.* Applied Physiology Laboratory, Dept. of P.E. Exercise & Sport Science and Dept. of Nutrition. University of North Carolina, Chapel Hill, NC 27599.

Previous research has reported endurance trained males have significantly lower resting testosterone levels without concurrent elevations in luteinizing hormone as compared to matched untrained males (*Med Sci Sports & Exerc.* 20:60, 1988). The purpose of this study was to determine the reproducibility of this finding in endurance trained and untrained males. Nineteen subjects (trained = 10; untrained = 9) volunteered to participate. To qualify for the trained category potential subjects had to exercise (via running, or cycling) for 60-90 min/d, 5 d/wk, for a period 5 years or greater. During the course of the study the trained subjects were instructed to maintain their normal level of exercise training. The untrained subjects were selected from sedentary individuals who performed no physical training other than occasional leisure time activities. Resting blood samples were collected on three separate (T1, T2, T3) occasions (2 week intervals between collections). At the time of collections, subjects rested quietly for 30 minutes, then blood were drawn from an indwelling venous catheter. Separated serum was analyzed for testosterone and luteinizing hormone (LH) by radioimmunoassay. Collections always took place on a Monday morning (~0800 h) after a 24 h control period in which the subject's diet and activity patterns were controlled. Results (mean$\pm$SEM) confirmed previous research as testosterone was significantly ($p<0.05$) lower in the trained compared to the untrained males (trained vs untrained; T1 5.4$\pm$0.4 vs 7.5$\pm$0.8, T2 5.0$\pm$0.4 vs 7.1$\pm$0.9, T3 6.0$\pm$0.3 vs 7.9$\pm$0.8, ng/ml). LH was not significantly ($p>0.05$) different between the groups at any time (trained vs untrained; T1 6.4$\pm$1.2 vs 5.6$\pm$0.8, T2 5.6$\pm$1.2 vs 5.4$\pm$0.8, T3 6.5$\pm$1.2 vs 4.3$\pm$0.8, mIU/ml). Furthermore, for testosterone and LH no significant changes ($p>0.05$) were observed from T1 - T3 for either group. Reliability coefficients were calculated within groups for all measures and found to range from 0.6 to 0.9. The present findings would suggest that the reproductive hormonal abnormalities associate with endurance trained males are reproducible.

6

METABOLIC SUBSTRATE RESPONSES TO SUBMAXIMAL EXERCISE IN THE MID-FOLLICULAR AND MID-LUTEAL PHASES OF THE MENSTRUAL CYCLE. A.C. Hackney, *FACSM*, M. McCracken, and B.A. Ainsworth, *FACSM.* Applied Physiology Laboratory, Dept. of P.E., Exercise & Sport Sciences, and Dept. of Nutrition, University of North Carolina, Chapel Hill, NC 27599.

This study examined substrate metabolism responses of eumenorrheic women to different intensities of submaximal exercise at the mid-follicular and the mid-luteal phases of the menstrual cycle. Nine women performed a 30 minute treadmill run in which the exercise intensity was made more difficult every 10 minutes (minutes 1 - 10, 35% VO2max; minutes 11 - 20, 60% VO2max; and minutes 21 - 30, 75% VO2max). Minute ventilation, oxygen consumption (VO2), carbon dioxide production, as measured by open spirometry, indirect calorimetry were used to calculate the non-protein respiratory exchange ratio, caloric cost, and carbohydrate - lipid utilization and oxidation rates. Results indicated the carbohydrate utilization (%/min) and oxidation (g/min) rates for the 35% and 60% intensities during the mid-luteal session were significantly ($p < 0.05$) lower than during the comparable intensities in the mid-follicular. Conversely, lipid utilization and oxidation were significantly ($p < 0.05$) greater during the 35% and 60% mid-luteal session than in the mid-follicular session. At the 75% intensity exercise level, however, the mid-luteal and mid-follicular carbohydrate - lipid utilization and oxidation rates were not significantly different ($p > 0.35$) from one another. The present findings indicate that the phase of the menstrual cycle in eumenorrheic women does influence metabolic substrate usage during low to moderate intensity submaximal exercise. These differences in substrate metabolism across the menstrual cycle phases are thought to be due to changes in the endogenous levels of the female sex hormones (i.e., estrogens and progestogens hormones).

THE EFFECT OF EXERCISE AND/OR PRELOAD ON SUBSEQUENT EATING OF RESTRAINED AND UNRESTRAINED EATERS

R.E. Keith, R.E. Carson and S.J. Weese. Dept. of Nutr. and Food Science, Auburn Univ., AL 36849

Eighty untrained, female college students were divided into unrestrained (UR) and restrained (R) eaters and assigned to one of the following test conditions: tasting only, exercise followed by tasting, preload followed by tasting and exercise/preload/tasting. Exercise consisted of 30 min of monitored, brisk walking. Preload was a 280 kcal flavored, milk-based drink. During the tasting phase subjects were left alone for 10 min to taste and rate three different types of cookies. The weight of cookies eaten served as the dependent variable. Subjects were deceived as to true intent of the project. Results indicated that UR ate significantly less following exercise (53.5±37.7 g, X±SD), preload (36.6±13.7 g), and exercise/preload (37.7±17.2 g) as compared with the tasting only session (82.5±36.6 g). For tasting only, R ate significantly less than UR (49.0±29.6 vs 82.5±36.6 g, respectively). R tasting remained unchanged throughout all treatment conditions. Unlike UR, R failed to adjust their intake with regards to exercise and preload. For UR subjects, moderate exercise prior to eating may have an appetite suppressing effect.

7

EXERCISE CHARACTERISTICS OF MALL WALKERS

T. Waggener, A. Waggener, W. Thompson, R. Smith, F. Servedio
H. Ptak, and R. Kazelskis
University of Southern Mississippi

The purpose of this study was to determine *in situ* exercise characteristics of mall walkers. Volunteers (N=94; F=68, M=26) from nine (9) Southeastern enclosed shopping centers (malls) participated in the study. $\dot{V}O_{2max}$ was obtained using the regression equasion of Rippe et al., 1988. Subjects completed informed consents and medical histories prior to participating in the $\dot{V}O_{2max}$ testing. Subjects not exhibiting any contraindications to exercise testing walked a mile, previously measured by a ROLATAPE, at a brisk walking pace.

Variable	Ranges	Mean	MD
Age (years)	22.00 - 80.00	65.30	67.0
Height (cm)	149.90 - 195.60	167.20	165.1
Weight (kg)	58.96 - 158.76	74.57	71.9
HRmax ($b \cdot min^{-1}$)	72.00 - 150.00	102.30	99.0
TTime	7.00 - 23.72	17.71	17.9
$\dot{V}O_{2max}$ (estimated) $mL \cdot kg^{-1} \cdot min^{-1}$	5.01 - 64.70	23.57	23.1

Oxygen consumption values for the subjects varied widely with age. As expected, as age increased $\dot{V}_{2max}$ decreased even though 84% of walkers walked at greater than 55% of their age-estimated maximum heart rate during the walk at a mean heart rate of 102 $b \cdot min^{-1}$. Low $\dot{V}O_{2max}$ values in some subjects may be due to the variety of chronic, degenerative disease processes reported on medical histories and normally attributed to the aging process.

Mall walking is a fast growing, popular activity with participants being primarily elderly. Mall walkers may be achieving a cardiovascular training effect if they normally walk as briskly as they did for this study and as often as self-reported (>90% reported three days or more per week).

Study endorsed by the National Organization of Mall Walkers, Hermann, MO

8

9

PHYSICAL ACTIVITY AND FITNESS IN AFRICAN AMERICAN COLLEGE STUDENTS WITH HEALTH-RELATED AND OTHER MAJORS

J. Rodean, Health and Physical Education Program, Clark Atlanta University, Atlanta, GA 30314

Patterns of physical activity (PA) and fitness were explored at one historically black Southern university. Fitness measures included body mass index (BMI), waist-to-hip ratio, body fat %, the sit-and-reach test, and a 3-min. step test which estimated VO_2. The Godin Leisure-Time Exercise (LTPA), College Alumnus (PAI), and Lipid Research Clinics PA questionnaires were used to calculate and categorize activity level (AL). Mean PAI was significantly higher ($p < .05$) for health-related (HM; n=38) compared to other majors (OM; n=38). Mean LTPA and time spent in selected sedentary activities and vigorous activity were not significantly different. The distributions of AL, BMI, and VO_2 were significantly different, with more HM in active and higher BMI categories. Although more OM reported no vigorous exercise than OM (28% vs. 18%), 68% HM and OM reported vigorous exercise ≥3 times weekly, with no significant difference in the distribution of KCALRISK using PAI or LTPA. Mean pretest and posttest knowledge scores were not significantly different for HM and OM. Sampling techniques in fitness and PA research should consider the distribution of HM and OM. Further study is suggested to explore the mechanisms for fitness and PA differences among HM and OM.

Supported by the Morehouse Research Institute.

10

HEALTH, FITNESS, AND WELLNESS NEEDS OF HEALTH-CARE PROFESSIONALS

J.L. Drummond and W.R. Thompson. Laboratory of Applied Physiology, School of Human Performance and Recreation, University of Southern Mississippi, Hattiesburg, MS 39406

Four hundred and seventy-one employees of a comprehensive medical center, 145 males (30.79%) and 326 females (69.21%), were administered a complete health, fitness, and wellness test battery prior to entrance into an employee wellness program. Ages ranged from 25 to 79 years for men ($\bar{x}$=44.06) and from 20 to 78 years for women ($\bar{x}$=43.79). Standard methods were used in data collection.

Variable	*Women ($\bar{x}$)*	*Men ($\bar{x}$)*	*Group $\bar{x}$*
Systolic BP (mm Hg)	123	129	125
Diastolic BP (mm Hg)	80	85	81
Body Fat (%)	33	23	31
$\dot{V}O_2$ max (ml · kg^{-1} · min^{-1})	29	36	31
FVC (Liters)	3	5	4
Cholesterol (mg · dl^{-1})	196	203	198
HDL-cholesterol (mg · dl^{-1})	57	45	53
CHOL:HDL-C (ratio)	4	6	4
Glucose (mg · dl^{-1})	104	108	105
Triglycerides (mg · dl^{-1})	148	191	161
Flexibility (inches)	3	2	2
Hand-Grip Strength (Kg)	30	37	34

These data illustrate that health-care providers are not setting an appropriate example for health-care receivers. Perhaps the primary concentration of health, fitness and wellness efforts should be with the health-care providers.

FATNESS, PHYSICAL ACTIVITY, AND LIPIDS IN AFRICAN-AMERICAN WOMEN

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High levels of coronary heart disease (CHD), body fatness, and low physical activity (PA) in minorities have been targeted for reversal by the Healthy People 2000 project. Body fatness is indirectly related to CHD risk by its association with low PA and atherogenic blood lipids. The purpose of this study was to identify associations between body fatness, PA and blood lipids in African-American women. Subjects were 97 women, ages18 to 40 years (mean ± SD, 27.6 ± 6.6 years). Fatness was measured by densitometry (% fat), body mass index (wt/ht^2, BMI), and waist-to-hip ratio (umbilicus/gluteal circumferences; WHR). Blood was drawn by venipuncture and analyzed for triglycerides (TG), total cholesterol (TC), low- (LDL-C), and high-density lipoprotein cholesterol (HDL-C) using a Kodak Ektachem analyzer. PA kcals/day were computed using a 7-day recall instrument. Data were analyzed using age-adjusted Pearson (r) product-moment correlational analysis (partial correlations ≥ 0.20 were significant at the .05 level). Statistically significant correlations were observed between HDL-C and % fat (-0.22), BMI (-0.20), WHR (-0.29) and between LDL-C and BMI (0.21). Correlations among PA, fatness, and other lipids were not significant ($p > .05$). Correlations between HDL-C and measures of central adiposity (skinfolds for subscapula, chest, abdomen, suprailium, axilla and circumferences for chest, waist, umbilicus) were r = -0.20 to -0.27. Correlations between HDL-C and measures of peripheral adiposity (skinfolds of triceps, biceps, thigh, patellar, calf and circumferences for thigh, calf) were r = -0.05 to -0.18. These findings show that HDL-C is inversely related to body fatness and particularly to measures of central adiposity. The lack of association between PA and lipid levels may reflect the relatively low and homogeneous levels of PA in this sample. Continued attention should be focused on strategies to reduce body fatness and increase PA levels in minority populations to decrease the risk factors for CHD.

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LIPOPROTEIN PROFILES OF MALE NON-SMOKERS EXPOSED TO ENVIRONMENTAL TOBACCO SMOKE AT THE WORK-SITE

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The purpose of this study was to examine the effect of environmental tobacco smoke (ETS) in the work place on HDL-C, HDL subfractions and apolipoproteins A-I and B. Males with no known factors influencing HDL-C (cigarette smoking, vigorous exercise, etc.) participated in one of two groups: 1) non-smokers who had never smoked, but were exposed to concentrated doses of ETS (ETS-EXPOSED, N = 7) at least 6 hrs per day, four days per week for at least the past 6 consecutive months and 2) non-smokers (NON-SMOKERS, N = 4) who had never smoked and were generally not exposed to ETS. Subjects who smoked (SMOKERS, N = 5) at least 20 cigarettes daily for the past 5 consecutive years served as controls. All groups were similar in alcohol and dietary fat (including fat type) intake. ANOVA revealed ETS-EXPOSED and SMOKERS had significantly ($p < 0.05$) lower levels of HDL, HDL_2 and apolipoprotein A-I than NON-SMOKERS. Values for ETS-EXPOSED were not significantly different from SMOKERS. HDL_3 was significantly depressed in ETS-EXPOSED when compared to NON-SMOKERS. No significant differences were observed for LDL between groups. HDL-C, HDL subfractions, and apolipoprotein A-I of the non-smoker may be adversely affected by exposure to ETS in ways similar to those observed in cigarette smokers. It is, therefore, possible that ETS exposure may be a contributing factor to increased risk of CAD by altering blood lipoprotein profiles.

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Relationships between Blood Pressure and Body Composition in Black and White females

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This study was designed to evaluate the relationships between blood pressure (BP) and body composition measurements in black and white females at rest and following a maximal Bruce treadmill (MT) test. The 18 subjects (9 black, age 23.4 yr, S 3.1, weight 59.2, S 7.4 kg; 9 white 22.8, S 2.5 yr, weight 59.5, S 10 kg) were measured for percent body fat, seven skinfolds,(chest, abdominal, triceps, thigh, suprailiac, subscapular and axilla) waist-hip ratios, baseline BP and BP immediately, 30 and 60 minutes after maximal exercise. The skinfolds were evaluated individually and as body (abdominal, suprailiac and subscapular) and as limb (triceps and thigh) comparisons. Baseline BP was the mean of three resting BP measurements. All of the subjects received all and identical treatments. Data analysis included the assessment of means, standard deviations, t-tests and correlations. There were no differences between the subjects on age, height, weight or any of the body composition or BP measurements, except for BP responses immediately following the MT test. The BP responses immediately following the maximal exercise of the black subjects were higher ($P<.05$) than the BP responses than those of the white subjects. Relationships between BP at rest and immediately following exercise with %fat, waist-hip ratio, and body skinfolds were higher for the black females than for the white females. The relationships between rest and immediate post maximal exercise BP and limb skinfolds were higher for the white females. These results suggest that with similar resting BP values, black females are more hyper responsive to maximal exercise and their fat deposits appear to have a greater influence on BP responses than in white females with similar physical characteristics.

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CHILDHOOD OBESITY ENHANCES BLOOD PRESSURE AND TOTAL CHOLESTEROL INDEPENDENT OF PHYSICAL ACTIVITY LEVELS

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This study examined the relationship between obesity (BMI & skinfolds $\geq$ 90%tile), self-reported physical activity (SRPA), and the development of cardiovascular disease risk factors in 3rd & 4th grade children. Non-obese controls (NOC) were matched for age, sex, race and height with 546 obese children (OC). Comparisons indicated that the OC had higher blood pressures (BP_{sys}: 108 ± 11 vs 104 ± 10 mmHg, $p=0.0001$; BP_{dia}: 70 ± 9 vs 68 ± 10 mmHg, $p=0.002$) and total cholesterol levels (4.44 ± 0.8 vs 4.08 ± 0.74 mmol/L, $p=0.0001$). OC and NOC had similar estimated aerobic power (VO_2max) when expressed as l/min, but lower VO_2max when adjusted for weight ($p=0.0001$). SRPA scores were similar for both groups. Further, multiple regression with 566 OC and 1618 NOC unmatched, adjusting for age, sex, race and height, indicated that obesity was significantly associated with a 0.31 mmol/L (12 mg/dl) increase in cholesterol, a 5 mmHg increase in BP_{sys}, and a 2 mmHg increase in BP_{dia} ($p=0.0001$, each). The SRPA level had no impact on obesity. These results suggest that childhood obesity increases cholesterol and blood pressure independent of physical activity levels.

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EFFECTS OF TRIAL DURATION ON STABILITY MEASURES

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Research involving stability measures of single leg stance often require the subject to maintain balance for a prescribed length of time; however, trial duration often varies among individuals. It was the purpose of this study to identify acceptable criteria for analyzing stability measures of varying duration. Eighty-eight elderly subjects with a mean (±SD) age of 68.1 ± 5.7 yr and radiographic evidence of knee osteoarthritis were instructed to perform three single leg stance trials under two conditions (eyes opened and eyes closed). Subjects stood barefoot on a force platform which sampled data at 60 Hz for a maximum of 10 s. Trial duration, total length (L) of the center of pressure (COP), average displacement of the COP (Rm), average velocity of the COP (Vel), total area (Ao), and elliptical area (Ae) were calculated (Table).

Table. Stability variables for single leg stance (M ±SD).

Variable	Eyes open	Eyes closed
Duration (s)	5.74 ± 3.59	2.24 ± 2.04
L (cm)	38.81 ± 25.76	23.0 ± 23.04
Rm (cm)	1.19 ± 0.75	1.67 ± 1.15
Vel (cm/s)	7.23 ± 3.71	10.49 ± 7.1
Ao (cm^2)	15.95 ± 15.31	13.81 ± 18.87
Ae (cm^2)	11.64 ± 17.29	18.23 ± 20.78

Trial duration was significantly correlated ($p<0.05$) with L ($r=0.81$), Vel ($r=0.23$), and Ao ($r=0.40$) for eyes open and L ($r=0.90$), Ao ($r=0.68$), and Ae ($r=0.22$) for eyes closed conditions. These data imply that subjects with greater trial duration (longer time balanced on one foot) appear less, not more, stable. While these variables are frequently reported in the literature, our results suggest variables correlated with trial time are not appropriate stability measures. Normalizing these variables to time, however, creates more suitable stability measures.

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COMPARISON OF CALCULATED AND MEASURED FORCES OF THE ERECTOR SPINÆ MUSCLES AND COMPRESSIVE FORCES AT L5/S1 DURING STATIC AND QUASI-DYNAMIC LIFTS.

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Limited data are available using a static model to predict forces in the low back during a quasi-dynamic task. The output from the static models could be used to determine maximum permissible and action limits, for use in the screening of workers for manual material handling jobs that may subject workers to excessive low back stress. We thus compared the predicted (2D static model) and measured (2D quasi-dynamic model) forces of the erector spinæ muscles (F_{es}) and the compressive forces at L5/S1 (F_c). Four men and 4 women were asked to lift, with bent legs, and place weights of 5% and 15% of body mass, on a shelf at 80% of stature. The lifts were performed on an AMTI (OR6-5-1) force platform and in front of a Motion Analysis video camera synchronized with the force plate. Kinetic and kinematic data at the beginning of the lifts were entered into a dynamic model of lifting. F_{es} and F_c were computed and compared to forces predicted by a 2D static model (University of Michigan). The calculated F_{es} (3348 N ±SD = ±1234) were significantly ($P < .05$) greater than the predicted F_{es} (2732 N ± 835). The calculated F_c (3749 ± 1297) were significantly ($P < .05$) greater than predicted F_c (3032 N ±883). There was an $r = .95$ between predicted and calculated F_{es} with an SEE of 382 N (X variable = calculated F_{es}, Y = measured F_{es}). There was an $r = .89$ between predicted and calculated F_c with an SEE of 591 N (X variable = calculated F_c and Y = measured F_c). These data suggest that, after considering a correction factor, static lifting models may be useful for the prediction of maximal permissible forces and action limits during a quasi-dynamic task.

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A TWO DIMENSIONAL CINEMATOGRAPHIC ANALYSIS OF FASTBALLS AND CURVEBALLS OF YOUTH LEAGUE PITCHERS

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The purpose of this study was to investigate the differences in kinematics between the fastball (FB) and curveball (CB) pitching motions of youth league pitchers. Eight 12 year old right-handed male pitchers volunteered to participate in the study. Pitchers were filmed by a 16 mm LOCAM motion picture camera at 200 frames per second. The results indicated that the overall pitching mechanics were the same between the two pitches. However, a significant difference ($p < .05$) was found between ball velocity at release for the FB (25.6 m/sec) and CB (21.4 m/sec), respectively. In addition, there was also a 7% greater velocity contribution of the middle finger of the FB ($P < .05$). The position of the wrist may be the cause of the differencesin velocity and segment contribution. The wrist of the curveball was supinated prior to release. While supinated, the CB wrist did not generate equal angular velocity, linear velocity, and linear acceleration as the FB. The middle finger of the CB did not generate equal linear velocity and linear acceleration. Thus these data suggest that the differences between the two pitches may be related to the position or rotation of the wrist prior to the ball release.

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3D KINEMATICS OF THE WOMEN'S SHOT PUT PERFORMANCE AT THE BARCELONA OLYMPIC GAMES.

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The purpose of this study was to determine which 3D kinematic variables significantly contribute to the distance thrown in women's shot put performance. The best two analyzable throws of the women finalists (n = 12), all gliders, were digitized at 100 Hz using 3D analysis techniques. The athletes had a mean age of 25.8 yrs ($\pm$ 2.5 SD), height of 1.8 m ($\pm$ 0.06), and mass of 94 kg ($\pm$ 8.5). Twenty-eight 3D kinematic variables along with temporal parameters were calculated for each of the 23 women's throws. The throws averaged 18.99 m ($\pm$ 0.96) at a relative release height of 1.19 x body height ($\pm$ 0.04), a release angle of 39.4 deg ($\pm$ 2.7) and a release velocity of 12.68 m/s ($\pm$ 0.41). Release velocity was the most significant predictor of distance thrown ($r = 0.74$, $p \leq .01$). 3D kinematic parameters that significantly correlated ($p \leq .05$) with release velocity were distance of the shot beyond the toe board at release (DBTB; 0.11m, $\pm$ 0.10), shoulder to hip angle at power position (SHAPP; 33.5 deg, $\pm$ 11.1) and shoulder to hip angle at release (SHAR; -27.5 deg, $\pm$ 12.7). These data suggest that increasing the DBTB, SHAR and SHAPP will increase release velocity thus producing a farther distance thrown.

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ENTRAINMENT OF BREATHING FREQUENCY TO STRIDE FREQUENCY IN TRAINED RUNNERS

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Previous research has demonstrated that trained runners have a greater minute ventilation ($\dot{V}_E$) when running as compared to walking at similar levels of carbon dioxide production ($\dot{V}CO_2$). As the metabolic rate is constant between these two conditions yet $\dot{V}_E$ is higher during running, these findings suggest a neurogenic mechanism being responsible for this hyperventilatory response. To determine if the increases in $\dot{V}_E$ are due to the neurogenic mechanism of entrainment of the breathing cycle to the stride cycle, seven well trained runners completed walk and run trials at similar $\dot{V}CO_2$ levels. During both the walk and the run trials, metabolic and gas exchange responses were measured continuously. Dominant stride and breathing frequencies were determined by spectral analysis using a fast Fourier transform. Entrainment was mathematically defined as the quotient of the stride frequency and the breathing frequency when this number would result in an integer or half integer no greater than 5. Limits of ± 0.05 of the closest integer or half integer were used as boundaries for identifying entrainment. Carbon dioxide production was not significantly different between the walk and the run trials, 2.65±0.06 and 2.67±0.08 L/min, respectively. Despite the constancy of the metabolic rate, V_E was significantly higher during the run as compared to the walk, 71.6±2.3 and 67.7±1.3 L/min. During walking, 4 of the 7 subjects demonstrated entrainment. Three of these subjects had a 2:1 ratio and the other subject had a 3:2 ratio. During running, 3 of the 7 subjects demonstrated entrainment. Two of the subjects that demonstrated entrainment had a 5:2 ratio and the third had a 2:1 ratio. Results from chi square analysis showed there was a significant difference in the observed frequency of entrainment to the expected frequency at the 0.01 level. The fact that not all runners in this investigation demonstrated entrainment would suggest that there are other mechanisms responsible for the increase in ventilation seen when comparing running and walking at equal metabolic rates in trained runners. At present, the identification of this/these factor(s) is not evident.

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CARDIOVASCULAR ADAPTATIONS TO ONE-LEG TRAINING

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The cardiovascular adaptations that occur during one-leg exercise training were measured in an attempt to determine how these responses are manifested during exercise. Each leg was trained at 85% of one-leg VO_{2peak} during 5 week training sessions. Significant increases in VO_{2peak} occurred with leg 1 and both legs following the first training period (TR1). However, following the second training period (TR2) only two-leg VO_{2peak} increased. Heart rate (HR) and ventilation decreased significantly at minute 20 of the training session following one week of exercise with each leg. An attenuated HR response was observed when day 1 of TR2 was compared to day 1 of TR1. No differences in ventilation occurred between the two training periods. Blood lactate significantly decreased during TR1 and did not differ between training periods.

Leg	Pre VO_{2peak} (L/min)	Mid VO_{2peak} (L/min)	Post VO_{2peak} (L/min)
Leg 1	2.51 ± 0.16	2.79 ± 0.12*	2.69 ± 0.18
Leg 2	2.54 ± 0.15	2.51 ± 0.16	2.67 ± 0.21
Both	3.24 ± 0.22	3.50 ± 0.26*	3.65 ± 0.32*†

Data are presented as Means ± SEM.

*Significantly different from pretraining VO_{2peak}; $p<0.05$.

† Significantly different from midtraining VO_{2peak}; $p<0.05$.

These data suggest that central and peripheral factors play mediating roles in the exercise training responses. Thus, the interplay between central and peripheral circulatory adjustments is necessary for the adaptations to aerobic exercise training.

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TOLERANCE TO LOWER BODY NEGATIVE PRESSURE (LBNP) IN A HEALTHY POPULATION

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Numerous studies use presyncopal LBNP exposures to test reflexes to central hypovolemia. However, there is no population data concerning LBNP tolerance. Furthermore, the validity of common LBNP tolerance indices has not been investigated. LBNP tolerance data from 119 subjects (86 males, 33 females; 24±5 yrs; 71.7±12.6 kg; 173.4±11.0 cm) were analyzed. During LBNP, heart rate, blood pressures (systolic, diastolic, and mean), forearm blood flow, forearm vascular resistance, and change in leg circumference were measured. All LBNP exposures were terminated with the onset of presyncopal signs and/or symptoms. LBNP tolerance was quantified using four different indices: duration of exposure (DUR); maximal negative pressure tolerated (MNP); cumultative stress index (CSI); and the LBNP tolerance index (LTI). Average LBNP tolerance was 22.12±0.46 min (DUR), -77±2 mm Hg (MNP), 975±37 mm Hg•min (CSI), or 222±5 mm Hg•min (LTI). The cardiovascular parameters exhibited the same responses as have been documented in the literature. DUR, MNP, and LTI were normally distributed with kurtosis and skewness not different from zero. However, CSI in this population was not normally distributed. Variances of all tolerance indices were homogenous. Additionally, LTI was more closely representative of published central venous pressure LBNP responses (r^2=0.59). Age, weight, height, and gender were not associated with LBNP tolerance, but $\dot{V}$O2peak (n=86) exhibited a weak negative correlation with LBNP tolerance (p=0.04, R^2=0.05). We have established normative LBNP tolerance values in a large, healthy population. Given our results, it appears that the LTI is the most valid index of LBNP tolerance. Additionally, LBNP tolerance is not related to physical parameters, with the exception of a weak relationship with VO2peak.

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COMPARISON OF FEMALE VS MALE MAX ARM CYCLING RESPONSES IN TWO POSTURES

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Supine exercise is not well understood. The purpose of this study was to compare VO2, plasma volume (PV) expansion, and heart rates (HR) between a supine (SU) and upright (UP) maximal arm cycling exercise (ACE) in females (F) and males (M). Posture-stabilized hematocrit (HCT) was measured pre, immediately post-, and 24 hours post-test to assess PV shift in 6 F subjects (age=22.2±1.9 years, ht=161.9±6 cm, wt=58.9±7.8 kg) who performed an ACE UP and SU. Test duration (SU=5.5±1.4 min; UP=6.2±0.4 min), peak VO2 (SU=18.9± 3.7; UP=19.9±2.3 ml/kg/min), VO2 at each min, recovery HR at 1, 3, 5, and 10 min, acute PV response (SU=2.3; UP=-6.2%) and pre- vs 24 hour post-test PV response (SU=5.6; UP=-0.8%) were not significantly different (p>.05). However UP work HR was significantly higher than SU at 2, 3, 4, and 5 min and peak (p<.05). In comparison, M (measured in a previous study) showed a significant difference (p<.05) between postures in recovery HR at 1, 3, and 5 min and pre- vs 24 hour post-test PV change. Repeated measures ANOVA revealed a difference (p<.05) between sexes in the pre vs 24 hour PV response SU (M=-5.13±7.4; F=5.59%±7.12) and between peak VO2 (M=27.1 ±4.3; F=19.4±3.0 ml/kg), and also between postures for peak HR (SU=137.3±17.5; UP=150.0±19.9). SU posture elicits a lower peak HR than UP posture in an ACE max test.The difference in muscularity and muscle distribution of M vs F may contribute to cardiovascular responses which might impact 24 hour PV response and peak VO2.

PREDICTION OF PEAK VO_2 IN OBESE CHILDREN DURING LEG CYCLING

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In many settings that involve children's fitness, the actual measurement of VO_2 is often not feasible or practical. Consequently an accurate estimate of VO_2 is essential. The present study was undertaken to examine the validity of a new prediction equation that includes work rate (W), pedal rate and body weight as independent variables (Berry, et al., MSSE, 1993). We tested the efficacy of this model in a population of obese children. As part of a weight loss program sixteen obese children completed a Peak VO_2 test on a Monark bicycle ergometer. Physical characteristics included the following: (mean $\pm$ SD) Age (yrs) 12.7 $\pm$ 2.7, BW (kg) 77.7 $\pm$ 27.9; Ht (m) 1.52 $\pm$ 0.1; % Fat 42.7 $\pm$ 7.2; Peak VO_2 1.43 (l/min) $\pm$ 0.32; Peak VO_2 19.8 (ml/min/kg BW) $\pm$ 4.6; Pedal rate (rpm) 52.4 $\pm$ 7.2; Work rate (W) 93.0 $\pm$ 13.1. In the Berry, et al. (1993) equation: VO_2 (ml/min) = 10.9 (work rate, W) + 8.2 (pedal rate) + 8.3 (body weight, kg) - 559.6, $R^2 = 0.95$, SEE = 120.3 ml/min. Using this equation a predicted Peak VO_2 value of 1.52 $\pm$ 0.31 (l/min) was found with a correlation of 0.80 between actual and predicted VO_2 with no significant difference ($p \leq 0.05$) noted. Also, a correlation of r = 0.80 was found between VO_2 (l/min) and BW. Thus as BW (kg) increased VO_2 (l/min) increased. This new equation may particularly be applicable for obese populations since, in addition to W and pedal rate, BW is part of the equation.

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EVALUATION OF ESTIMATES OF AEROBIC CAPACITY FROM SUBMAXIMAL AND NON-EXERCISE MODELS

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When direct measurement of maximal oxygen uptake (VO_2max) is not feasible, aerobic capacity is often estimated from submaximal tests. The purpose of the present study was to evaluate the accuracy of three modes of exercise testing and a non-exercise model used to predict VO_2max. Single stage submaximal tests were conducted on a cycle ergometer, treadmill, and step for all subjects. Subjects were 15 men and 17 women aged 20 to 34 years (M = 23.1 ± 3.4 years). VO_2max was assessed by open-circuit spirometry on a treadmill (M = 51.3 ± 7.3 $ml \cdot kg^{-1} \cdot min^{-1}$) and on a cycle ergometer (M = 47.8 ± 7.5 $ml \cdot kg^{-1} \cdot min^{-1}$) for all subjects. VO_2max was estimated from one heart rate response to a submaximal power output on each mode of exercise. VO_2max was also estimated from a non-exercise model. The multiple correlations for the models ranged from R = .47 to .62. The standard errors (SEs) of the models ranged from 6.4 to 11.9 $ml \cdot kg^{-1} \cdot min^{-1}$. Repeated measures ANOVA revealed a significant ($p < .05$) mean difference only between measured treadmill VO_2max and VO_2max estimated from the submaximal treadmill test. Estimated VO_2max from the submaximal treadmill test was also significantly higher ($p < .05$) than all other estimates of VO_2max. The non-exercise model was more accurate (SE = 6.4 $ml \cdot kg^{-1} \cdot min^{-1}$) than the single stage models and the step test appears to be more accurate (SE = 8.2 $ml \cdot kg^{-1} \cdot min^{-1}$) than the cycle (SE = 11.9 $ml \cdot kg^{-1} \cdot min^{-1}$) and the treadmill tests (SE = 11.4 $ml \cdot kg^{-1} \cdot min^{-1}$). Standard errors followed the same pattern when males and females were examined separately.

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PREDICTION OF PEAK VO_2 IN OBESE CHILDREN AND ADOLESCENTS WITHOUT EXERCISE TESTING

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Conventional field tests for predicting PEAK VO_2 may not be appropriate for use in the obese pediatric population. Jackson, et al., (MSSE, 1990) recently examined a non-exercise model which included a physical activity scale (PA-R), % fat or BMI and age to predict peak VO_2 in adults (R=.82). In a previous study we found %fat and PA-R to account for 25.7% and 16.2% of the PEAK VO_2 variance in a group of non obese female youth (n=34). In the current study we examined the applicability of the model in 16 obese youth (m=1, f=15). Physical characteristics included the following: (mean $\pm$ SD) Age (yrs): 12.1 $\pm$ 2.8, BW (kg): 81.8 $\pm$ 28.9, Ht (m): 1.5 $\pm$ 0.1, %fat: 43.2 $\pm$ 7.5, BMI: 33.8 $\pm$ 8.2. Peak VO_2 was measured during treadmill walking. A Sensormedics MMC was used for VO_2 assessment with heart rate (HR) measured via a POLAR VANTAGE XL monitor. Percent fat was estimated from bioelectrical impedance (Goran, et al, 1992). The PA-R self-report instrument (Ross and Jackson, 1990) ranges from 0 - 7 (least to highest PA level). Peak $V0_2$, HR, RER and PA-R averaged 19.8 ml/min/kg BW $\pm$ 4.4; 180.7 $\pm$ 16.6; 0.98 $\pm$ 0.08; 2.8 $\pm$ 1.0, respectfully. Pearson r values for peak VO_2 with PA-R, %fat, BMI and age were: 0.54, 0.71, -0.63, -0.39, respectfully. In a forward selection multiple regression model, an R of 0.568 was found with %fat and PAR as the best predictors of peak VO_2. In this model, %fat accounted for 50.7% of the variance with PA-R adding another 6.1%. These data indicate this model may be a promising method for predicting PEAK $V0_2$ in obese youth.

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CAN PARENTS AND TEACHERS PREDICT PHYSICAL ACTIVITY LEVELS AND AEROBIC POWER IN CHILDREN?

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The purpose of this study was to determine the importance of using parent's and teacher's evaluations to predict the VO_2max and physical activity (PA) levels of children. The subjects were 1490, 4th & 5th graders, their parents, PE teachers and classroom (CR) teachers. The children completed a self-administered physical activity questionnaire (PAQ), had their height, weight, and skinfolds (tricep & subscapular sites) measured and their VO_2max predicted by submaximal cycle ergometry. Their parents, CR and PE teachers rated the child's PA and VO_2max on a 1-4 (low - high) scale. Pearson correlations revealed that the best correlate of the child's VO_2max was the PE teacher's rating ($r=0.42$, $p<0.01$), while the CR teacher's report was the best correlate of the child's PA ($r=0.25$, $p<0.05$). Multiple regression analyses using anthropometrics (age, sex, height & skinfolds) to predict VO_2max resulted in an $R^2=0.48$; $p<0.0001$. The addition of the parent's and teacher's reports improved the model by 6% ($R^2=0.54$; $p<0.0001$); only the mother's and PE teacher's estimates significantly contributed to the variance. The anthropometric model to predict PA from the PAQ was poor ($R^2=0.04$; $p<0.01$). The inclusion of the parent's and teacher's reports improved the model ($R^2=0.07$; $p<0.0001$); only the father's and CR teacher's reports significantly contributed to the variance. These data suggest that to improve the ability to predict VO_2max the PE teacher should be asked to provide an assessment. Further, there seems to be little relation between the child's and his/her teacher's or parents' perceptions of PA levels.

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HOW WELL DO PEDOMETERS ESTIMATE WALKING DISTANCES?

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This study was conducted to evaluate the accuracy of pedometers for estimating walking distance. Twenty-one college-affiliated adults volunteered to participate in the study. Subjects tested five pedometer models (two units each) under two conditions: walking a measured mile on a treadmill, and walking a measured course (1.6 miles) in a local neighborhood. A comparison of the observed values to the actual mileage revealed that these pedometers performed poorly. The average absolute errors (|Actual-Observed|/Actual*100) ranged from 17.1% to 62.4%. Relative failure rate (no data collected) was 1.3%; there was one complete failure (device never functioned). All models performed significantly worse than a reasonable standard of accuracy (90% accurate, 95% of the time).

PEDOMETER SUMMARY, BY MODEL

Condition/Test	1 ($30)	2 ($30)	3 ($20)	4 ($14)	5 ($12)
|Average % Error|, Treadmill	17.10	43.85	21.42	44.95	17.28
|Average % Error|, Street	18.05	36.15	34.25	62.45	19.60
P, testing model against standard	0.01	0.01	0.01	0.01	0.01

Correlations between clones were often low (0.85 to 0.17), suggesting poor quality control or perhaps basic design flaws. We conclude that these pedometers give unacceptably poor distance estimates;we would **not** recommend them for controlled exercise or clinical settings.

VALIDATION OF VACUMED'S VISTA METABOLIC SYSTEM

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Twelve subjects volunteered to participate in this study to validateVacumed's Turbofit Metabolic Software/Windows, Version 3.2b with data collected using their metabolic measurement system (VMS). The data collected was compared to a previously validated system (SensorMedics Corp., S2900). Trials consisted of a test-retest reliability protocol followed by a validation protocol comparing the metabolic systems' output to a standardized prediction cycle ergometer workload equation (ACSM). Trials consisted of five, 5-min stages: rest, free-spin (VMS only), 240 kpm, 480 kpm, and 720 kpm. Mean values of the last three minutes of each stage were recorded simultaneously for ventilation (STPD), oxygen consumption (O_2), carbon dioxide production (CO_2), respiratory exchange ratio (RER), $\%O_2$, and $\%CO_2$. A pnuemotachometer was used between each metabolic unit in the validation protocol to determine ventilation values and to verify deadspace volume losses. Regression analyses showed both systems to be highly reproducible (VMS: r=0.98, SEE=49ml; S2900: r=0.99; SEE=59ml). The ACSM prediction equation used for O_2 underestimated the actual values measured on both systems by approximately 200 mls which agrees with a recent study (Latin et al., 1994; Med. Sci. Sports & Exercise).

ALL MEASUREMENT PERIODS COMBINED *(† = $p \leq 0.05$)*

SYSTEM	Vent (L)	O_2 (mls)	CO_2(mls)	RER	$\%O_2$	$\%CO_2$
VMS	21.9	938	926	0.95	16.6	4.0
S2900	21.1	921	864	0.90†	16.6	4.0

It was concluded that both metabolic systems were reliable and valid for determining metabolic parameters at rest and during exercise. However, a statistically significant difference in RER between the two systems occurred which could not be explained by a difference in $\%O_2$ and $\%CO_2$ values. Further research is needed to explain this difference.

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ELECTRICALLY BRAKED ERGOMETERS MAY HAVE SUBSTANTIAL ERRORS

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Some cycle ergometers used in training and research are electrically braked and supposedly account for variations in pedal frequency. One of the problems with these ergometers is that they are difficult to calibrate. We measured the VO_2 and heart rate (HR) of thirteen subjects (8m, 5f)(mean age = 26.4 yrs; mean weight = 70.2 kg; mean %fat = 12.1%), who cycled for 8 min on a Lifecycle (Life Fitness, Inc.) at two frequencies (80 and 100 rpm). Dependent t-tests demonstrated that VO_2 ($t=-5.79$, $p<.05$) and HR ($t=-6.19$, $p<.05$) were significantly greater for 100 rpm indicating that the higher frequency required a significantly greater amount of work and that resistance had not been accomodated for these two frequencies (assuming little variation in mechanical efficiency). Using measured VO_2 and RER, calculated caloric expenditure varied from that shown on the cycle (same 54 kcal value for all tests) by 13% at 80 rpm and 35% at 100 rpm. These preliminary results suggest that electrically braked cycle ergometers should be calibrated or tested periodically across rpm's and relative to each other.

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RISK OF INJURY DURING ONE REPETITION MAXIMUM (1-RM) STRENGTH TESTING IN ELDERLY SUBJECTS SCREENED FOR PREVIOUS ORTHOPEDIC INJURIES

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Previous studies have indicated that 1-RM testing is contraindicated in elderly subjects due to the reported increased risk of injuries (Pollock et al., 1991; Grubs et al., 1982). This study attempted to determine the injury rate of elderly subjects performing two 1-RM chest press and leg press strength tests, who had been thoroughly screened for previous orthopedic injuries. A total of 20 male subjects ranging in age from 60 to 73 yrs were recruited for the study. One subject was eliminated from 1-RM chest press strength testing due to previous orthopedic injury of the upper extremity. Three subjects were also eliminated from 1-RM leg press strength testing due to previous orthopedic injury of the lower extremity. Therefore 19 subjects performed two 1-RM chest press strength tests and 17 subjects performed two 1-RM leg press strength tests. No injuries (A subject was considered to be injured if daily physical activities had to be stopped or significantly altered for at least one week.) were reported during either 1-RM chest press or leg press strength testing. These results support Pollock's et al. (1991) suggestion that most injuries during 1-RM testing resulted from previous orthopedic injuries.

THE RELIABILITY OF BIOELECTRICAL IMPEDANCE FOR ASSESSING BODY COMPOSITION DURING THE MENSTRUAL CYCLE

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Numerous studies have reported the validity of Bioelectrical Impedance Analysis (BIA) as an accurate tool for assessing body composition. Few studies have investigated the reliability of the analyzers during repeated assessments. Moreover, less is known regarding the reliability of BIA measurements during various phases of the menstrual cycle. Seven female subjects (mean age 23.6±3.4 years) underwent BIA four times during the menstrual cycle in order to determine the reliability of BIA in females using the Valhalla model 1990B plethysmograph. Subjects were tested three consecutive times on four seperate occasions corresponding to days 1, 4, 14, & 21 of their menstrual cycle. During each assessment, electrodes were placed on the subject following standard procedures. Electrodes remained in place during each of three assessements performed in succession in order to minimize inter-test variance and provide a means of determining reliability of the BIA instrument. The following variables were assessed: Resistance in ohms (R), Reactance (X_c), Impedance in ohms (Z), Phase Angle (PA), Lean Body Weight (LBW), Fat Weight (FW), and Percent Body Fat (%BF). Pearson Correlation Coefficients were performed on all BIA data collected on days 1, 4, 14, & 21 to determine instrument retest reliability throughout the study. In addition, day to day reliability (days 1, 4, 14, & 21) were determined for each test. Analysis of test-retest reliablity revealed Pearson Correlation Coefficients (r) ranging from 0.99 to 1.00 for R, 0.95 to 1.00 for X_c, 0.99 to 1.00 for Z, 0.94 to 1.00 for PA, 0.99 to 1.000 for LBW, 0.99 to 1.00 for FW, and 0.99 to 1.00 for %BF. Day to day variance analysis revealed Pearson Correlation Coefficients (r) ranging from 0.78 to 1.00 for R, -0.03 to 1.000 for X_c, 0.79 to 1.000 for Z, -0.60 to 1.00 for PA, 0.90 to 1.00 for LBW, 0.95 to 1.00 for FW, and 0.92 to 1.00 for %BF. The greatest day to day variation occurred in X_c and PA data on day 4 of the menstrual cycle coinciding with completion of menses/commencement of the follicular phase. BIA data analyzed for days 1, 14, and 21 of the menstrual cycle were highly correlated. Results reveal that BIA provides strong test-retest reliablity. However, day to day variances in X_c and PA may occur in females depending on the day of the menstrual cycle.

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SUBCUTANEOUS FAT THICKNESS AS MEASURED BY MAGNETIC RESONACE IMAGING AND SKINFOLD CALPIER

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Fat thicknesses measurements are often used to provide an index of subcutaneous body fat. Although frequently utilized and practical for every day use, there are disadvantages in using calipers, as they compress the fatty tissue, and there is a limit to the size of the skinfold they can pinch. The purpose of this study was to compare the fat thicknesses measured from magnetic resonance imaging (MRI) with the thicknesses estimated from skinfold calipers (SF). Twenty three (23) 7-12 year old males and females volunteered to participate in the study. Twelve skinfold sites were chosen on the basis of their frequent use for both determining body density and for anthropometric classification at selected sites (T=triceps, B=biceps,CH = chest, FL = $forearm_{lateral}$, ABD = abdomen, SI = suprailium, TL = $thigh_{lateral}$, AT = anterior thigh, C = calf, ST = sternum, SS = subscapular, SC = subcostal). The chosen arrangement represented a good spread of sites over the body surface area. Cross-sectional MRIs were made at positions on the body corresponding to the 12 sites. Fat thickness was also estimated using Lange skinfold calipers (Table).

Table. Fat thicknesses for MRI and calipers (SF) sites (* significant at $p < .05$)

	T	B	CH	FL	ABD	SI	TL	AT	C	ST	SS	SC
MRI	8.19*	7.17*	12*	5.84*	12.4*	7.48*	22.3*	11.1*	7.22*	6.58*	7.01*	7.8*
SF	13.3	8.13	9.4	9.65	14.3	12.1	22.6	18.6	13.7	6.0	10.0	7.44

After statistical analysis using Pearson correlation coefficients, it was revealed that all skinfold sites were significantly correlated. A very high correlation existed for subcostal (r = .9821) and abdomen (r = .9255), a high correlation for thigh (r = .8934), calf (r = .8275), $thigh_{lateral}$ (r = .8207), chest (r = .7700) and $forearm_{lateral}$ (r = .7000). Moderate correlations existed for suprailium (r = .6741), subscapular (r = .6667), tricep (r = .6381) and sternum (r = .5532) and a low correlation existed for bicep (r = .4997). It can be concluded that the most closely related were subcostal, abdomen, thigh, calf, thigh lateral, chest, and $forearm_{lateral}$. Sites that would be most useful could included abdomen, calf and $forearm_{lateral}$. These sites represent anatomical landmarks in three different body regions and could be indicative of a good overall subcutaneous fat measure and could be used to write new skinfold equations.

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STABILITY OF TRIAL CURVES DURING REPEATED HYDRODENSITOMETRY ASSESSMENTS.

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We have previously reported that the mean of underwater weighing trials 4,5, and 6 provides a valid or "true" measure of underwater weight (UWW) for determining percent body fat (Obesity Research, 1993) during hydrodensitometry as opposed to the conventional method of using the mean of trials 8, 9, and 10. The purpose of the current study was to assess the pattern of underwater weighing trials during repeated hydrodensitometry assessments. In 27 Caucasian females (age 19.3y, height 168cm, mass 61kg) we compared trial curves for ten consecutive underwater weighing trials, conducted on three separate visits, over a four month period. Mean percent fat (23%) did not change significantly ($p > .05$) across the three assessments. Repeated measures ANOVA for trials polynomial curve comparison revealed no statistically significant ($p > .05$) differences in the underwater weighing trial curves. These data suggest that performance curves for underwater weighing appear to be repeatable and that approximately six trials are needed to establish "true" underwater weight even in experienced subjects.

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A COMPARISON OF CALCULATED LDL-CHOLESTEROL VALUES USING VENOUS AND CAPILLARY BLOOD.

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Blood lipid screening is widely practiced by many groups today, and it is common to estimate blood lipid profiles using capillary blood. Since risk profiles are based upon venous values, however, it is imperative to determine whether capillary values and venous values are equivalent. That was the purpose of this study. Venous and capillary samples were taken from twenty-three adult volunteers who reported to the lab rested and in a fasted state. Five milliliters of blood was drawn from a forearm vein, and a fingertip sample was drawn from a non-dominant hand within minutes. Cholesterol, triglyceride, and HDL-cholesterol concentrations in these samples were analyzed by a Kodak DT-60 analyzer. LDL-cholesterol (LDL-C) was calculated according to the method of Friedewald. A paired "t" test was performed on these capillary and venous LDL pairs to determine if the two values were significantly different; a Pearson R was calculated as well. The mean values differed very little (cap, 86.7±5.7 mg/dl; ven, 88.1±5.3 mg/dl; $P=0.48$), and the correlation between venous and capillary values was very high ($R=0.94$). This suggests that, for groups, there is essentially no difference between LDL-C values calculated from capillary and venous blood. The individual picture may be quite different, however. There were five instances (22% of cases) in which the difference between capillary and venous values exceeded 12 points. One case elicited a 20-point difference. This suggests that one should use caution interpreting individual capillary LDL-C values, particularly at the risk category interfaces.

ANABOLIC STEROID USE AMONG SECONDARY SCHOOL ATHLETES

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A total of 867 student athletes between the ages of 14 and 19 were surveyed by questionnaire as to their use and knowledge of anabolic steroids. The 640 boys and 222 girls answered the questions as part of a pre-participation physical screening exam for the sport they desired to play in the '93-'94 school year. Anabolic steroid use was found to be 1.4%. Oral and injectable steroids were each used by 42.9% of the user group while 14.3% used both. Cycle length was <6 weeks for 75% of the users and 6-9 weeks for 25%. 50% did only 1 cycle while 25% each did 2-4 and 5 or more cycles. Among non-users, 15.3% know somebody who is using steroids, 31.1% claim it would be easy to obtain steroids and 30.8% believe that using steroids would make their physique worse. The largest percentage of non-users (26.0%) obtain their information about steroids from coaches while 27.3% of the users relied on teachers/textbooks. These data indicate that steroid use in this geographical location is lower than use in other areas of the country as reported in previous studies. The data also provide valuable information to educators of secondary school athletes who wish to teach students about steroids.

BODY COMPOSITION, POWER, AND SPEED CHANGES DURING THE COURSE OF A COMPETITIVE FOOTBALL SEASON

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The purpose of this study was to investigate changes in body composition, power, and speed in high school football players during the course of a competitive football season. Thirty-six first-team high school football players volunteered and completed all phases of the evaluation. Testing was conducted five times during the season: the week prior to the beginning of fall practice (T-1); the beginning of the third week of practice (T-2); the week of the first game (T-3); the beginning of the third week of the season (T-4); and the final week of the season (T-5). All athletes (from each of the four high school represented) participated in similar training programs (i.e., conditioning, weight training, number of weekly practices, time per practice session, etc.) prior to the beginning of fall practice, during preseason, and during the season. Measurements included: total body weight (W), skinfold measurement (SF), vertical jump (VJ), and 40 yard sprint speed (S). Repeated measures ANOVA with Scheffe comparisons of treatments identified a significant ($P<.05$) decrease in W from T1, T2, T3, and T4 to T5. There was also a significant decrease in W from T2 and T3 to T4. A significant decrease was noted in SF from T1 to T3, T4, and T5. SF decrease significantly from T2 to T4 and T5. From T1 to T2 VJ decreased significantly; however, it increased significantly from T1 to T5. A significant increased was noted in VJ from T2 to T3, T4, and T5. VJ also increase significantly from T4 to T5. S decreased significantly from T1 to T2, T3, and T4. However, S increased from T2, T3, and T4 to T5. These data suggest that preseason training has a positive influence on W and SF; whereas, in-season training negatively affects W and SF. However, preseason training appears to have a negative influence on VJ and S, which last into the season. Yet, these measures return to or exceed preseason levels by the end of the season.

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THE EFFECTS OF SWIM-FIN TRAINING ON SWIMMING AND CYCLING PERFORMANCE.

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Training with swim fins is becoming a normal part of most swim programs in both competitive and non-competitive settings through-out America. Competitive swimmers use them to maintain a higher (level to the water surface) profile, practice faster arm stroke turnover and recreate racing velocity swimming. This sprint-assisted method of training has been shown to be effective in producing faster swim times (Rowe, 1977). A previous study by our group showed no increase in physiologic demand despite faster swim times and decreased arm turnover. The purpose of this study was to determine 1) if the type of fin (long or short) would improve non-fin performance in non-competitive subjects 2) determine at what distance greatest improvements would occur and correlate the physiologic responses to the changes and 3) determine if fin training caused cross training effects to enhance leg endurance on a cycle ergometer and swim kick test.

The subjects were taken from a college swim class and randomly divided into control (no-fin), short fin (Zoomer), and long fin (standard) training groups. After an initial swim trial subjects were further grouped into 1) skilled 2) moderate and 3) novice swimmers. The subjects trained equal volumes which was progressively increased with 40-45% of the training yardage with fins.

The subjects were tested for 500yd, 200yd, and 3 x 100yd (2:1 work to rest ratio intervals) time trials before and after; and a 50 yard kick-board test and progressive sub-max stress test were also performed before and after training. Blood lactate was collected 90 seconds after completion of the 3 x 100yd swim trial. Heart rates were monitored (Vantage-XL,Polar) after the 3 x 100yd and continuously during the cycle test. The results showed no significant improvement in swimming performance when comparing long, short, and no fin groups for the improvements on the 500 yd, 200 yd, 50 yd kick, or 3 x 100yd intervals (averaged) nor in lactate levels. Significant differences were found for decrease in heart rates at given workloads on the cycle ergometer for short and long fin groups in all levels on the with the long fin group having less decrease. There was a significant within group difference (before-after) for all groups for 500-, 200-, and 3 x 100-, and 50- yd kick tests. It was concluded that swim fins during training in novice swimmers do not improve swim time performance, over non-fin training.

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LOW VOLUME HIGH INTENSITY EXERCISE AND ITS IMPACT ON BLOOD LACTATE IN TRAINED RUNNERS

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The purpose of this study was to determine the effects of a six day reduction in exercise training (taper) characterized by low volume high intensity training regimen on submaximal and maximal blood lactate concentrations in sixteen well trained distance runners (age 28.3 ± 1.9 years, $\dot{V}O_{2max}$ 68.1 ± 1.1 $ml \cdot kg^{-1} \cdot min^{-1}$, present training volume 89 ± 8 km/week; mean ± SE). Each subject completed a treadmill testing session to become familiar with all testing procedures. Subjects were matched on treadmill performance time and $\dot{V}O_{2max}$ and then divided into either a taper (TAP) or control (CON) group. The taper period was six days in length, and each subject in the TAP group reduced their total training volume by 70% from the previous week. Approximately one half of the reduced training was completed with high intensity interval work. The control group continued their normal training regimen for a six day period. Submaximal and maximal treadmill performance measurements were completed one day before (pre) and immediately after the taper (post). Time to exhaustion during the maximal exercise test, $\dot{V}O_{2max}$, submaximal and maximal blood lactate concentrations were used as performance measures. Time to exhaustion and $\dot{V}O_{2max}$ were not significantly different after the taper period for either the TAP or CON groups. Submaximal blood lactate values were significantly lower (pre 1.20 ± .002, post 1.10 ± .003 mM, $p<0.05$), and maximal blood lactate values were significantly higher (pre 6.52 ± .004, post 7.01 ± .005 mM, $p<0.05$) after the taper for TAP. No differences in submaximal (pre 1.37 ± .003, post 1.37 ± .004 mM) or maximal (pre 6.67 ± .008, post 6.69 ± .005 mM) blood lactate concentrations were found for CON. These findings indicate that this six day taper regimen did reduce submaximal blood lactate concentrations in TAP runners during submaximal work while TAB subjects were able to tolerate higher maximal blood lactate concentrations during maximal work.

EFFECTS OF WARM-UP UPON CARDIOVASCULAR RESPONSES TO SUDDEN STRENUOUS EXERCISE IN COMPETITIVE DISTANCE RUNNERS

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Previous investigations have examined the effect of sudden strenuous exercise without prior warm-up in sedentary high risk individuals. However, the present investigation examined the effects of a warm-up prior to sudden strenuous exercise on cardiovascular and electrocardiographic responses in competitive male distance runners (n=11) and an age matched apparently healthy control group (n=12). Ss were randomly assigned to two treatments, treatment I a treadmill (TM) run at 90% VO_2 max for 2 min, followed by a 6 min recovery period (walking on the TM at 40% VO_2 max) or treatment II a 10 min warm-up on the TM (at 60% of VO_2 max), followed by a run at 90% VO_2 max and recovery. The dependent variables were: ECG ST segment deviation, heart rate (HR), blood pressure (BP), and rating of perceived exertion (RPE). HR differed ($p<0.05$) among groups and between treatments at the end of the recovery. BP differed ($p<0.05$) among groups during the recovery and between treatments at 30 sec into the 90% run. The competitive distance runners demonstrated a better recovery than the age-matched apparently healthy individuals. The control group had higher incidence of ischemia ($p<0.05$; i.e.,ST segment deviation) than the competitive distance runners. Warm-up reduced the incidence of ischemia in both groups. These data suggest that warm-up ameliorates, but does not completely eliminate the ischemic response (ST segment deviation) to sudden strenuous exercise. Warm-up did not affect the physiological responses (HR, BP) to sudden strenuous exercise.

DEVELOPMENT OF A SCALE TO MEASURE PERCEIVED DISCOMFORT ASSOCIATED WITH ROUTINE PHYSICAL ACTIVITY OF PREGNANT WOMEN

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Consistent with the emerging theme of increased focus on women's health issues, the purpose of this study was to develop a scale to measure perceived exertion and discomfort associated with routine physical activity during pregnancy. Potential scale items were initially identified by asking an expert panel to nominate relevant physical activities that they believed would be associated with some degree of discomfort during pregnancy, The expert panel consisted of obstetricians , nurses, exercise physiologists, and pregnant women. The expert panel nominated 37 potential items. An experimental version of the questionnaire that contained all of these items we s then administered to pregnant women during routine office visits to cooperating obstetricians. Participants rated items on a 5-point discomfort scale and also rated items with respect to relevance in the participant's weekly routine. A total of 25 women completed the scale. Modal responses showed that 32% (12) of the scale items (i.e., physical activities) were judged to be highly relevant, while another 41% (15) were judged to be moderately relevant. On 23 of the 27 physical activities judged to be relevant, 40% or more of the participants indicated discomfort associated with these activities. Discomfort ratings for many of the specific scale items were highly correlated with one or more criterion variables: month of pregnancy, age of the expectant mother, degree of edema, and degree of back pain (all $p<.05$), In conclusion, the reported version of this experimental scale has predictive validity for use in documenting changes in discomfort with routine physical activities in women during pregnancy.

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EFFECT OF VIEWING MUSIC VIDEOS DURING EXERCISE ON RATINGS OF PERCEIVED EXERTION

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Several studies (Pennebaker & Lightner 1980; & Seigel et al, 1984) have indicated that attention to external stimuli can alter the extent to which internal stress stimuli are perceived. In order to determine if viewing and listening to music videos distract from the ability to assess perceived exertion during exercise, 30 male subjects 18 to 25 years of age participated in two treatments presented in random order. One treatment consisted of exercising for 6 minutes on a Monarch (Model 668) cycle ergometer at a workload of 122.5 watts while viewing and listening to music videos (MV). During the subsequent treatment, subjects followed the same exercise protocol, however exercise was performed in a quiet environment (QE). An analysis of the data employing a paired sample *t*-test, indicated that ratings of perceived exertion (RPE) (p=.57) were not significantly different. The means and standard deviations for the MV and QE treatments are presented below.

Variable	MV	QE
RPE	13.5 ± 1.6	13.3 ± 1.7

The results of this study imply that external stimuli in the form of viewing and listening to music videos does not distract subjects from their ability to assess exertion during exercise. Therefore, RPE can be employed to monitor exercise intensity during situations where subjects are distracted by viewing and listening to music videos.

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EFFECT OF SCALE VISUALIZATION ON THE ABILITY TO RATE RATINGS OF PERCEIVED EXERTION (RPE)

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The purpose of this study was to determine if there was a difference in the ability to rate RPE with and without viewing the RPE scale. Seven healthy subjects (3 female and 4 male), 20-25 yrs of age who were familiar with Borg's 6-20 RPE scale participated in four exercise sessions. The first session consisted of a symptom limited GXT on a treadmill. The second session served as a reference test where subjects were asked to randomly exercise on a treadmill for two 8 min periods separated by a 12 min seated rest based on their interpretation of RPE levels 13 and 15 while viewing Borg's scale. Subjects regulated their walking or running speed without being aware of their pace. Sessions 3 and 4 employed the same exercise protocol as the second session, however, subjects regulated exercise intensity with the RPE scale while viewing and without viewing the scale. Heart rate (HR) and oxygen consumption (VO_2) were analyzed with ANOVA-RM to determine if there was a difference in the ability to regulate exercise intensity while exercising at RPE levels of 13 and 15 with and without viewing the scale. The analysis indicated no difference in HR (p=.73) and VO_2 (p=.26) between the three conditions when subjects were exercising at level 13 of the RPE scale. When subjects were exercising at level 15 of the RPE scale both HR ($p \leq .05$) and VO_2 ($p \leq .05$) were different with higher values being reported when not viewing the RPE scale than either the reference test or when viewing the RPE scale. These results suggest that monitoring high intensity exercise with the RPE scale without visualization may result in under estimation of exertion.

DIFFERENCES IN MAINTENANCE OF TARGET HEART RATE DURING THREE DIFFERENT MODES OF EXERCISE: WATER JOGGING, RUNNING, AND STEP AEROBICS.

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This study was designed to investigate subject ability to monitor and control target heart rate (THR)levels during exercise of differing types. Eight male college-age subjects with no history of disease which would contraindicate exercise participated in three exercise sessions at 70% to 75% of maximum heart rate (MHR) which equates to approximately 50% to 55% of peak $\dot{V}O_2$. Prior to the exercise sessions, peak $\dot{V}O_2$ values for each subject were collected by measurement of expired gases and MHR values were determined by ECG. The exercise sessions consisted of water jogging, step aerobics, and running. Intensity levels were monitored continuously during each exercise session utilizing the Polar Vantage XL heart watch. Subjects were instructed to monitor their own heart rates and maintain them at 70% to 75% of MHR for 30 minutes. Data from the study demonstrated that maintenance of THR was significantly ($p < .05$) higher during water jogging (69%) than either running (63%) or step aerobics (54%). During the time when heart rates were out of the THR zone, significantly ($p < .05$) more time was spent above the zone (32% running, 32% step aerobics) than below the zone (6% running, 14% step aerobics). These data suggest that maintenance of THR during exercise may not be consistent between modes. Regardless of exercise mode, exercise intensity may be difficult to maintain according to ACSM guidelines.

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EFFECTS OF ß-BLOCKADE ON THE SLOW COMPONENT OF VO_2 KINETICS DURING HIGH-INTENSITY CONSTANT-LOAD EXERCISE

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To determine the influence of ß-blockade on the slow component of VO_2, six males were studied during high-intensity constant-load exercise bouts on a cycle ergometer: once under control (placebo) conditions, and once under the influence of propranolol (80 mg, oral, 2 h prior to exercise). Although the intended exercise time was 20 min, exercise time was reduced ($P < 0.05$) during propranolol (14.5 ± 5.3 min) compared to control (19.2 ± 2.0 min) trial. This was consistent with the higher ($P < 0.05$) central (17.0 ± 2.0 vs. 15.0 ± 1.6) and overall (17.4 ± 1.8 vs 15.4 ± 1.7) RPE observed during the propranolol condition. There was a trend for lower end-exercise VE ($P < 0.17$), VCO_2 ($P < 0.09$) and RER ($P < 0.07$) during the propranolol trial. Blood [lactate] was not different between propranolol (6.98 ± 1.51 mM) and control (8.39 ± 3.7 mM) trials. Despite slower VO_2 kinetics during the first few min of exercise, analysis on mean VO_2 responses beyond the 4th min of exercise revealed no significant differences between conditions (end-exercise VO_2= 3.23 ± 0.48 l/min in propranolol trial and 3.25 ± 0.38 l/min in control trial). Although the lack of a difference in mean end-exercise VO_2 suggests that ß-blockade with propranolol did not influence the slow component of VO_2 kinetics during high-intensity exercise, it must be noted that individual VO_2 responses varied considerably. The possibility that ß-blockade may augment the VO_2 response to high-intensity exercise in some, and attenuate it in others, requires further study.

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Comparison of Blood Pressure Responses in Black and White females following different modes of Exercise

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Recent evidence suggests that submaximal exercise reduces blood pressure (BP) and that an inverse relationship appears to exist between the prevalence of hypertension and physical fitness. Little is known, however, about exercise and its relation to BP in African-Americans. The purpose of this study was to compare BP responses following a maximal Bruce treadmill (MT) test (X time 9 minutes), a ten minute submaximal test (ST) at 45% of maximal and a 30 second Wingate test (WT) with baseline BP. The subjects were 18 females (9 Black, age 23.4 yr, weight 59.2 kg; 9 White, 22.8 yr, 59.5 kg). Baseline BP was the mean of three resting measurements. Blood pressure responses were measured immediately, 5, 10, 15, 20 30, 40, 50 and 60 minutes after each of the exercises. All subjects received all and identical treatments. Data analyses included assessment of means, standard deviations, repeated measures MANOVA and a Scheffe HSD test. The baseline BP values were 109.0 and 112.1 for the black and white females, respectively. Blood pressure responses following all three modes of exercise were not difference and there were no interactions between the black and white females ($P>.01$). Systolic BP responses were elevated initially for all modes of exercise. Responses for all modes, except the Wingate test, returned to baseline after five minutes of recovery. Responses following the Wingate test returned after ten minutes. Diastolic responses were variable as values following the ST did not change and those following MT were below baseline initially, but were back at baseline after five minutes. Systolic following WT were below baseline for 15 minutes after the exercise. These data suggest that in average fit subjects BP responses following exercise are not different for black and white females and that the modes of exercise produce similar BP responses following the exercise.

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CARDIOVASCULAR AND METABOLIC RESPONSES TO AN IYENGAR HATHA YOGA ROUTINE

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Cardiovascular, metabolic and perceptual responses were compared during a 32 min treadmill walk (TW) at 4 mph and a vigorous, standing-pose, hatha yoga routine (YR). Subjects were 6 male and 4 female yoga practitioners, age 38-47 yrs. The YR consisted of 12 standing poses held for 40 sec with 10 sec for transitions. Heart rate (HR), blood pressure (BP), oxygen uptake ($\dot{V}O_2$) and rating of perceived exertion (RPE) were measured at 8, 16, 24, and 32 minutes of exercise. All comparisons between YR and TW were significantly different ($p<.05$) except HR and RPE at 8 min. At 16, 24, and 32 min, both HR and RPE were higher during YR than TW (138, 139, 144 vs 117, 118, 120 b/min; 15.4, 15.3, 15.9 vs 12.5, 12.7, 12.9). BPs were higher during YR at each interval (systolic 153.3, 147.8, 147.3, 147.3 vs 132.5, 130.7, 127.1, 130.0 mm/HG; diastolic 84.8, 93.0, 86.4, 89.0 vs 70.0, 69.8, 70.8, 68.4 mm/Hg). $\dot{V}O_2$ was higher during TW than YR at each time interval. Across the 32-min session, mean energy expenditure was 41% $\dot{V}O_2$ max for YR and 67% $\dot{V}O_2$ max for TW. The higher HR, BP and RPE responses associated with YR can be attributed to major static exercise components inherent in this type of yoga. The complementary dynamic exercise aspects of the vigorous standing poses resulted in a lower exercise intensity than moderate walking; yet, yoga may be sufficient to induce cardiovascular conditioning in this group of healthy, physically-active subjects.

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EFFECTS OF STEP DISTANCE AND BENCH HEIGHT ON INTENSITY OF BENCH STEP EXERCISE

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Bench step aerobic exercise (BSE) has become a popular low-impact alternative to traditional aerobic dance; however, the factors that may affect BSE intensity are unknown. The purpose of this study was to provide general insight into the influence that bench height (HT) and step distance (DT) exhibit on the metabolic demands of various common stepping patterns: basic step (BS), turn step (TS), and over the bench step (OS). Female volunteers performed four min of stepping at 120 footstrikes/min for each combination of height, distance, and step pattern on two separate days. Test order was randomized. Mean values for the last two min are shown below:

	Basic Step		Turn Step		Over the Bench Step	
HT(cm)/DT (cm)	VO_2	HR	VO_2	HR	VO_2	HR
10.2/ <30.5	17.2	136	19.9	146	15.7	130
	*(26%)	(10%)	(20%)	(3%)	(65%)	(25%)
10.2/ >61	21.6	149	23.8	150	24.3	163
25.4/ <30.5	28.5	178	30.4	183	28.2	179
	(7%)	(3%)	(6%)	(2%)	(18%)	(5%)
25.4/ >61	30.4	183	32.2	187	33.3	187

*Numbers in parentheses are the percent increase in VO_2 & HR between the shorter and longer stepping distances.

Increasing either height or distance significantly ($P < .05$) increased VO_2 and HR response to BSE. However, increases in horizontal step distance increased O_2 cost independent of height. In conclusion, step distance away from the bench may be considered as an alternative for modifying intensity when step height cannot be manipulated.

EFFECT OF WIDELY VARYING STEPPING RATES ON PHYSIOLOGICAL RESPONSES DURING STAIRMASTER 4000™ (SM) EXERCISE

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Previous research has suggested that step rate does not affect physiological responses to stairclimbing exercise; however, cadence variations in earlier studies may have been too small to produce different responses. Therefore, the purpose of this study was to determine the effect of widely differing predetermined cadences, as well as a self-selected cadence (SELF), on physiological responses during SM exercise. 13 women, ages 20 to 24, volunteered to perform 6 minutes of submaximal SM exercise at 3 intensities (5.76, 7.25, and 8.74 METs), using each of 4 cadences (manufacturer-recommended [MR]; 50% [+50] and 100% [+100] over MR; and SELF). The order of intensities and cadences was randomized. Values for heart rate (HR), oxygen uptake (VO_2), minute ventilation (V_E), and rating of perceived exertion (RPE) were averaged over the last 2 minutes of each 6 minute session. Dependent variables were compared across stepping rates at each intensity using repeated measures ANOVA; follow up contrasts compared each alternative cadence to MR. Results indicated that cadence did not affect HR or V_E at any of the intensities measured ($p > 0.05$). At 5.76 METs, VO_2 was lower during +50, +100 and SELF than during MR; however, VO_2 during MR was significantly higher than predicted ($p \leq 0.05$; see Table). At 7.25 METs, VO_2 was lower during +50 and SELF than during MR ($p \leq 0.05$), while VO_2 during MR and +100 were higher than predicted. At 8.74 METs, there was no effect of cadence on VO_2 ($p > 0.05$); however, RPE was higher during +100 than during MR ($p \leq 0.05$).

Oxygen Uptake ($ml \cdot kg^{-1} \cdot min^{-1}$)

METs†	MR	+50	+100	SELF
5.76	22.3 ± 2.7§	20.8 ± 1.8*	20.4 ± 2.2*	20.8 ± 1.2*
7.25	27.6 ± 3.0§	25.8 ± 2.2*	26.9 ± 2.4§	25.7 ± 1.4*
8.74	31.4 ± 3.5	31.1 ± 3.2	30.9 ± 3.7	31.0 ± 1.7

†METs predicted by manufacturer; *$p \leq 0.05$, less than MR; §$p \leq 0.05$, greater than predicted METs.

At each intensity, the cadence during SELF was approximately 40 steps/min higher than the MR rate. These results suggest that cadence does affect energy cost of SM exercise, particularly at lower MET levels, where slower step rates resulted in increased O_2 cost.

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GROUND REACTION FORCES IN BENCH AEROBICS

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The purpose of this research was to determine the ground reaction forces (GRF) created during step aerobics when different bench heights, stepping maneuvers and cadences were employed. Six aerobic instructors (mean BW 53.6 kg) and six novices (mean BW 52.6 kg) randomly performed a 12-min bench aerobics routine, at 120 bpm and also 130 bpm, while following an audio/visual tape. Three common step combinations: Basic Step (BS), Travel Step (TS), and Plyometric Lunges (PL) were performed (1 min ea.) on bench heights of 6", 8", 10" and 12". Bench heights were randomly assigned every three minutes. GRF were recorded at 100 HZ by a Kiestler force platform during the last 10 sec of every condition. Data were analyzed using repeated measures ANOVA ($P < .05$) and Scheffe comparisons were utilized to determine significance. No significance was seen between the two groups. Mean vertical GRF ranged from 0.926± .103 BW to 1.423+.163 BW for the BS, 6 in bench, 120 bpm and PL, 12 in bench, 120 bpm, respectively. Results for mean peak vertical GRF were recorded at 1.501+.205 BW for BS, 6 in bench, 120 bpm as the minimum force produced and 2.927+0.371 BW as the maximum for PL, 12 in bench, 120 bpm. Forces were significantly greater when graduating from 6 in to 10 in and 12 in, and also from 8 in to 12 in bench heights but not when increasing from 6 in to 12 in in succession. In conclusion, risk of injury could possibly be reduced if bench stepping was begun on a low bench height (preferrably 6 in) and the heights were successively increased only after a period of adjustment.

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THE ENERGY COST OF SELECTED SLIDE BOARD EXERCISE MOVEMENTS

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Group exercise leaders have developed slide board protocols comprised of a variety of choreographed maneuvers. The purpose of this investigation was to determine the energy cost associated with four popular slide board exercise maneuvers: standard slide (SS), hip flexion slide (HF), knee flexion slide (KF), low-profile slide (LP). Nine female subjects (VO_2 max 44.7 $ml \cdot kg^{-1} \cdot min^{-1}$) completed each slide board movement at a sliding rate of approximately 35 cycles per minute while being monitored continuously for VO_2 ($ml \cdot kg^{-1} \cdot min^{-1}$) via open-circuit spirometry. The statistical analyses (repeated measures ANOVA and Sheffe F-test, $p < .05$) indicated a significant difference between the slide board movements: LP (37.8 ± 4.1) > KF (34.4 ± 2.9); HF (34.3 ± 4.4) > SS (29.5 ± 4.2). The LP imposed the greatest energy cost and was approximately 1 MET more demanding than KF and HF. The LP also yielded a 20% higher VO_2 compared to SS. No difference was shown between KF and HF but these movements elicited a significantly higher VO_2 compared to SS. The present SS maneuver was executed with hands on the thighs and required the subjects' feet to maintain constant contact with the slide board during lateral displacement. In contrast, both HF and KF required the subjects to raise the alternate foot off the board between each half of every sliding cycle. This vertical displacement of limb mass may have allowed a more forceful take-off during the sliding cycles in addition to demanding greater activity of the leg musculature when raising each limb segment from the exercise surface. The LP was performed by having the subjects markedly lower their center of gravity to a "deep crouch" and required them to touch each bumper at the termination of every sliding pass with the cross-lateral hand. These data demonstrate that such stylistic requirements in a slide board exercise protocol result in significantly affecting the energy cost of a given slide board exercise bout at a constant sliding rate.

OXYGEN UPTAKE AND HEART RATE RESPONSES BETWEEN ON LAND AND HEAD-OUT WATER IMMERSION WALKING IN THE ELDERLY

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It is generally accepted that the central redistribution of blood volume with head-out of water immersion (HOI) leads to an increase in stroke volume. However little research exists concerning the physiological effects of HOI on the cardiorespiratory responses to graded dynamic exercise for the elderly (OLD). The purpose of this study was to determine the effects of HOI in chest deep water on the heart rate (HR) and oxygen uptake ($\dot{V}O_2$) responses to graded walking exercise in OLD and young (Y) subjects. Subjects were 15 OLD (age 72.9 ± 4.2 yr) and eight Y individuals (age 23.6 ± 1.5 yr). The subjects self-selected three walking speeds (easy, moderate and hard) and exercised for 6 minutes at each intensity on land and in water. The mean (± SD) velocities for the OLD were 57 (± 9) $m \cdot min^{-1}$, 76 (± 7) $m \cdot min^{-1}$, 83 (± 8) $m \cdot min^{-1}$ and 19 (± 3) $m \cdot min^{-1}$, 23 (± 3) $m \cdot min^{-1}$, 26 (± 3) $m \cdot min^{-1}$ on land and in water, respectively. Likewise the mean velocities for the Y were 44 (± 9) $m \cdot min^{-1}$, 66 (± 7) $m \cdot min^{-1}$, 104 (± 12) $m \cdot min^{-1}$, and 16 (± 4) $m \cdot min^{-1}$, 25 (± 3) $m \cdot min^{-1}$, 31 (± 2) $m \cdot min^{-1}$ on land and in water, respectively. The correlations between $\dot{V}O_2$ and HR on land (r = 0.84 OLD, 0.83 Y) and in water (r =0.83 OLD, 0.69 Y) were significant in both age groups. HR response at a given $\dot{V}O_2$ was significantly lower during walking in water than on land in Y group ($\dot{V}O_2$ ($ml \cdot kg \cdot min^{-1}$) = -11.20 + 0.278x, y = -10.89 + 0.240x, (where by x = HR)) but was similar in both conditions for those in the OLD group ($\dot{V}O_2$ $ml \cdot kg \cdot min^{-1}$) = -10.2 + 0.211x, y = -6.29 + 0.193x). The data indicate that immersion-induced central redistribution of the blood volume may lead to a change in the HR-$\dot{V}O_2$ relationship in older subjects.

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AGE-RELATED DECLINE OF FITNESS PARAMETERS IN MALE FIREFIGHTERS

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The purpose of this study was to determine whether fitness parameters change in male firefighters over time. One hundred fifty-nine male firefighters were divided into three age-groups (20-29, n=48; 30-39, n=92; 40-49, n=19) and were evaluated for body fat (BF), trunk flexion (TF), abdominal muscular endurance (SU), upper body muscular endurance (PU), cardiorespiratory endurance (V02) and upper body strength (1RM bench press). Regression analysis revealed a significant decline in SU by age group. BW remained constant while BF increased. TF and 1RM values demonstrated little change while PU and V02 declined moderately. The results are listed below (mean ± SD): * $p<0.05$

	20-29	30-39	40-49	%Change
BW (kg)	85.8 ± 11.8	84.3 ± 13.5	86.6 ± 11.4	-0.2
BF (%)	17.2 ± 5.8	18.5 ± 5.8	19.8 ± 3.7	+9.0
TF (cm)	30.4 ± 9.4	28.6 ± 8.4	32.7 ± 8.7	+1.0
SU (reps)	62.8 ± 16.5	54.1 ± 17.2	50.6 ± 13.6	-8.7*
PU (reps)	37.2 ± 11.9	35.3 ± 15.4	32.0 ± 13.5	-5.9
V02 (ml/kg/min)	33.0 ± 8.0	32.0 ± 8.6	28.5 ± 7.3	-4.9
LRM (kg)	92.5 ± 17.2	88.6 ± 17.8	90.5 ± 15.6	-1.6
LRM (% BW)	1.1 ± 0.2	1.0 ± 0.2	1.0 ± 0.2	-0.9

Results reveal a trend in male firefighters to maintain flexibility and upper body muscular strength while muscular and cardiorespiratory endurance decrease. Future research should include females and performance-based tasks.

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INFLUENCE OF AGE AND FAT MASS ON THE DECLINE OF MAXIMAL OXYGEN UPTAKE IN MEN AND WOMEN.

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The purpose of this study was to investigate the decline in maximal oxygen uptake (VO_2max) that occurs with increasing age. Forty-eight sedentary males between the ages of 18 and 80 were tested. Eighteen sedentary females between the ages of 20 and 73 were also tested. VO_2max was determined using a graded exercise treadmill test and expressed in ml/kg/min. Body composition (fat mass, fat free mass) was determined using hydrostatic weighing with expiration to residual volume. In the men, VO_2max showed a decrease of .412 ml/kg/min per year. A stepwise regression showed that age alone was the most important determinant for the decline of VO_2max, accounting for 76.2% of the variance ($r=.873$, $p<.05$). Combining age and fat mass into the regression equation accounted for 86.9% of the decline in VO_2max ($r=.932$, $p<.05$). In women, a similar rate of decline of .367 ml/kg/min per year was evident. For the women, age was the only determinant in the stepwise regression accounting for 67% of the decline in VO2max ($r=.818$, $p<.05$). These results suggest that age accounts for the majority of the decline in VO_2max that occurs in sedentary individuals. Also, fat mass is a determinant in men but not in women.

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CIRCUIT WEIGHT TRAINING EFFECTS ON BODY COMPOSITION AND NEUROMUSCULAR FUNCTION OF MALE AND FEMALE SENIOR ATHLETES

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Volunteer subjects with interests in a variety of senior sports (N=18 male, 8 female, $\bar{X}$ age=68) were given a battery of tests at entry (PRE), 10 wks (MID) and 20 wks (POST) to document the effects of systematic circuit weight training (CWT). A control group (N=8 male, 6 female, $\bar{X}$ age=74) received only the test battery PRE & POST. Experimental subjects were trained and supervised in 8-12 variable resistance exercises, performed 3 days/wk (1 set, 10-15 reps). At MID subjects increased to 2 sets/station. The control group received no physical training. CWT began with 10 min stretching and light aerobic activity and ended with 6-12 min of target zone aerobic activity. After each pair of lifts, 1 min aerobic interludes were taken. Body composition determined by duplicate skinfold estimates from two examiners improved PRE to POST (-2.1% fat, $p<.001$; .55kg FFW, $p<.04$; -1.4kg fat wt, $p<.001$; -.8kg TBW, $p<.02$). Maximum sit ups in 1 min improved (5.9, $p<.001$) as did sit & reach flexibility (1.1 in, $p<.001$). A 1 RM bench press improved (6 lbs, $p<.003$) but no significant change occurred in 1 RM leg press (7.1 lbs, $p>.05$). No significant PRE to POST changes occurred in the control group. Significant changes occurred for most variables from PRE to MID indicating rapid adaptation to overload training. Adherence to the training protocols was high (>82%). There were no injuries sustained during 1500 hrs of CWT. Elderly male and female athletes respond positively to supervised CWT, decrease their body fat and show increases in muscular strength and endurance.

EXERCISE AND BETA-ADRENERGIC MODULATION OF CARDIAC MYOSIN ISOFORMS IN THE RAT MYOCARDIUM

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The signals that regulate the expression of cardiac myosin isoforms are poorly understood. To examine the role of beta (ß) adrenergic stimulation as a regulatory mechanism in the expression of cardiac myosin isoforms, adult rodents (120 days) were subjected to endurance exercise-training and/or pharmacological ß-blockade. Specifically, two hypotheses were tested: 1) exercise-training would promote a V3 to V1 cardiac ventricular isoform shift in rats, while ß-blockade would retard this effect; and 2) sedentary rats treated with a ß-blocker would demonstrate an increase in the relative distribution of the V3 isoform. Thirty-two male Sprague-Dawley rats were divided into four groups: exercise-sham (ES), exercise-propranolol (EP), sedentary-sham (SS), and sedentary-propranolol (SP). Exercise-trained animals performed treadmill running (5 days/wk) for six weeks. EP animals received daily propranolol injections (30 mg propranolol/kg, IP) 30 minutes prior to exercise; SP rats also received daily propranolol injections. Both ES and SS received daily sham injections (IP) of the isotonic saline vehicle. Following the six week experimental protocol, the whole heart was removed, and the left ventricle isolated, homogenized, and prepared for non-dissociating polyacrylamide gel electrophoresis. Total heart mass did not differ between any of the experimental groups ($P>0.05$). Computerized densiometric analysis of native ventricular isomyosin gels did not support the notion that endurance exercise promotes a shift toward the V1 isoform (Mean±SEM; SS=50.1±1.8% vs. ES=45.3±2.1%). However, ß-blockade in both sedentary and exercise-trained rats significantly increased the V3 isoform (SS=23.1±1.7% vs. SP=43.9±2.9% and EP=38.8±3.9%). These experiments demonstrate that ß-stimulation contributes to the modulation of cardiac myosin isoform expression. Further, these data suggest that although a baseline level of adrenergic stimulation is necessary to maintain normal cardiac myosin distribution, exercise-induced sympathetic stimulation does not modify the normal isomyosin profile of the adult ventricle.

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LACTATE AND MANNITOL HAVE DIFFERENT CAPILLARY PERMEABILITIES IN CAT SKELETAL MUSCLE

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Because mannitol is used as a reference tracer for lactate in studies of unidirectional uptake of lactate by skeletal muscle, it is important to characterize the relative movement of these substances from plasma to tissue. Isolated, perfused, cat lower hindlimb muscles were perfused with an electrolyte-albumin mixture containing enough blood from the same cat to give hematocrits of 5-10%. The recirculating mixture was warmed to 37°C and bubbled with 95% O_2-5% CO_2. Papaverine and isoproterenol were added to vasodilate. Step changes in the arterial concentration of ^{3}H-mannitol, ^{14}C-lactate and Evans blue were made, sometimes simultaneously changing the lactate concentration from 1-2 mM/l to 20-25 mM/l. Venous samples were collected every 6 sec for 1-2 minutes, plasma separated, and plasma lactate, Evans blue, and tracer concentrations determined. Permeability-surface area products (PS) for mannitol and tracer and chemical lactate were obtained from the venous concentrations using an exponential fit to the data and a mathematical model which accounted for cell uptake and tissue accumulation. In 7 determinations in 4 cats, lactate PS was 1.45 ± 0.04 (SE, n=7) times greater than the simultaneously-determined mannitol PS. Tracer lactate PS (10.3 ± 0.4, n=7) was not different from PS calculated from chemical lactate concentrations (10.3 ± 0.6, n=4). Comparison of mannitol and lactate PS values to permeabilities of other extracellular solutes suggests that lactate transport across the capillary wall is mainly through extracellular routes. The data strongly indicate that the use of the U_{max} method with mannitol and lactate could cause serious errors in the estimate of lactate uptake by muscle cells.

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BLOOD MARKERS AFTER TWO BOUTS OF ECCENTRICS

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Diminished responses in creatine kinase (CK) and muscle soreness (DOMS) occur when a bout of eccentric exercise is repeated within 6 weeks of an initial bout. The purpose of this study was to determine whether similar reductions would be seen in inflammatory-related markers such as interleukin-1,beta (IL-1), neutrophil count (NEU), and cortisol (CTSL), after a second bout of eccentrics. Fourteen males performed 2 downhill runs (R1 and R2) at -10% for 40 min., at a speed equal to ~ 50% $VO2_{max}$; runs were separated by 2 weeks. Blood samples were drawn before the run, immediately after, and every h for 12h (venous catheter). A venipuncture was performed every 24h for 5d, at which times DOMS was recorded. All values were corrected for changes in plasma volume. A control day (C) was performed 2 weeks prior to R1 to account for any diurnal variations. Data were analyzed using a repeated measures ANOVA ($p<0.05$). When R1 was compared to R2: DOMS was significantly less after R2 at 24h, and CK was significantly less after R2 at 96h. During the 12h following exercise: there were no significant differences for IL-1 and CTSL between C, R1, and R2; however, CTSL decreased significantly for all three conditions across time. NEUs increased similarly ($p<0.05$) after R1 and R2, compared to C. We concluded that despite reductions in DOMS and CK after the second bout of exercise, there were no significant reductions in NEU, CTSL or Il-1, inflammatory-related markers.

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THE IMPACT OF EXERCISE TRAINING ON CARDIAC METABOLIC AND CONTRACTILE PROPERTIES OF THE OBESE ZUCKER RAT.

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Exercise training ameliorates defects present in the skeletal muscle of obese Zucker rats (fa/fa), however, little is known about cardiac adaptations to exercise training in this animal model of obesity, hyperinsulinemia, and insulin resistance. In this study obese Zucker rats engaged in a 7 wk treadmill training program at either low intensity (LI) or high intensity (HI). The activities of marker enzymes of cardiac metabolic potential including citrate synthase (CS) hexokinase (HK), and 3-hydroxyacyl CoA dehydrogenase activity (HOAD) were spectrophotometrically determined. Distribution of myosin among its three isoenzyme, V1, V2, V3, (a measure of cardiac contractile properties), was determined following electrophoretic separation of crude myofibril preparations. Sedentary lean (LNCTR) and obese (OBCTR) animals served as controls.

GROUP	CS	HK	HOAD	V1
	(Umol/min/g wet wt)			%
LNCTR	185± 7.7	1.28± 0.15	65.5± 4.47	70± 1
OBCTR	157± 9.7	1.53± 0.17	65.4± 1.61	77± 5
LI	177± 10.7	1.35± 0.23	84.3± 3.47	71± 2
HI	179± 9.9	1.28± 0.16	61.2*+3.46	65± 5

(* $P < 0.05$)

Results demonstrate that neither exercise nor the fa/fa genotype alters cardiac myosin isoenzyme distribution. In contrast, exercise only enhanced cardiac potential for B-oxidation and did so in an intensity specific manner.

NATURAL KILLER CELL CYTOTOXIC ACTIVITY IN WEIGHT LIFTERS AND SEDENTARY CONTROLS

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Natural killer cell cytotoxic activity (NKCA) and the proportion of circulating natural killer (NK) cells was compared in 10 well-trained weightlifters versus 10 sedentary controls. Height, weight, and percent body fat did not differ significantly between the two groups. The average subject in the weight training group was able to squat 1.8 times his body weight, lifted weight more than 6 hours per week, and had been a weight trainer for nearly 9 years. NKCA did not differ between the weight training and control groups (166±33 versus 155±27 lytic units, respectively), and the proportion of NK cells was the same (15.1±1.9% versus 15.1±1.3%, respectively). The results of this cross-sectional study of long-term weightlifters and sedentary controls indicate no significant differences in NKCA. The two groups did not differ in the distribution of lymphocytes or natural killer cells, lending strength to this conclusion. These data differ from those of several other cross-sectional studies that have reported elevated NKCA in aerobically-trained individuals.

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EXERCISE AND ALVEOLAR MACROPHAGE ANTIVIRAL FUNCTION

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Epidemiological studies in humans and experimental studies in animals suggest that strenuous physical activity may increase the risk of developing upper respiratory infection, whereas moderate exercise may lower the risk. An important cell involved in upper respiratory viral defense is the alveolar macrophage. The alveolar macrophage can readily take up viruses nonspecifically and kill them, thus serving as the first line of defense. The purpose of this study was to examine the effects of two doses of exercise on alveolar macrophage antiviral activity. Male CD-1 mice were randomly assigned to stress control (SCON), moderate (MOD; 18 m min , 5% grade, 30 min d) or exhaustive (EXH 18-40 m min , 5% grade, 90-210 min d), the latter 2 groups subjected to three days of treadmill running for the indicated duration and speed. Mice were sacrificed immediately following exercise on day three. Alveolar macrophages were removed, infected with herpes simplex virus type one, and incubated for 60 hours. The macrophage cytopathic resistance was assessed by a quantitative vital dye uptake assay. The resistance of both the MOD and EXH exercised mice to viral infection was significantly ($p<.05$)lower than that of SCON. These preliminary findings suggest that alveolar macrophages may have reduced ability to defend against certain viruses following moderate or exhaustive exercise. The time course of the apparently reduced antiviral activity and the in vivo response is under investigation.

Supported by ACSM Foundation / Cybex Research Grant

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OPIOID ANTAGONISM ALTERS GLUCOSE HOMEOSTASIS DURING DYNAMIC EXERCISE IN MAN.

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In an attempt to investigate the role of the endogenous opioid peptides in substrate mobilization and hormonal responses to dynamic exercise, eight trained cyclists completed exercise trials at 90% of VO_2max until exhaustion and at 70% VO_2max for 90 minutes. Trials were conducted following the administration of the opiate antagonist naloxone (NAL) (0.1 $mg \cdot kg^{-1}$ bolus + 0.1 $mg \cdot kg^{-1} \cdot hr^{-1}$) or volume matched saline (SAL) at each intensity. Serum glucose was maintained at significantly higher levels (~5.1±0.4 mM vs 4.1±0.2 mM) at 60 and 90 minutes of exercise in the 70%-NAL trial, and at all points during exercise and at 30 and 60 minutes of recovery in the 90%-NAL trial. The serum insulin response to exercise was not altered by NAL administration at either intensity. Serum C-peptide was ~ 50% higher at 60 and 90 minutes of exercise in the 70%-NAL trial. In contrast, serum C-peptide was significantly lower (~15-20%) during exercise in the 90%-NAL trial. The plasma glucagon response to exercise at 70% VO_2max was not altered by NAL administration, but was significantly elevated during exercise in the 90%-NAL trial. Plasma glucagon was unchanged vs. baseline in the 90%-SAL trial, but increased by ~ 25 $ng \cdot L^{-1}$ in the 90%-NAL trial at 10 minutes of exercise. Plasma epinephrine was 50-150% (~2-3 nM) higher during exercise from 30-90 minutes of exercise in the 70%-NAL trial, and was higher at termination (4.9±2.1 vs. 2.7±1.7 nM) in the 90%-NAL trial. Plasma norepinephrine was significantly higher at 10 minutes of exercise (19.1±2.8 vs. 11.6±1.7 nM) and at termination (21.0±1.7 vs. 12.2± 1.4 nM) in the 90%-NAL trial, but was unaltered relative to control values during exercise in the 70%-NAL trial. Thus, opiate antagonism prevents the decline in serum glucose during prolonged exercise while potentiating the hyperglycemic response to brief, high intensity exercise. These changes appear to occur secondary to altered counterregulatory hormone responses to exercise.

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THE EFFECT OF TRAINING AND EPINEPHRINE INFUSION ON POTENTIAL MEDIATORS OF RPE.

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Seven untrained male subjects [mean age (±SD) = 25.6 ± 3.9 yr, mean ht = 177.0 ± 5.9 cm, mean wt = 65.81 ± 7.4 kg] trained on a cycle ergometer 4 d per wk, 40 min/session, for 6 wk to determine the impact of training on potential mediators of ratings of perceived exertion (RPE). The training stimulus remained constant throughout the entire 6 wk of training. Prior to, and at the end of each week of, training each subject performed a 20-min, high-intensity, constant-load exercise test (absolute power was the same each wk). After the six wk of training, an additional 20-min constant-load test was performed (same absolute power output), during which epinephrine was infused at a rate of 100 ng/kg/min over the final 10 min of exercise. When including all constant-load tests (except for the epinephrine infusion test) in the data analysis, there were significant ($P<0.05$) correlations between overall-RPE and: blood lactate concentration [HLa] ($r=0.60$), blood glucose concentration [GLU] ($r=0.44$), HR ($r=0.46$), ventilation ($\dot{V}E$) ($r=0.52$), plasma epinephrine concentration [EPI] ($r=0.56$), and plasma norepinephrine concentration [NE] ($r=0.61$). However, during the course of training, the temporal changes in metabolic variables were not always consistent with the changes in RPE. After 2 wk of training, significant ($P<0.05$) decreases were observed for end-exercise RPE, $\dot{V}O_2$, $\dot{V}E$, [HLa], [GLU], [EPI] and [NE]. Further decreases for HR, RPE, and [HLa] were observed at wk 4, 5, and 6 respectively ($P<0.05$). Epinephrine infusion resulted in significant ($P<0.05$) increases in [EPI], [HLa], [GLU], and $\dot{V}E$, and a decrease in [NE]; RPE and HR were unchanged. We conclude that: 1) adaptations to training occurred rapidly, with significant reductions in constant-load exercise RPE, [EPI], [NE], [HLa], $\dot{V}E$, $\dot{V}O_2$, and HR observed within the first 1 to 2 weeks; 2) RPE is correlated with, but not causally related to [EPI], [NE], [HLa], $\dot{V}E$, HR or [GLU] during constant-load, high-intensity cycle ergometry.

CHEST TRAUMA WITH SYNCOPE -- FOOTBALL

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HISTORY -- 18 year-old black male varsity football tight end was struck in the sternal area by the foot of the ball carrier during practice. He had trouble breathing, fell down, and was unresponsive for about 10 seconds. He then got up, with no more dyspnea, and had only mild soreness in the area of the sternum. He denied palpitations or other symptoms. Past medical history is remarkable for asthma, but he denied symptoms in the last three years. His only medications were cough medicine and a vaporizer for a cold. He has no history of heart disease. His family history is positive for asthma.

PHYSICAL EXAM -- He is a muscular adolescent in no distress. Height 175 cm, weight 82 kg, axillary temp 98.2, pulse 72, respiratory rate 30, blood pressure 120/70. Left nasal mucosa was edematous. heart exam was regular rate and rhythm, no gallops or murmurs. Lung exam revealed light end-expiratory wheezes diffusely with diminished breath sounds but no respiratory distress. Sternum and sternochondral joint is nontender without ecchymosis. Abdominal exam is benign. Neurological exam is normal, with patient fully oriented with no focal deficits.

HEEL PAIN - TRIATHLETE

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HISTORY -- A 26 year-old male triathlete presents with a 16 month history of right heel pain that has not improved with "conservative" treatment. He can only run 1 or 2 miles because of the pain, but is able to swim and bicycle without too much difficulty. His pain is worse in the morning when he gets out of bed or after he sits for a long time and stands up. He denies any numbness or tingling in the heel or foot. His treatment has included: 2-different hard orthotics, one injection, NSAID's and reduction in training.

PHYSICAL EXAM -- He has bilateral tight heel cords (5° dorsiflexion with knee extended) and bilateral pes cavus. Leg lengths are equal. Neurologic exam is normal and Tinel's negative at medial malleolus. There is point tenderness along the right medical calcaneus, and slight tenderness on the left.

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FOOT PAIN -- FOOTBALL LINEMAN

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HISTORY -- 21-year-old football lineman with a complaint of right foot pain. The pain began when he plantar flexed and inverted his foot while cutting. pain is present in both the weightbearing and non-weightbearing positions. He had experienced two previous incidences of foot pain resulting from similar mechanisms. These injuries were diagnosed as stress fractures to the second and third metatarsals.

PHYSICAL EXAM -- He is point tender over the fourth metatarsal. Pain is present with plantar flexion and dorsiflexion of the toes. Swelling is present over the dorsum of the foot. The posture of the plantar surface of the foot in a non-weightbearing position suggests metatarsus adductus. He has calcaneal valgus when observed standing suggesting pronation.

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FOOT & ANKLE PAIN -- BASKETBALL

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HISTORY -- 16-year-old male sustained an inversion injury to his right ankle playing basketball in gym class. No prior history of ankle injury. Initial treatment consisted of ice, crutches and compression. X-rays obtained on the day of injury were negative for fracture. NSAID was added on the fourth day because of persistent pain. He did not return for follow up for two months. Upon follow up he had constant pain in the foot and ankle and was unable to weight bear due to pain. His school attendance was poor and he would not go out in public because he was "embarrassed by the limp". Past social history revealed a very troubled childhood with placement in several foster homes. He had psychiatric hospital admissions for dysthymic disease and conduct disorder. He was diagnosed by school psychologist as having attention deficit disorder and was taking Ritalin at the time of injury.

PHYSICAL EXAM -- Initial exam revealed a swollen foot and ankle with ecchymosis over the lateral malleulus. Anterior drawer and inversion signs were negative. Follow-up exam two months post injury showed a swollen, blue foot. The foot was very cool to touch. There was tenderness to palpation over the entire foot and ankle. Drawer sign remained negative. Dorsalis pedis pulse was present. Posterior fibial pulse was absent. A 15 mm ulcer was noted over the Achilles tendon.

PAINFUL KNEE EFFUSION -- BASEBALL PLAYER

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HISTORY -- 20-year-old baseball coach felt a painful pop in right knee while walking to dugout after batting practice. No prior history of knee problems. Initial pain was mild but progressively increased over the next 2-3 days. No swelling initially but an effusion developed by the next day. Pain unrelated to weight bearing.

PHYSICAL EXAM -- He has moderate effusion right knee. Active range of motion 5° - 85°. Quadriceps and patella tendon intact and nontender. Negative patellar apprehension. MCL/LCL nontender and stable. Negative Lachman, pivot shift, and posterior drawer. Medial/lateral joint lines nontender.

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ACUTE LATERAL HIP PAIN -- WATER-SKIING

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HISTORY -- A previously well, 44-year-old, avid water-skier fell while water-skiing and suffered an acute forced abduction injury of his right leg. An eyewitness at the scene noted that his right lower extremity appeared to deform to a right angle to his body. Radiographs at a local emergency room were negative. One week later, the patient was complaining of severe right lateral hip pain and limited hip abduction and adduction.

PHYSICAL EXAM -- Exam revealed tenderness over the posterior aspect of his right greater trochanter. Trendelenburg sign was positive. Right hip range of motion had full flexion and extension with minimal abduction, adduction, internal rotation, and external rotation.

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ECCENTRIC VERSUS CONCENTRIC STRENGTH TRAINING INDUCES GREATER MUSCLE HYPERTROPHY.

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The growth-promoting effects of muscle stretch are well-established. For example, muscles immobilized in a lengthened position hypertrophy (Goldberg et al., MSSE, 7:248, 1975). In a strength-training paradigm, 21 young men were randomly assigned to either an eccentric (ECC, n = 7), concentric (CON, n = 8) or a control group (KON, n = 6) to determine if eccentric versus concentric training induces greater hypertrophy. The subjects isokinetically (Kin-Com, 500H) trained the quadriceps muscle group of one leg at 60 $°\cdot s^{-1}$ for 12 weeks, using the periodization principle. Muscle biopsies were taken from the vastus lateralis before and after training. Both groups achieved significant gains in strength ($P < 0.05$, data not shown). The Table shows the changes in muscle fiber area (in μm^2).

Groups	Fiber type	Pre Mean	Pre ±SE	Post Mean	Post ±SE	Δ	Δ, %
ECC	I	3329	316	3487	286	158	4.7
CON	I	4425	311	4376	307	-49	-1.1
ECC	II	4163	285	5530	214	1367	32.8‡
CON	II	4898	372	5230	345	332	6.8

‡ $P < 0.05$

A conversion of type IIb to type IIa fibers was also evident in both training groups. These data suggest that eccentric contractions may play an important role in the mechanism of human skeletal muscle hypertrophy.

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PEAK TORQUE AND ANGLE SPECIFIC TORQUE KNEE EXTENSION AND FLEXION BILATERAL DEFICIT IN FEMALES.

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Data collection techniques may alter accurate reporting of the bilateral deficit (BD) during dynamic movements due to the shape of the torque curve. The BD has been historically reported as a peak torque (PT) measurement but angle specific torque at 60 degrees of flexion (AST) is also used when describing isokinetic data. This study sought to investigate the effects of two different data collection techniques (PT vs AST) on the BD in untrained females. Twelve adult females aged 34.9±8.2 yrs performed three isokinetic knee extension/flexion repetitions at 60, 120, 180 and 240 degrees per second using both unilateral and bilateral limbs. The BD% = 100*[bilateral total/unilateral total]-100. See BD% table below; means±(SEM): (*p<0.05)

	Extension PT	Extension AST	Flexion PT		Flexion AST
60	-11.9(3.4)	-11.7(3.5)	-16.5(2.7)		-13.5(3.0)
120	-6.2(2.4)	-6.5(2.5)	-11.8(2.8)		-13.2(3.4)
180	-4.7(1.5)	-6.9(1.6)	-5.1(2.8)	*	-12.5(2.7)
240	-3.1(2.0)	-1.8(2.9)	-0.9(2.9)	*	-14.4(4.6)

Results revealed no difference between PT and AST extension BD while PT flexion BD was significantly less than AST at 180 and 240 d/s. These results appear to demonstrate that the bilateral limb flexion torque curve bears a different shape when compared with unilateral limbs at fast contractile velocities.

MYOTATIC STRETCH REFLEX RESPONSES OF THE CONTRALATERAL LEG DURING IPSILATERAL ISOMETRIC, CONCENTRIC, AND ECCENTRIC CONTRACTIONS.

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Previously we reported (Hortobágyi et al., Society for Neuroscience Abstracts, Vol. I, p.156, 1993) 45% greater cross-transfer of muscular strength following exercise training of the quadriceps muscle of one leg with eccentric compared to concentric exercise. The mechanism of this greater cross-transfer of strength with eccentric exercsise training is unclear. We hypothesized that some of the cross-transfer effects might be mediated through reflexive activity associated with the eccentric muscle stretch. We have thus examined the impact of isometric, concentric, and eccentric contractions of the quadriceps muscles of one leg on the patellar tendon tap-elicited reflexive amplitude of the non-exercising leg. Six men and six women (mean age = 26.9 years ±SD = 6.83, n =12) were examined at baseline, under the three contraction modes (isometric contraction at 1.57 radians inclusive knee angle, concentric and eccentric knee extension at 1.05 radians·s^{-1}) and two conditions of tendon taps of the contralateral leg (with and without Jendrassik [J] maneuver). Reflexes were also evoked during recovery. The criterion measure was the reflex amplitude of the reflex response (in mV). No significant ($P > 0.05$) differences occurred across contraction conditions.

	Baseline		Isometric		Concentric		Eccentric		Recovery	
	No J	J	No J	J	No J	J	No J	J	No J	J
Mean	3.56	6.40	5.71	7.36	5.82	5.72	5.03	5.92	3.03	5.55
±SD	2.27	2.30	3.09	3.07	3.33	3.61	3.74	3.62	2.86	3.27

These data suggest that the greater cross-transfer effect of strength to the contralateral leg observed in our previous study was probably not mediated through a monosynaptic reflex mechanism. We speculate that the cross-transfer effect is probably mediated by central factors.

EFFECTS OF KNEE PAIN ON MAXIMAL EXERCISE BLOOD PRESSURE RESPONSES

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To test the hypothesis that knee pain might influence exercise blood pressure responses, 38 older adults ($\bar{X}$ age = 67yrs; 60-77) were studied at rest and during maximal treadmill exercise. Maximal measurements were taken during the last achieved stage of a GXT using a modified Naughton protocol. Blood pressure was by ausculation and knee pain self-rated on a 5 point scale (1=none, 2=mild, 3=moderate, 4=horrible, 5=excruciating). The study group (29 women, 9 men) was untrained ($\bar{X}$ VO2max =19.0 ml/kg/min) and overweight ($\bar{X}$ BMI= 28.2) with varying amounts of resting knee pain (1-3). All subjects were normotensive at standing rest ($\bar{X}$ SBP=127 mmHg, $\bar{X}$ DBP=78 mmHg). Criteria for true achievement of maximal exercise were met by 35 of 38 ($\bar{X}$ RER=1.1). At maximal exercise, $\bar{X}$ SBP was 185 mmHg, $\bar{X}$ DBP, 70 mmHg. Knee pain was significantly increased (1.37 vs 2.95, $p<0.001$). Despite the fact that 13 of 38 (34%) graded their knee pain at maximal exercise as either horrible or excruciating, none of the 38 had clearly exaggerated blood pressure responses (SBP>230, DBP>110) to the exercise. Neither maximal SBP nor maximal DBP was related to exercise knee pain (r=-0.07,0.09, respectively; $p>0.05$). We conclude that normotensive, osteoarthritic older adults can achieve maximal exercise levels during a GXT and have appropriate blood pressure responses to maximal exercise that are not affected by significant amounts of knee pain.

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THE EFFECT OF GENDER ON LOAD RANGE DURING ISOKINETIC KNEE EXTENSION AND FLEXION EXERCISE

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The benefits of isokinetic strength training are proportional to the amount of range of motion (ROM) actually spent at the pre-determined isokinetic velocity or load range (LR). This study sought to determine if gender differences existed for LR during isokinetic knee extension/flexion exercise. Subjects (9 male, 9 female; age 35.4 ± 7.2 yrs) performed three maximal isokinetic knee extension/flexion repetitions at 60, 120, 180, 240, 360 and 450 degrees per second (d/s). Males exhibited significantly greater LR at 240, 360 and 450 d/s during both extension and flexion. Values below (means±SEM) are in degrees of ROM. (* $p<0.05$)

	EXTENSION			FLEXION		
	Males		Females	Males		Females
60 d/s	76.9(0.2)		76.7(0.2)	77.1(0.3)		76.6(0.2)
120	71.8(0.2)		71.6(0.2)	71.2(0.3)		70.5(0.2)
180	65.9(0.5)		65.2(0.5)	65.2(0.7)		63.9(0.2)
240	59.5(0.7)	*	57.5(0.6)	58.8(0.6)	*	56.6(0.7)
360	43.3(1.0)	*	39.3(1.7)	42.3(0.8)	*	38.7(1.5)
450	16.9(2.5)	*	0.0	17.5(1.9)	*	6.9(1.0)

These results demonstrate that females were less able than males to attain velocity at very high speeds during both extension and flexion exercise. Consideration should be given to velocity selection during isokinetic strength training of females.

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TRUNK MUSCULATURE STRENGTH AND CHRONIC LOW BACK PAIN

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It is widely hypothesized that idiopathic low back pain (LBP) may be due in part to weak trunk musculature. The purpose of this study was to compare trunk extension-flexion strength in a group of subjects with chronic LBP and an asymptomatic group (NBP) matched for age ($\bar{X}$=28.5 years, s.d. 5.14 years), body composition ($\bar{X}$=18.3%, s.d. 8.35%), and gender (M=7, F=8). Additionally intratester reliability was assessed. Four sets of four reps of trunk flexion and extension exercises were performed on a Cybex Trunk Extension-Flexion unit at 60 and 120°/s. Back peak torque(BPT) and abdominal peak torque (APT) were measured. Results are shown:

Speed	BPT	BPT/BW	BPT/LBW	APT	APT/BW	APT/LBW
60°/s-NBP	195.1	119.3	145.0	117.7	71.2	86.2
LBP	174.0	109.1	130.6	115.5	71.9	86.3
120°s-NBP	176.2	106.8	129.7	124.6	75.1	82.1
LBP	152.8	96.1	115.0	109.2	67.7	81.0

Repeated measures ANOVA did not reveal any significant difference between groups. Unexpectedly there was not a consistent decrease in torque with an increase in speed for APT variables. Additionally results indicated significant intratester reliability in setting up the TEF unit. The LBP subjects of our sample do not evidence weakness in abdominal or back musculature.

PREDICTORS OF FUNCTIONAL LIFTING AND CARRYING TASKS

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In occupational medicine it is important to evaluate a patient's readiness for return to work through the use of batteries of simulated work tasks referred to as functional capacity evaluations (FCE). Performance on an FCE can be based on a variety of measures. On the Isernhagen FCE simulated work tasks, the floor to waist lift (FW), waist to overhead lift (WO), and front carry (FC), are important predictors of functional lifting capacity. This investigation evaluated the ability of 11 independent variables in predicting lifting and carrying capacity. Characteristics of the 24 subjects included the following mean ± SD values: age 31.3 ± 5.9 yrs, weight 80.83 ± 9.92 kg, and height 176.05 ± 5.34 cm. A forward stepwise regression analysis was used to develop a model that would predict the dependent variables FW, WO, and FC. The independent variables consisted of age, weight, % fat, grip strength, bench press strength (BP), overhead press strength (OH), leg press strength (LP), one min. sit-ups, sit and reach (SR), static push, and static pull. The following regression models were developed for each of the dependent variables:

$$WO = 7.926 + 0.061\ (LP) + 0.663\ (SR),\ P < 0.0001,\ R = 0.81$$
$$FW = 14.94 + 0.167\ (LP),\ P < 0.0001,\ R = 0.74$$
$$FC = 45.183 + 0.109\ (LP),\ P = 0.0123,\ R = 0.51$$

Results of this investigation indicate that leg press strength is an important predictor of both lifting and carrying capacity. When preparing individuals to return to work where lifting and carrying capacity are important considerations, leg press strength is an important variable.

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THE EFFECTS OF INTERMITTENT ISCHEMIA AND RUN TRAINING ON THE MORPHOLOGY OF RAT SOLEUS MUSCLE FIBERS

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This study examined the effects of run training on fiber number and cross-sectional area (CSA) of ischemic soleus muscle. Eighteen adult (4 mo. old) male Sprague-Dawley rats were divided into three groups: ischemic exercise (IE, n=6), exercise (E, n=6), and control (C, n=6). Ischemia in the IE group was induced by double ligation and severing of the left hindlimb femoral artery just distal to its appearance from beneath the inguinal ligament, fourty-eight hours before initiation of exercise. E and C animals underwent sham surgury. The exercise protocol consisted of running on a motor driven treadmill at a speed of $25 m \cdot min^{-1}$, at a 15% grade, five days/week for seven weeks. The E animals were randomly paired with IE animals and run until the IE animals exhibited an abnormal gait associated with ischemic pain (~30min). The C animals were restricted to cage activity. Twenty-four hours after the last exercise bout, the animals were dissected and myosin ATPase histochemistry (pH=4.6) was performed on cross-sections of the left hindlimb soleus muscles. Approximately 100 fibers from each muscle were classified as type I or II and analyzed for CSA. Post-training body weights were significantly greater ($P<0.05$) in the C group compared to IE and E (mean±SE) (C=475±15g; IE=421±15g; E=434±10g). Soleus muscle weights were not different between groups (C=236±10mg; IE=213±0.1mg; E=241±0.1mg). ATPase fiber typing revealed a decrease ($P<0.05$) in the mean CSA of the IE group type I fibers compared to C animals (C=6970±762μm^2; IE=4804±578μm^2; E=5432±195μm^2). Mean CSA of the type II fibers as well as the percentage of total fiber number for both type I and II fibers were not statistically different between groups. Thus, a decrease in muscle blood flow during exercise training results in a selective atrophy of type I fibers while type II fibers are unaffected.

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MORPHOLOGICAL AND PHENOTYPIC ALTERATIONS IN THE SOLEUS MUSCLE OF ADULT RATS FOLLOWING CLENBUTEROL TREATMENT

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This study examined the effects of 6-wks of treatment with the β_2-receptor agonist, clenbuterol, on the soleus muscle of fourteen adult female Sprague-Dawley rats (4 mon. old). We hypothesized that the selective type II hypertrophy associated with clenbuterol treatment would increase the proportion of total cross-sectional area (CSA) occupied by type II fibers without changing the number of type II fibers. Further, we hypothesized that this type II hypertrophy would result in a slow-to-fast shift in the relative proportions of the myosin heavy chain (MHC) isoforms.The animals were divided into two groups: clenbuterol treated (CL, n=7) (2mg•kg^{-1} body weight injected subcutaneously every other day), and control (CON, n=7) (injected with isotonic saline). Myosin ATPase histochemistry (pH=4.6) was performed on cross-sections of the soleus muscles. Approximately 100 fibers from each muscle were classified as type I or II and analyzed for CSA. Portions of the same muscles were analyzed using polyacrylamide gel electrophoresis (PAGE) to separate the various MHC isoforms. Post-treatment body weights were ~5% greater in the CL group compared to CON ($P<0.05$). The PAGE analysis indicated a decrease (~5%; $P<0.05$) in the relative percentage of type I MHC with a concomitant increase ($P<0.05$) in type IIdx MHC (CL=5.9% vs. CON=0.9%). ATPase fiber typing revealed increases ($P<0.05$) in the proportion of type II fibers expressed both as a percentage of total fiber number (CL=17% vs. CON=8%) and total CSA (CL=16% vs. CON=6%). Finally, the mean CSA of the type II fibers was ~25% greater ($P<0.05$) in CL. In conclusion, these data support our hypothesis that CL treatment results in an increase in the proportion of type II fiber CSA in the soleus. However, this was not due entirely to hypertrophy of the type II fibers but also to an increase in the total number of type II fibers. Therefore, the relative increase in the number of type II fibers, hypertrophy of these fibers, and the emergence of the type IIdx MHC in the CL group indicate a transition of muscle fiber phenotype as well as selective hypertrophy of type II fibers.

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EFFECTS OF AEROBIC EXERCISE IN NORMOTENSIVE ADULTS: A META-ANALYTIC REVIEW OF CLINICAL TRIALS

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Previous meta-analytic research (1) examining the effects of aerobic exercise on resting systolic (SYS) and diastolic (DIA) blood pressure in hypertensive adults found decreases of approximately 8 and 6 mm Hg, resting SYS and DIA blood pressure, respectively. Using the meta-analytic technique, the purpose of this study was to examine the effects of aerobic exercise on resting SYS and DIA blood pressure in normotensive adults. The results of 24 human clinical training studies published in journals between 1963-1992 and representing 1,210 subjects (1,061 exercise, 149 control) met the criteria for inclusion. Calculation of treatment effects (TE) revealed small reductions ($\bar{X} \pm$ SD) of 1.64 ± 4.00 and 2.71 ± 3.67 mm Hg, resting SYS and DIA blood pressure, respectively. Reductions in resting DIA blood pressure were significantly correlated with initial percent fat ($r = .72$, $P<0.05$). The results of this study suggest that aerobic exercise induces small reductions on resting SYS and DIA blood pressure among normotensive adults.

1. KELLEY, G.A. Hypotensive effects of aerobic exercise: A meta-analytic review of controlled clinical trials. *South Med J.* (in press)

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EFFICACY OF LONG TERM PARTICIPATION IN CARDIAC REHABILITATION

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Cardiac rehabilitation programs (CRP) have known beneficial short term effects on plasma lipids and functional capacity (FC). To determine the long term effects of a CRP, we compared plasma lipids and FC at entry (EN) and at 1-4 years of follow-up (FU) in 15 patients who remained in a CRP (Long Term) and 15 patients who participated in a CRP < 3 months (Short Term). Subjects were matched on month of entry into the CRP, age, and sex. Mean age (±SD) was 61.3 ± 7.8 years and mean time to follow up (±SD)was 32.8 ± 9.2 months. The data presented are mean ± SEM and were analyzed using repeated measures ANOVA. Level of significance was set at $p < 0.05^*$.

	Long Term		Short Term	
	EN	FU	EN	FU
TC (mg/dl)	211.5±7.1	217.1±5.7	215.9±9.8	216.9±9.4
HDL (mg/dl)	43.8±4.0	46.5±4.4	37.5±2.9	34.9±2.4
LDL (mg/dl)	134.9±6.6	143.1±6.1	146.3±8.1	143.5±9.5
TG (mg/dl)	163.8±15.8	137.4±18.0	161.1±10.7	192.2±28.0*
TC/HDL	5.4±0.5	5.1±0.4	6.1±0.3	6.5±0.4*
METS(est.)	8.3±0.7	10.7±0.8	7.6±0.7	8.1±0.7*
WT (lbs.)	175.8±6.8	176.3±7.3	188.2±8.9	193.7±8.7

At entry there were no differences between the two groups for any of the variables examined; however, the long term group showed a significant decrease in TG and TC/HDL and an increase in FC compared to the short term group. In addition, favorable yet non-significant trends were seen in HDL and WT when comparing the long term group to the short term group at follow up. These data would suggest that long term participation in a multidisciplinary CRP results in significant changes in plasma lipids and FC not seen in patients who are associated with a CRP for less than 3 months.

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EXAMINATION OF HYPERTENSION AND HYPERCHOLESTEROLEMIA AS POSSIBLE PREDICTORS OF SILENT MYOCARDIAL ISCHEMIA

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The purpose of this study was to evaluate systemic hypertension and hypercholesterolemia as predictors of asymptomatic (silent), as opposed to symptomatic (angina pectoris) ischemic heart disease. Forty two subjects at Georgia Baptist Medical Center had graded exercise treadmill tests (GXT) considered positive for ischemia (persistent horizontal or downsloping ST segment depression > 1mm). The diagnoses were then confirmed by 201 thallium scan stress tests (TSS). Of particular interest during their original examination was the presence or absence of systemic hypertension, defined as resting SBP > 150mmhg and/or DBP > 95mmhg, and the presence or absence of hypercholesterolemia, defined as TCL > 250mg/dL. Of the 26 subjects with silent ischemia, 6 had resting hypertension (23%) while 20 were normotensive (77%). Of the 16 subjects experiencing exercise induced angina pectoris, 1 was hypertensive (6.3%) while 15 were normotensive (93.7%). Of the 26 silent ischemia subjects, 1 had TCL > 250mg/dL (3.8%) while 25 had normal total cholesterol levels (96.2%). Of the 16 subjects with symptomatic ischemia, 5 had TCL > 250mg/dL (31%), while 11 had normal total cholesterol levels (67%). The differences between symptomatic and silent ischemia patients were not significant at the .05 level. While it is commonly accepted that hypertension and hypercholesterolemia predispose subjects to ischemic heart disease, they do not appear to be meaningful factors in predicting the absence or presence of angina pectoris.

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EFFECT OF SUMMER CAMP ON PHYSICAL ACTIVITY PATTERNS OF PATIENTS WITH CYSTIC FIBROSIS (CF)

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Two therapeutic goals for children with CF are to increase vigorous exercise, to improve pulmonary toilet and cardio-pulmonary reserves, without markedly increasing total energy expenditure, which would handicap needed weight gain. The impact of summer camp vs being at home on these goals was evaluated by ambulatory heart rate (HR) monitoring with Polar Vantage XL. Eleven consenting subjects were profiled upon intake to a nine-day summer camp for preteens with CF; adequate data for comparison (by paired t-tests) between camp and home conditions was available for 9 subjects with mean ages 9.7±1.9 yr (x+SD), height 136.8±10.6 cm, weight 33.2±5.1 kg, and percent predicted FEV_1 68.0±26.1%, including 5 boys. HR monitors were placed in the early morning and removed approximately 24 hr later, with each subject monitored for one day during camp. After camp, during the rest of the summer vacation, each subject was monitored for one day in their regular routine at home.

	24-hr Avg HR	12-hr Avg HR	% minutes >120 bpm	PAHR-25 Index	PAHR-50 Index
CAMP	107.0±13.0*	118.6±9.3*	44.3±22.1**	17.7±29.9	4.1±8.8
HOME	95.6±11.3	101.8±8.5	13.2± 7.7	13.2±11.4	4.6+6.0

(bpm = beats/min; PAHR-25 = percent of HR's 25% above resting; PAHR-50 = percentage HR's 50% above resting; * $p<.05$; ** $p<.01$)

There was evidence of more than 3 times more aerobic activity at camp than at home, but with a 12% higher average HR, indicative of a greater energy expenditure vs heat stress at camp.

Supported by Sunny Shores Sea Camp and Florida CF, Inc.

A COMPARISON OF SERUM LIPOPROTEIN AND BODY COMPOSITION IN COLLEGE STUDENTS UNDERGOING STRENGTH VERSUS ENDURANCE RESISTANCE TRAINING PROGRAMS

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Current research suggests that there is a strong association between aerobic training and positive changes in serum lipoproteins. The purpose of this study was to compare the effects of a muscular strength (MS) versus muscular endurance (ME) program on serum lipoproteins and body composition in college students . Subjects included 11 men and 4 women (8 MS, 7 ME) enrolled in a 12-week college weight training course. Both groups trained two days per week for 90 minutes per session. The MS group trained using high weights and low repetitions, at a 6-8 repetition maximum (RM) and the ME group trained using low weights and high repetitions, at a 15-20 RM. Outside activity and diet were unchanged throughout the semester. Evaluations on each subject included: fasting serum lipoproteins, body composition, flexibility using the sit-and-reach technique, strength using 1-RM for chest press, arm curl and leg extension, and endurance using 60-second push-up and sit-up tests. Results showed significant within group improvements in the MS and ME groups, respectively, for flexibility, ($p<.01$), as well as strength using the chest press ($p<.01$), arm curl ($p<.01$) and leg extension (MS $p<.01$; ME $p<.05$). In addition, the MS group showed a significant increase in lean body mass ($p<.05$) and the ME group showed a significant increase in push-ups ($p<.05$). No changes were observed in serum lipoproteins following training in either group. Furthermore, there were no significant differences between the MS and ME groups for any variables. In conclusion, these data support previous research that strength can be improved with both MS and ME training, however, resistance training of either type is not associated with any significant changes in serum lipoproteins.

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THE USE OF BIOELECTRICAL IMPEDANCE TO DETERMINE BODY FAT COMPOSITION IN CHILDREN

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The purpose of this study was to examine the value of bioelectrical impedance (BIA) for estimating percent body fat in 9-12 yr. old children. Eighty children had their height, weight, and skinfolds (tricep & subscapular) measured and body fat assessed by BIA. Body fat content was also computed from the sum of skinfolds (SF_{fat}) using equations based on age, gender and race (Lohman, 1992). The results indicated that the body fat measured by the BIA was significantly lower ($p=0.0001$) than that estimated from skinfolds ($BIA=23.0\pm8.9$; $SF_{fat}=27.8\pm8.5$). The differences were not related to race ($p=0.12$), gender ($p=0.90$), prior activity ($p=0.11$), or state of hydration. Pearson correlations between BIA, and weight, BMI, sum of skinfolds (Σ-SF), and SF_{fat} were weak.

Correlates	Weight	BMI	Σ-SS	SF_{fat}
BIA	0.524	0.559	0.570	0.448
SF_{fat}	0.712	0.752	0.890	----

The correlations between SF_{fat} and weight or BMI were consistently stronger. These results suggest that BIA may not be an appropriate method of estimating percentages of body fat in children. Further, these results suggest that body fat estimates from skinfolds may be more consistent with other measures of body fat.

Supported by a grant from National Institute for Nursing Research, NIH (NR01837).

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INFLUENCE OF WATER-RUN TRAINING ON RUNNING PERFORMANCE AND BODY COMPOSITION

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The purpose of this study was to examine the effect of a six week water-running program on the maintenance of performance (treadmill run time to exhaustion), body composition (%fat, %fat free weight), and hip flexor range of motion. Sixteen highly trained male runners ($\dot{V}O_2$ max = 58.6 ± 3.6 $ml \cdot kg^{-1} \cdot min^{-1}$) were assigned to one of two training groups (matched by $\dot{V}O_2$ max); water running (WR) or treadmill running (TMR). Performance time was recorded using a digital timer while subjects performed a graded treadmill test to exhaustion. Body composition was determined by hydrostatic weighing and corrected for residual lung volume. Subjects participated in their respective training programs consisting of workouts of either 30 min at 90-100% $\dot{V}O_2$ max or 60 min at 70-75% $\dot{V}O_2$ max which were alternated daily, five days a week. Training for the TMR group was conducted on a motorized treadmill and WR subjects performed workouts in a swimming pool while wearing a commercial flotation belt. Subjects' workout intensities were monitored by heart rate telemetry. No significant differences were observed between TMR and WR for any of the pre-test variables. No significant within group changes were seen due to training nor did training result in significant differences between WR and TMR for run time (1038 ± 343sec v 1241 ± 190sec), % body fat (14.2 ± 4.7% v 12.7 ± 5.0%) and % fat free weight (85.8 ± 4.7% v 87.3 ± 5.0%). These data suggest that water running may serve as an effective training alternative to land running for the maintenance of cardiovascular fitness and body composition among trained aerobic athletes.

Supported by grants from the Excel Sports Science, Inc. and the Florida State University Foundation.

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THE EFFECTS OF EXERCISE ON WEIGHT GAIN AND BODY IMAGE IN SEDENTARY PREGNANT FEMALES

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Past research has shown that active women can maintain a moderate level of exercise training during pregnancy. There is more controversy, however, regarding the effects of exercise on first time pregnant females (primigravidae) who have been previously sedentary. The present study was done to examine the impact of an exercise program on fitness level and self image of sedentary primigravidae. A total of nine exercising (mean age = 31.3) and six control primigravidae (mean age = 27.8) volunteered for the 15 week program initiated during the 2nd trimester of pregnancy. Volunteers exercised at a target heart rate (THR) of 130 $bts \cdot min^{-1}$ the first 2 weeks followed by a THR of 150 $bts \cdot min^{-1}$ for the duration of the study. Exercise included incline treadmill walking, cycling, stair-climbing and calisthenics set to music. Results showed that the exercise group had a significant increase in time on test ($p<.01$) while the control group showed a non-significant decrease in this variable. In addition, the exercise group showed positive changes in the Body Cathexis Scale which included muscular strength ($p<.01$), energy level ($p<.01$), body build ($p<.01$) hips ($p<.01$), physical stamina ($p<.01$), overall health ($p<.05$), and facial complexion ($p<.05$) and a negative change in sleep habits ($p<.05$). The control group showed no significant changes in any items except for a significant decrease in sexual satisfaction, ($p<.05$). Both the exercise and control groups gained a significant amount of weight, 36.97 lbs±10.9 and 34.97 lbs.± 7.6 respectively, with no significant differences in weight gain reported between the groups. All babies were delivered at term without complications. In summary, a well-supervised exercise program can be safely and effectively tolerated at a THR of 150 $bts \cdot min^{-1}$ in a group of sedentary primigravidae with favorable changes observed in fitness level and body image.

EFFECT OF INCREASED SWIM TRAINING ON NUTRIENT INTAKE AND CALORIC BALANCE OF MALE AND FEMALE COLLEGIATE SWIMMERS.

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To assess the effect of increased swim training volume on caloric balance, twenty-one collegiate swimmers (12 females and 9 males) were examined pre-season, after 3 weeks of primarily dryland training, and after 9 weeks and 18 weeks of swim training. Three-day food intake records were obtained to determine nutrient intake. Energy expenditure was estimated by indirect calorimetry and three-day activity records. Caloric expenditure increased by ~1000 kcal/day ($p<0.05$) after nine and eighteen weeks of swim training compared to pre-season. As training volume increased, the male swimmers increased caloric intake and consequently maintained caloric balance throughout the season. The female swimmers maintained caloric balance during the early and middle part of the season; however, they experienced a significant ~800 kcal/day deficit ($p<0.05$) at 18 weeks of training. Expressed per kilogram body weight, the male swimmers consumed ~1.8 g protein/kg and ~7.1 g carbohydrate/kg during peak training, while the female swimmers consumed ~1.3 g protein/kg and ~6.3 g protein carbohydrate/kg. In conclusion, male swimmers appear to match caloric intake to expenditure and consume adequate amounts of carbohydrate and protein during intense endurance training. In contrast, female swimmers did not match caloric intake to expenditure, and consumed inadequate amounts of protein and carbohydrate.

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ANAEROBIC CAPACITY AND PERFORMANCE OF CYCLISTS: EFFECTS OF DIETARY CARBOHYDRATE MANIPULATION

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The purpose of this study was to determine the effect of dietary carbohydrate intake on the peak oxygen deficit (anaerobic capacity) and high-intensity cycling performance. Nine male cyclists were tested under conditions during which the dietary carbohydrate intake corresponded to 35.3 $\pm$ 2.0%, 52.6 $\pm$ 2.0%, or 71.0 $\pm$ 2.0% of the total daily caloric intake and a regimen of pre-competition, high-intensity, reduced-volume training (taper) was followed. Conditions were counterbalanced and subjects were randomly assigned to conditions. Peak oxygen deficit and cycling time during supramaximal exercise (110% VO2max) were determined under each condition. Blood lactate concentration and acid-base status (pH, [HCO_3^-], PCO2, and base excess) were measured at rest, prior to, and immediately after supramaximal exercise. No significant differences ($p > 0.05$) were observed among the treatments for peak oxygen deficit and cycling time during supramaximal exercise. Blood lactate concentration and acid-base status measures were also not significantly different ($p > 0.05$) among treatments. Cycling time during supramaximal exercise improved progressively ($p < 0.05$) from the first to the last test (trials), regardless of treatment order. Peak oxygen deficit, blood lactate and acid-base status were not significantly different ($p > 0.05$) among trials. The total oxygen uptake utilized and total oxygen demand during supramaximal exercise increased progressively ($p < 0.05$) over trials. These results suggest that cycling performance during supramaximal exercise and peak oxygen deficit are not affected by dietary carbohydrate intake, and that the increase in cycling performance over time was mainly due to an increase in the energy provided by aerobic metabolism due to the high-intensity exercise employed in the taper regimen.

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EFFECTS OF CARBOHYDRATE SUPPLEMENTATION DURING INTENSE FIELD HOCKEY TRAINING ON DIETARY PATTERNS, PSYCHOLOGICAL STATUS & PERFORMANCE

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Carbohydrate supplementation during intense training has been suggested to optimize glycogen resynthesis and reduce symptoms of overtraining. This study examined the effects of carbohydrate supplementation on dietary patterns, psychological status, and aerobic & anaerobic performance during 7-days of U.S. National Field Hockey training. 7 members of the U.S. National Field Hockey team were matched and paired by position, training demands, and size to 7 team counterparts. One group blindly ingested a drink containing 1 gm/kg of carbohydrate (C) four times daily (4 gm/kg/d) while the remaining group blindly ingested identical volumes of a flavored water placebo (P). Pre- and post-training aerobic & anaerobic assessments were performed while daily dietary records were obtained. The Profile of Mood States (POMS) psychological inventory was administered prior to and following 10 practices held during the 7-day period. Data were analyzed by 2-way ANOVA with one repeated measure using Tukey post-hoc analyses. C supplementation increased ($p<0.002$) total caloric intake (2,306±793 vs. 3,444±985 kcals) and carbohydrate intake (336±131 vs. 590±169 gm) with no significant differences observed between groups in protein or fat intake. No significant ($p<0.05$) group or interaction differences were observed among P & C pre- or post-exercise tension, anger, depression, vigor, or confusion scores. Pre-exercise fatigue values tended be lower in the C group (8.2±5.1; 5.8±3.6, $p=0.10$) while post-exercise fatigue values were significantly lower in the C group (14.5±4.8; 10.7±6.2, $p=0.03$). No significant differences were observed among pre- (10.5±13.2; 9.5±18.3, $p=0.85$) or post-exercise (28.3±23.8; 22.3±25.9, $p=0.35$) total mood disturbance scores. No significant group or interaction differences were observed among P & C pre- and post-training maximal oxygen uptake, ventilation, VCO_2, respiratory exchange ratio, ventilatory anaerobic threshold (VANT), vertical jump height, maximal bench press or maximal leg press responses. A significant interaction ($p=0.03$) was observed among P & C time to exhaustion values (P=11.39±0.9 to 11.08±0.5; C=11.96±1.3 to 12.34±1.4 min). Results indicate that C supplementation increased dietary availability of carbohydrate, reduced perception of fatigue during training, and increased time to exhaustion following training. However, total mood disturbance and markers of aerobic and anaerobic capacity were not affected by C supplementation suggesting that additional factors contribute to fatigue during intense training.

This study was supported in part by Ross Laboratories of Columbus, Ohio & the Wellness Institute & Research Center at Old Dominion University.

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A COMPARISON OF BODY FAT DISTRIBUTION AND NUTRITIONAL INTAKE BETWEEN HIGHLY TRAINED AND SEDENTARY YOUNG WOMEN

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Little research is available regarding the relationship between endurance exercise training and regional adiposity in females. Exercise of sufficient intensity and duration may favorably effect the distribution of body fat in women. To examine this hypothesis cross-sectionally, 15 highly trained (HT) [$\bar{x}$ age=19.1±0.5 yr; $\bar{x}$ ht= 162.8±1.3 cm; $\bar{x}$ mass=52.2±1.4 kg; $\bar{x}$ $\dot{V}O_{2max}$=55.8±1.3 ml·kg·min^{-1}] were matched with 15 sedentary women (S) [$\bar{x}$ age=19.9±0.4 yr; $\bar{x}$ ht=163.8±1.0 cm; $\bar{x}$ mass=52.3±1.5 kg; $\bar{x}$ $\dot{V}O_{2max}$=39.1±1.0 ml·kg·min^{-1}) to determine if differences existed between groups in total body fat, body fat distribution, and nutritional intake. Hydrodensitometry results revealed a significantly lower body fat percentage for the HT group (13.1±1.0 vs 17.4±1.2%); however, no regional fat distribution differences were evident through measures of waist/hip ratio (0.82±0.01 vs 0.83±0.01), trunk/extremity ratio (0.91±0.05 vs 1.02±0.06) or subscapular/tricep skinfold ratio (0.92±0.05 vs 0.90±0.06). Three day dietary records indicated no significant difference between groups in total kcal intake (HT=1948±147 kcal, S=1775±182 kcal). An analysis of dietary quality revealed that the HT consumed a significantly higher percentage of carbohydrate (59.2±2.5% vs 51.0±2.1%) but were not different in percent of kcal from protein (15.4±0.7 vs 15.2±0.8%) or fat (26.6±2.6 vs 32.9±1.9%). These results indicate that in lean young women, exercise is associated with reduced body fat but not altered body fat distribution or nutritional intake.

THE RELATIONSHIP BETWEEN VO_{2MAX}, USING AN INDOOR TRAINER WITH THE TRIATHLETE'S OWN BIKE, AND SPRINT TRIATHLON PERFORMANCE

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The purpose of this study was to determine the relationship between VO_{2max} using an Indoor Trainer (a stationary cycle training device attached to the subject's own bike, IT) and performance in a sprint-distance triathlon (SDT). Subjects were 12 male experienced triathletes ($\bar{x}$ age = 29.75 ± 5.95 yr, ht = 179.49 ± 5.00 cm, wt = 75.94 ± 6.00 kg). Subjects completed the Hub City Hustle SDT and performed a GXT for VO_{2max}. SDT included a 0.5-mile swim, a 14.5-mile bike, and a 4.5-mile run. GXT had each subject attach his bike to a Performance Peak-Load II IT (resistance from zero [none] to six [most resistance]). A 53 - 19 gear ratio, and 80 rpm, were maintained throughout the test. After a 3-minute warmup, resistance was increased by one level at three min intervals until rpm < 80 for 30 sec, or volitional exhaustion. Mean VO_{2max} = 5.15 ± 0.75 $l \cdot min^{-1}$, and 68.14 ± 10.19 $ml \cdot kg^{-1} \cdot min^{-1}$. SDT times (min) were: Swim, 18.04 ± 4.13; Bike, 45.96 ± 6.11; Run, 36.91 ± 4.55; Overall, 100.91 ± 13.13. A Pearson correlation compared all subjects' VO_{2max} (relative and absolute) to performance in the swim, bike, and run portions and overall time in SDT. Relationships were considered significant (*) at the alpha level of $p < .05$. Pearson r values between VO_{2max} and times in the SDT were:

	SDT Component			
	Run	Bike	Swim	Overall
VO_{2max} ($l \cdot min^{-1}$)	-0.50	-0.51	-0.57	-0.59
VO_{2max} ($ml \cdot kg^{-1} \cdot min^{-1}$)	-0.74 *	-0.59	-0.55	-0.71 *

The relationships evident between relative VO_{2max}, measured using an IT, and times in an SDT (run portion and overall) may prove to be beneficial to triathletes for establishing training programs and/or determining progress towards success in SDT.

HIGH INTENSITY TAPERING IMPROVES PHYSIOLOGIC DETERMINANTS OF PERFORMANCE IN DISTANCE RUNNERS

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It is common for endurance athletes to taper prior to major competitions, however little is known about physiologic responses to this type of training in distance runners. The purpose of the present investigation was to examine the effects of a seven day high intensity low volume taper on physiologic determinants of performance in distance runners. Sixteen highly-trained male distance runners underwent 4 wks of normal heavy base training (BT)(88.7±7.9 km/wk). Following BT, subjects were performance-matched and randomly assigned to one of two groups: taper (TAP) and control (CON). TAP completed 7 days of diminishing volume (~60% reduction) high intensity interval training. CON maintained normal training. Responses to treadmill running at six submaximal velocities and a graded maximal test were observed before and after tapering. Significant decreases in weight relative (-2.9 $ml*kg^{-1}*min^{-1}$) and absolute (-.14 $l*min^{-1}$) submaximal oxygen consumption were observed following TAP ($p<.01$). No changes were observed in submaximal respiratory exchange ratio, maximal aerobic power (VO_{2max}), or time to exhaustion during graded maximal exercise in either group. Submaximal HR and ventilation were reduced ($p<.05$) and the minimum velocity associated with VO_{2max} (vVO_{2max}) was elevated ($p<.01$) following TAP. In addition, subjects reported lower RPE-overall and RPE-leg following TAP while running at a treadmill velocity corresponding to 10 kilometer race pace ($p<.05$). These results indicate that 7 days of high intensity tapering improve running economy and vVO_{2max}, and maintain VO_{2max} in distance runners. The improvement in running economy was associated with reduced submaximal HR and ventilation. This combination of factors may contribute to improved distance running performance capability.

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RELIABILITY AND PRACTICALITY OF THE CONCONI RUNNING TEST

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The Conconi Running Test uses the relationship between heart rate and workload to determine an optimal running pace for long distance runners. The purpose of this study was to determine if it could accurately predict a runner's time in a 8 or 5 kilometer cross country race. Eight cross country runners (4 males, 4 females) completed the Conconi Running Test on a treadmill 1-2 weeks before and after their first meet of the season. The average predicted running speed from the Conconi Running Test was 3.97 $m \cdot s^{-1}$ at the estimated anaerobic threshold limit. This was 93 % of the actual 3.69 $m \cdot s^{-1}$ running speed achieved by the runners in their first running meet. The average predicted running speed was 2.99 $m \cdot s^{-1}$ at the estimated aerobic limit while they competed at 125% of that limit. The difference between flat treadmill running and the energy requirements needed for running hills might explain much of this difference. The reliability coefficient for the test-retest condition was lower r = .88 than the correlation between the test-run condition, r = .98 for the estimated anaerobic threshold limit and r = .88 for the estimated aerobic limit. The effects of four weeks of training was probably responsible for the low test-retest correlation. It was concluded that while the running speed in competition was lower than the value predicted by the Conconi Running Test, the test provided a good estimate to be used for training purposes.

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THE RELATIONSHIPS BETWEEN THREE SPRINT EXERCISES AND PERFORMANCE IN A SPRINT DISTANCE TRIATHLON

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The purpose of this study was to determine the relationship between short-distance sprint performances (in swimming, biking, and running) and performance in Hub City Hustle sprint distance triathlon (SDT, 0.5-mile swim, 14.5-mile bike, 4.5-mile run). Subjects were 12 male experienced triathletes between the ages of 22 and 40 ($\bar{x}$ age = 29.75 ± 5.95 yr, ht = 179.49 ± 5.00 cm, wt = 75.94 ± 6.00 kg). Each subject completed the sanctioned SDT, and underwent performance testing, within 21 days of SDT. The short-distance sprint performance tests were each conducted on separate days and included a 200-yard swim, a 3-mile bike ride and a 1-mile run. Subjects were asked to complete each test as fast as possible. Time to complete each test was recorded. A Pearson correlation was use to compare these data to the subjects' performance in the swim, bike, and run portions, and overall time in the SDT. Statistical significance (*) was established at an alpha level of $p < .05$. Relationships are indicated below.

	SDT Component			
	Run	Bike	Swim	Overall
Sprint Run	.87 *			.74 *
Sprint Bike		.92 *		.85 *
Sprint Swim			.75 *	.37

The results of this study indicate that sprint performances in swimming, biking, and running are significantly related to performance times in a SDT. Sprint biking and sprint running were specifically related to overall performance. Therefore, sprint training may be important in order to be competitive in SDTs.

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