

## IN THIS ISSUE

Metabolic Syndrome: An Important Target for Exercise Intervention	1
Lifestyle Management of Hypertension	2
Fitness, Physical Activity, and Inflammatory Markers for Cardiovascular Disease	5
Coaching News Column	8
Metabolic Syndrome: Fast Track to the End of the Road	9
Self-Tests	11

# ACSM's Certified News



AMERICAN COLLEGE  
of SPORTS MEDICINE®  
www.acsm.org

APRIL/MAY/JUNE 2006

VOLUME 16; ISSUE 2

## News you need! Certification Updates

Spring 2006

by: Mike Niederpruem, National  
Director of Certification and  
Registry Programs

The ACSM Committee on Certification and Registry Boards (CCRB) Executive Council has been hard at work completing the conversion of the ACSM Health/Fitness Instructor® (HFI) and ACSM Exercise Specialist® (ES) certification exams from pen-and-paper format to computer-based testing format. Both exams were launched in CBT format on February 20. Now, all ACSM certification exams are available “on-demand” worldwide in English for the first time ever. Potential candidates can now register for an exam at a date, time, and convenient location that optimizes their exam preparation. Plus, candidates also obtain their test results immediately upon completion of their respective exam. Candidates can register for an exam by visiting [www.pearsonvue.com/acsm](http://www.pearsonvue.com/acsm). For more information regarding all aspects of ACSM certifications, please visit the ACSM website ([www.acsm.org](http://www.acsm.org)) and follow the links to certification.

### Workshops – 2007 Applications Now Available

Because ACSM exams are widely known for their difficulty, most candidates prefer to participate in a workshop prior to taking an exam. Applications are now available for 2007 workshops for both HFI and ES, and the application process is easier than ever. We even have a few select opportunities for 2006 workshops this Fall and Winter. Please contact Hope Wood for more information or a workshop application by calling (317) 637-9200, ext. 151, or via e-mail at: [certification@acsm.org](mailto:certification@acsm.org).

### Certified News – Call for Authors

ACSM's *Certified News* is a free, quarterly print publication for all ACSM Certified Professionals. Each issue contains two or

**Certification Updates... Continued on Page 12**

## Metabolic Syndrome: An Important Target for Exercise Intervention

Jonathan N. Myers, Ph.D., FACSM  
Cardiology Division  
Palo Alto Veterans Administration Health Care System  
and Stanford University, Palo Alto, CA

This issue of ACSM's *Certified News* focuses on the metabolic syndrome (MetS). This condition describes the clustering of particular risk factors that are associated with cardiovascular disease, including obesity, insulin resistance, hypertension, heightened triglycerides, low HDL levels, and a pro-inflammatory state. “Clustering” is a term often ascribed to MetS because the presence of one factor greatly increases the chances that others will be present. Recent studies from the United States and Europe have shown that the risk of myocardial infarction and stroke are two to four times higher in individuals with MetS. Given the prevalence of MetS today (nearly 50 million people in the U.S. according to the *Third National Health and Nutrition Examination Survey*), the ability to recognize and understand the role of physical activity in treating and preventing MetS are critical. As health care professionals dedicated to applying the principals of physical activity in the prevention and treatment of disease, we have an important role in increasing the public's awareness of and management of MetS.

The article by Barbara Hogan and James Owings addresses the definition, prevalence, and treatment of MetS, and how health and fitness professionals can help individuals apply exercise, diet and other lifestyle factors to counteract the adverse effects of MetS on the risk of cardiovascular disease. Two additional articles in this issue address related components of MetS — hypertension and inflammation. Although inflammation is not one of the defining components of MetS, it is tied closely to the clustering of risk markers that comprise it, and the importance of inflammatory markers (particularly C-reactive protein, or CRP) in the development of cardiovascular disease is now well-recognized. Paul Sorace and Susan Kraus have addressed

lifestyle management of hypertension. Hypertension is one of the five factors that tend to cluster and define MetS; it is present in about 80 percent of individuals with MetS. It is important to note that in the most recent (2003) report of the Joint National Committee on the Prevention, Detection, and Treatment of High Blood Pressure, the definition of hypertension is more strict than in the past. “Prehypertensive” individuals (those with blood pressures between 120-139 systolic and 80-89 diastolic), once considered normal, require dietary and lifestyle changes to normalize blood pressure. As described in this article, regular exercise has multifactorial effects that contribute to lowering blood pressure. Because the fitness professional typically has more frequent and direct contact with the hypertensive patient than the physician, they have a particularly important role in the detection and management of hypertension, including functioning as a gatekeeper to refer an individual to their physician for medical management when appropriate.

Studies also show that the individual risk factors that define MetS tend to be under treated. For example, between two thirds and three quarters of individuals with hypertension or abnormal lipids are inadequately treated, and only about 25 percent of U.S. adults engage in the minimum amount of physical activity recommended in the various consensus documents, defined as 30 or more minutes of moderate activity, most days of the week. These latter statistics are a reminder of the responsibility we have as health professionals to encourage the public to increase their physical activity level. Physical activity favorably influences all components of MetS; thus, we should also encourage other health care providers to recognize regular exercise as part of the standard treatment for this condition.

# Lifestyle Management of Hypertension

Paul Sorace, MS, ACSM RCEP, CSCS  
Senior Exercise Physiologist  
Private Lifestyle Management, LLC  
Florham Park, NJ

Susan Kraus, MS, RD  
Senior Dietitian  
Private Lifestyle Management, LLC  
Florham Park, NJ



## Introduction

Hypertension (HTN) is a very common cardiovascular disease that affects more than 58 million Americans<sup>1</sup>. HTN is typically known as the silent killer because it usually occurs with no symptoms. People often do not seek medical care until they have symptoms arising from the organ damage caused by chronic high blood pressure. That's why it is important to have blood pressure checked at least annually. On rare occasions, people with HTN can have symptoms. These include headaches, dizziness, blurred vision, nausea, nose bleeds, and sometimes heart palpitations. These may be a sign of dangerously high blood pressure (called malignant hypertension) or a serious complication, such as a heart attack.

Hypertension is defined as having a resting systolic pressure of  $\geq 140$  mm Hg and/or a resting diastolic pressure of  $\geq 90$  mm Hg (Table 1) or being on antihypertensive medication(s)<sup>11</sup>. A recent addition to blood pressure categories is prehypertension, defined as a resting blood pressure between 120-139/80-89 mm Hg. Individuals with prehypertension are at increased risk of developing hypertension<sup>7</sup>. For example, studies show that persons with resting a blood pressure of 130-139 / 80-89 mmHG are twice as likely to develop hypertension as those with lower pressures<sup>9</sup>.

Anyone with a blood pressure above optimal would benefit from lowering their blood pressure<sup>11</sup> (see Table 1).

HTN is a significant risk factor for a cardiovascular event (e.g., stroke, heart attack) and cardiovascular diseases<sup>4</sup>. HTN also is associated with coronary heart disease, heart failure, peripheral artery disease, and renal insufficiency. HTN compounds diseases such as dyslipidemia and diabetes mellitus and elevated blood pressure (130/85 mm Hg or greater) is a component of the metabolic syndrome<sup>11</sup>. Lifestyle management is the primary method for prevention and treatment of HTN<sup>7</sup>. Lifestyle management of hypertension includes weight or fat loss, physical activity, a DASH (Dietary Approaches to Stop Hypertension) eating plan, reduced sodium consumption, and moderation of alcohol consumption<sup>4,7,11</sup>.

## Role of Exercise\Physical Activity on Hypertension

There are several proposed mechanisms by which exercise\physical activity lowers resting blood pressure. These include a decreased total peripheral resistance, changes in renal function, neurohumoral adaptations (decreased serum norepinephrine levels), possible genetic influences, enhanced vascular responsiveness, vascular structural adaptations, and the effects of acute exercise<sup>1,3</sup>. The blood pressure lowering effects from acute and chronic exercise are likely multifactorial.

The average reduction in blood pressure in individuals with hypertension from a single endurance exercise session or regular aerobic training (e.g., at least 30 minutes on most days of the week) is approximately five to seven mm Hg for systolic and diastolic blood pressures<sup>1</sup>. Even small reductions of two mm Hg in systolic and diastolic blood pressures significantly reduces stroke risk by 14 percent and 17 percent and CAD risk by 9 percent and 6 percent, respectively<sup>1</sup>. A reduced blood pressure can last up to 22 hours from a single exercise session, which encourages daily exercise for blood pressure control<sup>1</sup>. Exercise of moderate intensity (e.g., 40-70 percent oxygen uptake reserve {Vo2R}) has shown to be effective for lowering blood pressure<sup>1</sup>. Also, intermittent

## ACSM'S CERTIFIED NEWS

### EDITORS

Thomas P. LaFontaine, Ph.D., FACSM  
Larry S. Verity, Ph.D., FACSM

### COMMITTEE CHAIR

Dino Costanzo

### CCRB PUBLICATIONS SUBCOMMITTEE CHAIR

Jonathan N. Myers, Ph.D., FACSM

### ADMINISTRATION

#### PRESIDENT

Carl Foster, Ph.D., FACSM

#### PUBLICATIONS COMMITTEE CHAIR

Jeffrey L. Roitman, Ed.D., FACSM

#### EXECUTIVE VICE PRESIDENT

James R. Whitehead

### NATIONAL CENTER NEWSLETTER STAFF

#### NATIONAL DIRECTOR OF CERTIFICATION AND REGISTRY PROGRAMS

Mike Niederpruem

#### ASSISTANT DIRECTOR OF CERTIFICATION

Hope Wood

#### MANAGER, CERTIFICATION PROGRAMS

Traci Rush

#### CERTIFICATION PROGRAMS COORDINATOR

Gretchen Dovenmuehle

#### PROFESSIONAL EDUCATION COORDINATOR

Casey Belcher

#### DIRECTOR OF PROFESSIONAL EDUCATION AND DISTANCE LEARNING

Karen J. Pierce

#### ASSISTANT EXECUTIVE VICE PRESIDENT

D. Mark Robertson

#### SENIOR DIRECTOR OF PUBLICATIONS AND MARKETING

Jeff Richardson

#### PUBLICATIONS MANAGER

David Brewer

#### FOR MORE CERTIFICATION RESOURCES CONTACT

#### THE ACSM CERTIFICATION RESOURCE CENTER:

1-800-486-5643

### INFORMATION FOR SUBSCRIBERS

#### CORRESPONDENCE REGARDING EDITORIAL CONTENT

#### SHOULD BE ADDRESSED TO:

Certification & Registry Department

E-mail: certification@acsm.org

Tel.: (317) 637-9200, ext. 151

#### CHANGE OF ADDRESS

#### OR MEMBERSHIP INQUIRIES

#### MEMBERSHIP AND CHAPTER SERVICES

TEL.: (317) 637-9200, EXT. 139 OR EXT. 136.

ACSM's Certified News (ISSN# 1056-9677) is published quarterly by the American College of Sports Medicine Committee on Certification and Registry Boards (CCRB). All issues are published electronically and in print.

The articles published in ACSM's Certified News have been carefully reviewed, but have not been submitted for consideration as, and therefore are not, official pronouncements, policies, statements, or opinions of ACSM. Information published in ACSM's Certified News is not necessarily the position of the American College of Sports Medicine or the Committee on Certification and Registry Boards. The purpose of this newsletter is to inform certified individuals about activities of ACSM and their profession and about new information relative to exercise and health. Information presented here is not intended to be information supplemental to the ACSM's Guidelines for Exercise Testing and Prescription or the established positions of ACSM.

ACSM's Certified News is copyrighted by the American College of Sports Medicine. No portion(s) of the work(s) may be reproduced without written consent from the Publisher. Permission to reproduce copies of articles for noncommercial use may be obtained from the Rights and Permissions editor.

### ACSM NATIONAL CENTER

401 WEST MICHIGAN ST.

INDIANAPOLIS, IN 46202-3233.

TEL.: (317) 637-9200 • FAX: (317) 634-7817



AMERICAN COLLEGE  
of SPORTS MEDICINE  
www.acsm.org

© 2006, American College of Sports Medicine.  
ISSN # 1056-9677

**Hypertension... Continued from Page 2**

and continuous exercise have both proven to be effective for lowering blood pressure<sup>1</sup>. This is important for those who cannot participate in a structured exercise program (e.g., busy schedule, low fitness level).

Although the evidence that resistance training (RT) has a favorable effect on blood pressure is limited and inconsistent, a notable study found that engaging in a regular resistance training program resulted in approximately a two percent decrease in systolic pressure and a four percent reduction in diastolic pressure<sup>5</sup>. These modest reductions can be significant when combined with regular aerobic exercise, proper eating habits (e.g., DASH plan), stress reduction, and weight loss (if needed). The traditional benefits from RT (e.g., increased muscle strength & endurance) will enhance an individual's abilities to carry out activities of daily living and perform more physical leisure activities. This can contribute to lowering blood pressure and improved quality of life. However, since greater reductions in blood pressure are achieved with aerobic exercise, RT should serve to supplement an aerobic exercise program designed to improve resting blood pressure<sup>1,11</sup>.

The benefits of regular exercise for hypertensives go beyond lowering blood pressure. Endurance exercise helps lower triglycerides and increases HDL cholesterol, improves insulin sensitivity and glucose management, helps to reduce/maintain bodyweight, increases fitness (MET level), and reduces stress. These effects reduce the risk of heart attack or stroke, even if blood pressure is not lowered.

## Antihypertensive Medications and Exercise Effects

There are a large number of medications used to treat HTN. It's important that the exercise professional is aware of all antihypertensive medications being taken by the individual, since special considerations may need to be taken. Whether or not an individual is given medication(s) is based on a number of factors. These include: severity of HTN, presence or absence of cardiovascular disease or target-organ disease, and the presence or absence of cardiovascular risk factors or other medical conditions<sup>3</sup>.

An individual with a resting blood pressure of >160/100 mm Hg should be on medication before adding aerobic exercise to their therapy<sup>11</sup>. Some of the more common antihypertensive medications include:

- **Beta Blockers:** Slow heart rate, may impair thermoregulation, and can cause hypoglycemia (low blood sugar). Individuals should be aware of symptoms of heat illness, maintain adequate hydration, exercise in cooler temperatures, wear proper clothes, ensure safe blood sugar levels for exercise (e.g., pre-exercise meal), and rely more on

### Table 1 - Classification and Management of Blood Pressure for Adults\*†

BP Classification	SBP mm Hg	DPB mm Hg	Lifestyle Modification	Initial Drug Therapy	
				Without Compelling Indication	With Compelling Indications
Normal	<120	And <80	Encourage		
Prehypertension	120-139	Or 80-89	Yes	No antihypertensive drug indicated	Drug(s) for compelling indications.‡
Stage 1 Hypertension	140-159	Or 90-99	Yes	Antihypertensive drug(s) indicated	Drug(s) for compelling indications.‡ Other antihypertensive drugs, as needed.
Stage 2	≥160	Or ≥100	Yes	Antihypertensive drug (s) indicated. Two-drug combination for most.§	

\* From National High Blood Pressure Education Program. The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC7). 2003. 03-5233.

† Treatment determined by highest BP category

‡ Compelling indications include heart failure, post myocardial infarction, high coronary heart disease risk, diabetes, chronic kidney disease, and recurrent stroke prevention. Treat patients with chronic kidney disease or diabetes to BP goal of <130/80 mm Hg.

§ Initial combined therapy should be used cautiously in those at risk for orthostatic hypotension.

Abbreviations: DBP, diastolic blood pressure; SBP, systolic blood pressure.

This table, originally printed in *ACSM's Guidelines for Exercise Testing and Prescription*, Seventh Edition, is reprinted courtesy of Lippincott Williams & Wilkins.

rate of perceived exertion (RPE) for monitoring exercise intensity. The recommended RPE is approximately 12-13 on a 6-20 Borg scale. If an individual doesn't have myocardial ischemia, beta blockers can reduce their exercise capacity.

- **Diuretics:** Can impair the body's ability to regulate body temperature and can cause hypoglycemia. The same precautions as with beta blockers should be taken. Potassium loss can occur with some diuretics (e.g., Lasix or Furosemide), increasing the risk of exercise-induced dysrhythmias. Ensuring adequate potassium is essential (see DASH eating plan).
- **Calcium Channel Blockers, Alpha Blockers, Vasodilators (e.g., ACE Inhibitors, ACE II Receptor Blockers):** Can cause excessive hypotension with abrupt exercise termination. Prolonged cool downs are recommended to stabilize blood pressure. Some calcium channel blockers also blunt exercise heart rate (use RPE).

## Exercise/Physical Activity Recommendations

An individual with hypertension should have medical clearance before starting a vigorous exercise program<sup>11</sup>. It is prudent to measure blood pressure before each exercise session (ideally after being seated for at least 5 minutes). A reading of >200 mm Hg systolic or >110 mm Hg diastolic is a contraindication for exercise<sup>11</sup>. Regularly checking pre-exercise blood pressure can also show reductions in resting blood pressure, which can provide motivation for the individual and enhance exercise adherence. For hypertensive persons just starting an exercise program and those with higher resting blood pressures (e.g., stage two and higher), measuring blood pressure

during exercise may be prudent (and recommended by the physician). A reading of >220/105 mm HG indicates exercise should be terminated<sup>11,11</sup>.

Although the optimal training frequency, intensity, time, and type (FITT) to lower blood pressure is unclear at this time, aerobic exercise is the recommended primary type of activity for controlling hypertension<sup>1</sup>. RT should compliment the aerobic component<sup>11</sup>. Flexibility exercise should be incorporated to enhance joint flexibility. A sample exercise program with training tips for a hypertensive individual is as follows:

- Perform aerobic exercise 3-7 days per week, for 30-60 minutes, at 40-70 percent VO2R<sup>11</sup>. Include a gradual warm-up and an extended cool down. Daily exercise may provide better control due to the acute reduction from exercise<sup>1</sup>. For non-structured aerobic exercise (lifestyle activity), accumulate 30-60 minutes of physical activity throughout the day, on most, preferably all days of the week.
- Perform RT two to three days per week, using at least 8 to 10 exercises for the major muscle groups, performing one set with a lighter resistance and higher repetitions (e.g., 12-15 reps)<sup>11</sup>. Keep the intensity moderate (max. RPE 15-16)<sup>11</sup>. Emphasize continuous breathing (avoid Valsalva maneuver) and avoid tight gripping to help limit rises in blood pressure. As one progresses from a novice to intermediate lifter, program changes can be made if desired (e.g., added exercises/sets, increased frequency of training). RT can be performed in a circuit manner or a traditional manner (% 1-Rep Max. designs), although high-intensity RT programs should be avoided.

**Hypertension... Continued from Page 3**

- Perform flexibility exercise (static stretching) at least two days per week, preferably 5-7 days per week<sup>11</sup>. Perform a light aerobic warm-up prior to stretching.
- Continual life stress increases the risk of developing cardiovascular disease<sup>4</sup>. Stress, through a series of physiological interactions, can lead to increased blood pressure<sup>2,4</sup>. Stress management techniques can help reduce stress levels and in turn, blood pressure<sup>6</sup>. Some examples of stress management include regular exercise, deep breathing techniques, meditation, yoga, Tai Chi, and hobbies.

**Eating for Blood Pressure Control**

The DASH Diet (Dietary Approaches to Stop Hypertension) has been shown to reduce elevated blood pressure and also reduce the risk of developing hypertension<sup>8,10</sup>.

DASH is a combination diet that emphasizes fruits, vegetables (five to nine servings of fruits and vegetables per day), low fat dairy foods and is low in saturated fat, total fat, and cholesterol<sup>8,10</sup>. DASH includes plenty of whole grains, poultry, fish, nuts, and reduced amounts of red meats, sodium, sweets, and sugared beverages. Reducing dietary sodium is particularly important for HTN control \ prevention. Limiting sodium intake to no more than 2.3g (2300mg) per day can reduce systolic blood pressure by two to eight mm HG<sup>11</sup>. However, lowering sodium intake even more can have greater effects on blood pressure. A DASH - sodium eating plan that limits sodium intake to 1600 mgs/day has similar effects as single drug therapy<sup>7</sup>. Table 2 provides an example of DASH. DASH doesn't specify requirements for fat intake. However, heart healthy fats (*i.e.*, unsaturated fats) should be included in meal planning due to their beneficial effects on blood lipids and heart health. The DASH eating plan also can lower total cholesterol, low-density lipoproteins (LDLs), and homocysteine levels, favorably modifying overall cardiac risk (see recommended reading).

Limiting alcohol consumption to no more than two drinks per day in men and one drink in women and lighter persons can reduce systolic pressure by two to four mm HG<sup>11</sup>. Excessive caffeine consumption should be avoided due to its acute effects on heart rate and blood pressure. Daily caffeine consumption should be kept in moderation (*e.g.*, one to two cups of coffee). Maintaining a normal bodyweight (*i.e.*, BMI 18.5-24.9 kgm<sup>2</sup>) is recommended for blood pressure control, since obesity is a prevalent risk factor for HTN<sup>7</sup>. Weight loss, when required, causes significant reductions in blood pressure. A 10 kg bodyweight loss can result in a systolic pressure reduction of approximately 5-20 mm HG<sup>7,11</sup>. Long-term weight loss is best accomplished

**Table 2 - The DASH Eating Plan**

This plan is based on a 2000 calorie diet. Depending on the individual's needs, the number of daily servings in a food group may vary from those listed.

FOOD GROUP	NUMBER OF SERVINGS	SERVING SIZES	HEALTHY EXAMPLES	SIGNIFICANT NUTRIENTS
Grains	7-8	1 slice bread, 1/2 cup cooked ( <i>e.g.</i> , hot grain cereal, rice, pasta) *1 oz. cold cereal (volume varies based on the weight of the cereal; range from 1/2 -1 cup)	Whole grain breads, rolls, pita, cereals, oats, grits	Energy, fiber, magnesium
Vegetables (choose deep colored vegetables)	4-5	1 cup raw 1/2 cup cooked 6 oz. vegetable juice	Tomatoes, peppers, broccoli, spinach, greens, beans, squash, carrots	Potassium, magnesium, fiber, calcium
Fruits	4-5	6 oz fruit juice, 1 medium fruit ( <i>e.g.</i> , 2-3 inch orange), 1/4 cup dried fruit, 1/2 cup fresh, frozen or canned fruit	Apricots, bananas, dates, oranges, grapefruit, mangoes, melons, peaches, pineapples, prunes, raisins, strawberries, tangerines	Potassium, magnesium, fiber
Low fat or non-fat dairy	2-3	8 oz. milk, 1 cup yogurt, 1.5 oz. low fat cheese (if needed substitute calcium fortified soy or rice milk)	Fat free or low fat milk, buttermilk, yogurt, part skim cheeses, cottage cheese, puddings	Calcium and protein
Protein	2 or less servings	3 oz. cooked lean meat, skinless poultry, fish, whole eggs, egg whites or egg beaters, soy in the form of analogs, veggie burgers, tofu can substitute for animal protein	Select only lean; trim away visible fats; broil, roast or boil instead of frying; remove skin from poultry	Protein and magnesium
Nuts, seeds, and legumes	4-5 per week	1.5 oz. or 1/3 cup nuts, 1 oz. or 2 tablespoon seeds, 1/2 cup legumes	Almonds, filberts, mixed nuts, peanuts, walnuts, sunflower seeds, kidney beans, lentils, black beans, garbanzos	Energy, magnesium, potassium, protein, fiber

through modest decreases in calories consumed and increased physical activity, creating a daily and weekly caloric deficit.

**Summary**

The fitness professional plays a critical role in the detection, treatment, and prevention of hypertension. First, checking patient's \ client's blood pressures on a regular basis is important. An estimated 30 percent of hypertensive individuals are undiagnosed<sup>7</sup>. Consistently elevated blood pressure readings can prompt an individual to see their physician for a possible diagnosis and medical treatment. Second, the fitness professional has frequent interaction with the person, coaching them along the way to a healthier lifestyle to prevent/control HTN, decrease their mortality rate, and enhance their quality of life.

**References**

1. American College of Sports Medicine. Position Stand: Exercise and Hypertension. *Med Sci Sports Exerc* 2004; 36: 533-553.
2. Coumel P., Leenhardt A.: Mental activity, adrenergic modulation, and cardiac arrhythmias in patients with heart disease. *Circulation* 83 (suppl 4): 58-70, 1991.
3. Durstine J.L., Moore G.E. ACSM's Exercise Management for Persons with Chronic Diseases and Disabilities. 2nd ed. Human Kinetics, 2003; pp. 76-80.
4. Kaminsky L.A., K.A. Bonzheim, C. Ewing Garber, S.C. Glass, L.F. Hamm, H.W. Kohl III, and A. Mikesky (Eds.) ACSM's Resource Manual for Guidelines for Exercise Testing and Prescription, 5th ed. Baltimore: Lippincott Williams & Wilkins 2005, pp. 102-103, 179-187.
5. Kelley, G.A., and K.S. Kelley. Progressive resistance exercise and resting blood pressure: A meta-analysis of randomized controlled

trials. *Hypertension*, 35: 838-843, 2000.

6. Linden, W., Lenz, J.W. & Con, A.H. (2001). Individualized stress management for primary hypertension. *Archives of Internal Medicine* 161(8): 1071-1080.
7. National High Blood Pressure Education Program. The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC7), 2003, 03-5233.
8. Sacks F., Svetkey L., Vollmer W., et al. Effects on blood pressure of reduced dietary sodium and the Dietary Approaches to Stop Hypertension (DASH) diet. DASH-Sodium Collaborative Research Group. *N Engl J Med* 2001; 344: 3-10.
9. Vasan R.S., Larson M.G., Leip EP, et al. Assessment of frequency of progression to hypertension in nonhypertensive participants in the Framingham Heart Study: A cohort study. *Lancet*. 2001; 358: 1682-1686.
10. Vollmer W., Sacks F., Ard J, et al. Effects of diet and sodium intake on blood pressure: Subgroup analysis of the DASH-sodium trial. *Ann Intern Med* 2001; 135: 1019-1028.
11. Whaley, M.H., P.H. Brubaker, and R.M. Otto (Eds.). ACSM's Guidelines for Exercise Testing and Prescription, 7th ed. Baltimore: Lippincott Williams & Wilkins 2005, pp. 22, 43-44, 154-160, 213-215, 220.

Recommended Reading <http://www.nhlbi.nih.gov/new/press/01-06-21.htm>

**About the Author**

Paul Sorace, MS, ACSM RCEP, CSCS is the senior exercise physiologist for Private Lifestyle Management, LLC in Florham Park, NJ. Paul also conducts fitness seminars throughout the East Coast and he is a member of the ACSM Registered Clinical Exercise Physiologist Practice Board and the ACSM CCRB Publications Sub-Committee.

Susan Kraus, MS, RD is the senior dietitian for Private Lifestyle Management, LLC in Florham Park,, NJ. Susan also is involved in many community-based outreach programs, where she lectures on nutrition management for healthy lifestyles.

# Fitness, Physical Activity, and Inflammatory Markers for Cardiovascular Disease

Jonathan Myers, Ph.D.

Matthew Lee, MS

Cardiology Division

Palo Alto Veterans Administration Health Care System  
and Stanford University, Palo Alto, CA



In 1964, Luther Terry M.D., the U.S. Surgeon General, released a report from the Surgeon General's Advisory Committee on Smoking and Health. The report was based on more than 7,000 articles available at the time, and was America's first widely publicized official recognition that smoking led to cancer and other diseases. At approximately the same time, the American Heart Association (AHA) identified smoking, high blood pressure, and high cholesterol as the three "primary" risk factors for cardiovascular disease. Most Americans can identify these three as factors that lead to the development of cardiovascular disease. In the 40 years since the release of these two reports, epidemiologic research in the area of cardiovascular disease has evolved considerably; estimating an individual's risk for cardiovascular disease has become much more sophisti-

cated. Dozens of clinical, historical, and exercise test variables have been applied using complex statistical models to estimate who, and to what extent, an individual is at risk for a cardiovascular event or mortality from cardiovascular causes. For example, we rarely speak any longer of simply "high cholesterol"; rather, "lipid disorders" are considered, which typically includes various lipid subfractions (LDL, HDL, total cholesterol, triglycerides, and lipoprotein a (lp(a)), along with several newer biomarkers in the blood that are related to cardiovascular risk.

Researchers who study cardiovascular disease have recently come to recognize that atherosclerosis is largely an inflammatory process. The "response to injury" hypothesis as a cause of atherosclerosis was first proposed more than 30 years ago, and suggests that damage to the arterial endothelium leads to lesions in

the artery and eventually to atherosclerotic plaques. In acute illness, inflammation serves an important role as a defense mechanism, but chronic inflammation can be harmful, contributing to a number of chronic diseases, including coronary artery disease. A pathogen commonly associated with respiratory infection, called *chlamydia pneumoniae*, is one of the important micro-organisms that appears to be responsible for causing injury to the endothelium, beginning the process that leads to atherosclerosis. An important feature of the inflammatory process is the recognition that circulating immune cells are recruited to the inflamed vessel by interacting with adhesion molecules, such as vascular cell adhesion molecule 1 (VCAM-1) and intercellular adhesion molecule 1 (ICAM-1), along with other proteins associated with the body's immune response.

Inflammation particularly occurs in areas where plaque is unstable, and it is now recognized that as many as 70 percent of myocardial infarctions occur in areas of "vulnerable plaque".<sup>1</sup> Stated differently, most heart attacks occur when the arterial wall becomes inflamed and subsequently vulnerable to cracking. This process leads to the above-mentioned "response to injury"; a series of events that leads to atherosclerosis. A number of blood markers have been identified that are associated with inflammation, most notably white blood cell count, C-reactive protein (CRP), other proteins involved in the immune response, homocysteine, and fibrinogen.

The most widely studied inflammatory blood marker is CRP, which is a protein that has recently been shown to contribute directly to the atherosclerotic process.<sup>2</sup> Recent, large follow up studies have shown that elevated levels of CRP are associated with a higher risk of myocardial infarction, stroke, and mortality, both in healthy individuals and patients with existing cardiovascular disease.<sup>3</sup> The relationship between CRP and cardiovascular risk has consistently been shown to be independent of traditional risk factors such as smoking, hypertension, and lipid disorders. For example, Ridker *et al.*,<sup>4</sup> observed that CRP added markedly to the prognostic power of traditional risk factors, and had twice the predictive value for cardiovascular events as the lipoproteins (LDL and HDL). Similarly, in the Physician's Health Study,<sup>5</sup> a randomized trial of health outcomes among U.S. physicians begun in 1982, the highest risk quartile for CRP was associated with a nearly three-fold increased risk of sudden cardiac death when compared to subjects in the lowest quartile for CRP. Many studies published in recent years have shown that higher CRP levels are associated with risk factors that define the metabolic syndrome (abnormal blood glucose, obesity, low HDL, high triglycerides, hypertension and pre-hypertension).<sup>2,6,7</sup> Table 1 illustrates the normal and abnormal values for CRP based on these recent studies.<sup>8</sup>

## Physical Fitness and Inflammation

Several of the early epidemiologic studies in this area reported that the lowest CRP levels were observed in subjects with normal body weight, those who were most physically active, or both, when compared to overweight and/or inactive individuals.<sup>9-12</sup> A number of more recent studies have focused on the association between inflammatory markers and fitness assessed by maximal exercise testing. Church and colleagues<sup>13</sup> studied 722 men as part of the Aerobics Center Longitudinal Study, and reported that CRP levels were 80% lower in the most fit group compared to

**Markers... Continued from Page 5**

the least fit group. Similarly, Aronson *et al.*,<sup>6</sup> observed a strong inverse association between lower CRP levels and higher fitness among 1,640 men undergoing exercise testing as part of a preventive medicine evaluation. The effect of fitness was strongest among subjects with the metabolic syndrome, suggesting that the benefits of fitness may be most pronounced among individuals with insulin resistance.

As part of an activity participation survey, LaMonte *et al.*,<sup>14</sup> studied 135 women and found that those with the highest level of fitness had 47 percent lower CRP levels when compared to those with the lowest fitness level. CRP levels were also proportionately higher as body mass index increased. In Japan, Ichihara and colleagues<sup>15</sup> studied 2,722 adults and reported that CRP was proportionately higher as the level of peak VO<sub>2</sub> was lower. Using the six major cardiovascular risk factors, CRP increased in accordance with the number of risk factors present.

A number of other studies have been published in recent years, and the inverse association between CRP and fitness has been highly consistent; these studies have included overweight and unfit children, elderly individuals,<sup>16</sup> diabetics,<sup>7</sup> and those with and without heart disease.<sup>17</sup> The recent recognition that fitness is a more powerful predictor of survival than traditional risk factors and other exercise test variables<sup>18,19</sup> may be explained in part by the strong, inverse association between fitness and inflammatory markers.

## Physical activity and inflammation

Acute exercise induces a transient inflammatory response, including heightened CRP concentration. This is most likely due to joint and muscle inflammation after vigorous activity. However, regular, sustained exercise has been demonstrated to suppress inflammation. This has been observed by studying inflammatory markers and physical activity patterns cross-sectionally, and also by measuring CRP before and after periods of training. Mattusch *et al.*,<sup>20</sup> studied 12 runners before and after nine months of moderate training in preparation for the Cologne Marathon, during which subjects increased running distance from an average of 31 to 53 km/week. Following this training period, mean CRP decreased by 31 percent. Abramson and Vaccarino,<sup>21</sup> in an analysis of 3,638 middle-aged or older healthy men in the National Health and Nutrition Survey III (NHANES III), reported a strong and independent association between higher physical activity patterns and level of CRP. Men who engaged in physical activity five times per week or more had 37 percent lower CRP levels than those who performed activity roughly once a week or less. In a more

generalized follow-up from the NHANES III study, Ford and colleagues<sup>22</sup> analyzed CRP levels from 13,748 adults and found that the most active subjects had CRP levels nearly 50 percent lower than sedentary subjects. King *et al.*,<sup>23</sup> reported lower levels of CRP and other inflammatory markers only among subjects who engaged in relatively vigorous activities (jogging and aerobic classes) compared to those participating in less demanding activities. Colbert and coworkers however,<sup>16</sup> reported that CRP levels were markedly reduced among those engaging in both larger and smaller volumes of physical activity compared to sedentary subjects.

Because early studies in the area of inflammation and activity had focused on younger subjects exposed to high levels of training, several recent investigations have addressed older sedentary individuals or patients with existing cardiovascular disease. Such groups are actually more relevant in this context since they are at much higher risk for cardiovascular events. Milani *et al.*,<sup>24</sup> studied 235 consecutive patients enrolled in a three month cardiac rehabilitation program, and compared their response to a group of control patients who did not undergo rehabilitation. Mean CRP levels decreased 36 percent among patients who participated in the rehabilitation program. More recently, Golhammer *et al.*,<sup>25</sup> measured CRP levels before and after three months of rehabilitation in 28 patients with stable coronary artery disease, and observed a 48 percent decrease in CRP and similar reductions in other inflammatory markers following the training program. The latter two studies suggest that the effects of an exercise program on inflammatory proteins in patients with established cardiovascular disease are similar to those reported among younger, healthy individuals engaging in high levels of training.

## Strategies for lowering CRP

Currently, the primary treatment option for clinicians treating elevated CRP is therapy with the widely-used statin agents. Therapy with statins has been shown to reduce CRP by 20 to 30 percent,<sup>2</sup> and studies are currently underway to determine the impact of lowering CRP with statins in the absence of other clinical manifestations of cardiovascular disease.<sup>3</sup> ACE-inhibitors and aspirin are also known to reduce inflammation,<sup>26</sup> and these agents have been shown to be useful among individuals with high CRP levels. Smoking can be very hazardous to an area of vulnerable plaque; nicotine enhances inflammation by stimulating the release of additional proteins which can lead to rupture of the vulnerable area, contributing to a cascade of events in the vessel that leads to clotting. Diets high in whole grains and fiber and low in fat (10 to 15 percent) have been shown to reduce CRP

**Table 1 - C-reactive Protein Values Arranged in Quintiles of Risk\***

Rank	Quintile	CRP Range
Lowest Risk	1	<0.7 mg/L
Mild Risk	2	0.7 - 1.1 mg/L
Moderate Risk	3	1.2 - 1.9 mg/L
High Risk	4	2.0 - 3.8 mg/L
Highest Risk	5	3.9 - 15 mg/L

\* Values above 15 mg/L are generally associated with infection.

and other inflammatory markers.<sup>27</sup> The fact that an exercise program in healthy adults or a cardiac rehabilitation program after a cardiac event has been shown to reduce CRP levels by >30 percent suggests that the effect of exercise is at least as strong, and possibly greater, than the effect of statin therapy. As a minimum, these studies underscore the recommendation that regular exercise should complement dietary counseling and lipid-lowering therapy for patients with elevated CRP levels.

Why would higher levels of fitness or physical activity be associated with more favorable levels of inflammatory markers in the blood? This has not been clearly established, but several mechanisms have been proposed. Higher physical activity patterns and fitness are associated with lower levels of body fat and LDL-C, both of which have been suggested to be non-infectious triggers for elevated CRP.<sup>2,9</sup> It has also been suggested that physical activity can reduce inflammation by improving insulin resistance, since several inflammatory markers are higher among insulin-resistant subjects.<sup>28</sup> By promoting weight loss, circulating insulin levels are reduced, leading to a reduction in CRP. Physical activity also improves endothelial function, and endothelial cells are known to increase production of interleukins, important proteins involved in directing the immune response.<sup>29</sup>

## What recommendations should be made to the public?

The AHA does not currently recommend that all individuals routinely have a CRP evaluation. However, CRP should be considered any time an overall evaluation is performed to assess cardiovascular risk. It is now common for many clinicians to simply include analysis of CRP when blood is drawn routinely to assess cholesterol levels, since this minimizes cost and obviates the need for an additional blood draw. The AHA has specifically recommended the evaluation of CRP for individuals at intermediate or high risk for cardiovascular disease (*e.g.*, those with other risk factors or a Framingham score  $\geq 10$  percent five-year risk), and has also recommended CRP analysis for those with a previous myocardial infarction

**Markers... Continued from Page 6**

and anyone admitted to the hospital with chest pain.

The addition of CRP to a standard screening evaluation for cardiovascular risk can provide a simple and inexpensive way to improve the estimation of risk. For individuals who have abnormal CRP levels, preventive strategies can be initiated. Fortunately, the best ways to lower CRP are the same as those already known to lower overall cardiovascular risk; aside from increasing physical activity, these include reducing saturated and trans fat intake, stopping smoking, and control of blood lipids, hypertension, weight, and blood glucose levels. The knowledge that an individual's CRP level is high is an additional reason to encourage them to increase their physical activity. Because cardiovascular disease is increasingly recognized as an inflammatory process, it is reasonable to suggest that regular exercise helps to prevent heart disease by reducing inflammation.

**References**

1. Naghavi M, Libby P, Falk E, et al. From vulnerable plaque to vulnerable patient: a call for new definitions and risk assessment strategies: Part I. *Circulation*. Oct 7 2003;108(14):1664-1672.
2. Yeh ET, Willerson JT. Coming of age of C-reactive protein: using inflammation markers in cardiology. *Circulation*. Jan 28 2003;107(3):370-371.
3. Ridker PM. High-sensitivity C-reactive protein and cardiovascular risk: rationale for screening and primary prevention. *Am J Cardiol*. Aug 21 2003;92(4B):17K-22K.

4. Ridker PM, Glynn RJ, Hennekens CH. C-reactive protein adds to the predictive value of total and HDL cholesterol in determining risk of first myocardial infarction. *Circulation*. May 26 1998;97(20):2007-2011.
5. Albert CM, Ma J, Rifai N, Stampfer MJ, Ridker PM. Prospective study of C-reactive protein, homocysteine, and plasma lipid levels as predictors of sudden cardiac death. *Circulation*. Jun 4 2002;105(22):2595-2599.
6. Aronson D, Sella R, Sheikh-Ahmad M, et al. The association between cardiorespiratory fitness and C-reactive protein in subjects with the metabolic syndrome. *J Am Coll Cardiol*. Nov 16 2004;44(10):2003-2007.
7. McGavock JM, Mandic S, Vonder Muhll I, et al. Low cardiorespiratory fitness is associated with elevated C-reactive protein levels in women with type 2 diabetes. *Diabetes Care*. Feb 2004;27(2):320-325.
8. Rifai N. C-reactive protein and coronary heart disease: diagnostic and therapeutic implications for primary prevention. *Cardiovasc Toxicol*. 2001;1(2):153-157.
9. Barinas-Mitchell E, Cushman M, Meilahn EN, Tracy RP, Kuller LH. Serum levels of C-reactive protein are associated with obesity, weight gain, and hormone replacement therapy in healthy postmenopausal women. *Am J Epidemiol*. Jun 1 2001;153(11):1094-1101.
10. Esposito K, Pontillo A, Di Palo C, et al. Effect of weight loss and lifestyle changes on vascular inflammatory markers in obese women: a randomized trial. *Jama*. Apr 9 2003;289(14):1799-1804.
11. Forouhi NG, Sattar N, McKeigue PM. Relation of C-reactive protein to body fat distribution and features of the metabolic syndrome in Europeans and South Asians. *Int J Obes Relat Metab Disord*. Sep 2001;25(9):1327-1331.
12. McLaughlin T, Abbasi F, Lamendola C, et al. Differentiation between obesity and insulin resistance in the association with C-reactive protein. *Circulation*. Dec 3 2002;106(23):2908-2912.
13. Church TS, Barlow CE, Earnest CP, Kampert JB, Priest EL, Blair SN. Associations between cardiorespiratory fitness and C-reactive protein in men. *Arterioscler Thromb Vasc Biol*. Nov 1 2002;22(11):1869-1876.
14. LaMonte MJ, Durstine JL, Yanowitz FG, et al. Cardiorespiratory fitness and C-reactive protein among a tri-ethnic sample of women. *Circulation*. Jul 23 2002;106(4):403-406.

15. Ichihara Y, Ohno J, Suzuki M, Anno T, Sugino M, Nagata K. Higher C-reactive protein concentration and white blood cell count in subjects with more coronary risk factors and/or lower physical fitness among apparently healthy Japanese. *Circ J*. Jul 2002;66(7):677-684.

For a complete list of references, please e-mail certification@acsm.org.

**About the Authors**

*Jonathan Myers, Ph.D., FACSM, is a Health Research Scientist at the VA Palo Alto Health Care System and a Clinical Associate Professor at Stanford University. He currently chairs the ACSM CCRB Publications Subcommittee.*

*Matthew Lee, MS, is a graduate student at Boston University School of Public Health and Division of Graduate Medical Sciences.*



## Staying up to date with the ACSM Calendar of Events

Find the latest continuing education information in the ACSM Calendar of Events at [www.acsm.org](http://www.acsm.org). Select "Education and Continuing Education and Calendar of Events."

# Ready for Another Peak Experience?



**Then attend the ACSM 53rd Annual Meeting in Denver!**

**T**ake your career, experiences, and learning to new heights! Learn from other distinguished experts in a program that contains the highest quality basic science, applied science, and clinical sports medicine sessions. **And while you're in Denver**, treat yourself to its many attractions, including Coors Field, the home of the Colorado Rockies, or a visit to one of Denver's many fine restaurants or jazz clubs.

For more information, go to [www.acsm.org](http://www.acsm.org) or call 317-637-9200 (ext. 135).

POWERED BY ACSM'S RESEARCH COURTESY OF THE ABOVE ACSM COLLEGE & WORKING PARTNERS



THE VERY BEST SCIENCE

CEC AND CME OPPORTUNITIES

NETWORKING AND SOCIALS

STREAMLINED SESSIONS

*This meeting is streamlined from four days to three and one-half days! Also the session lengths have been streamlined so you can choose from more programming available in more concise formats.*

ADVANCE PROGRAM NOW AVAILABLE • VISIT [WWW.ACSM.ORG](http://WWW.ACSM.ORG)

## Coaching News



## Personal Training Plus Wellness Coaching: A Powerful Combination



This is the eleventh edition of the Coaching News column, sponsored by Wellcoaches Corporation in alliance with ACSM, and it appears regularly in *ACSM's Certified News*.

After twelve years of working in the clinical arena, while spending a portion of my time as a personal trainer and strength coach, I decided two years ago that it was time to work full time as an entrepreneur. With my certification as a wellness coach, I'm able to combine personal training with coaching in a way that is not only very unique in the fitness business, but also highly effective.

I have never felt more fulfilled in my work, and my clients have never accomplished more. Yes, I have matured over the years, and have learned a great deal from experience, but wellness coaching has added a whole new dimension to my fitness business.

I often describe the wellness coaching I do as business and/or life coaching disguised as wellness coaching. As fitness professionals we

are well aware that in order for someone to be successful in their pursuit of sound health and wellness, success is often determined by their ability to balance all aspects of their lives carefully and consciously. So very often, we are strategizing with our patients and clients through all aspects of their lives so that they can not only find the time and energy to exercise and eat right, but so that they discover why they might be struggling.

I always felt that there were many coaching themes in the work that I was doing, but until I went through the process of becoming a wellness coach, I never realized how much more I could help people by simply becoming more of a coach and less of a teacher throughout the process.

Coaching, as it turns out, is very different from what we do as trainers, because we are taking ourselves out of the role of teacher and instructor and into the role of guide and coach. And there is no limit to the techniques and strategies that can be used as a coach to help guide someone to long-lasting solutions. The true beauty is that your approach will always be slightly different than mine, because as coaches we are all unique in our approach to combining the art and science of coaching.

Combining coaching with personal training has allowed me to do the teaching necessary to design effective exercise programs, while also providing the space and time necessary to listen, guide, problem-solve, and strategize with clients about how to make all of it work. People love this opportunity, and they all feel that this is what they truly need to be successful. Their results are proof that it works.

Here is one example of what I'm talking about... (more examples posted at [www.thefitnessnomad.com](http://www.thefitnessnomad.com))

His name is Mike and he's 34 years old with two small children less than 10 years old. He's still married to the love of his life, but has become somewhat disconnected with her. After all, she is a full time lawyer too, and having children will challenge even the best of marriages. I know that story well with two of my own.

Mike's workload is at least double that of the average person, but he's in debt, has just started his own law firm, and can't afford to hire the help he needs in his office. So he just grinds it out, because he's not the kind of guy who is used to putting himself first. Though he knows he needs to take better care of himself, he is so deep into his situation, that he doesn't even know where to begin.

He wants to quit smoking, but has become reliant on the nicotine for alertness during his late night work. The cigarettes also feel to him like a necessary vice since there is almost nothing left in his life for him personally at this point.

He wakes up tired every day, doesn't eat or drink much until dinner time, and works in an

environment at the office and in the courtroom that demands his optimal performance at all times. Somehow, he's getting it all done, but he is aware that he's struggling, which is why he made the decision to hire me.

Mike and I decided that two sessions per week for three months was a good start (one coaching session and one training session). And though it was a challenge, he made time in his schedule for both and didn't miss any of them.

Four months later Mike doesn't need coaching more than once a month, and even though his workload has not really changed, he has found time for exercise, is eating during the day, drinking more water, and working all night only when absolutely necessary, instead of relying on this as a solution.

It's worth noting that Mike had suffered a serious back injury about a year before coming to see me, and had tried to begin an exercise program on his own, but his back pain and spasms wouldn't allow him to be consistent. Working with me as his trainer, we were able to address this problem and prevent his back from limiting his performance.

Mike reports that he is feeling much better, has more energy, and has begun formulating a better plan for his workload. This has given him new hope. Mike's life is more balanced, and he now sees me only twice per month, mostly for exercise, and we perform isolated coaching sessions on an as needed basis, either in person or over the telephone.

Having a coach provides a level of support that is often missing in people's lives. Combining the coaching support with personal training has allowed me to help my clients create lasting change and transform their lives. Combining personal training + coaching is the next big thing in fitness — not only for our clients, but also for our personal transformation as fitness professionals.

This article was written by John Ashworth, based in Madison, WI. John is a personal trainer, wellness coach, and entrepreneur. His credentials include ACSM Certified Exercise Specialist, NSCA Certified Strength & Conditioning Coach, and a wellness coach certification. John recently founded two companies: [www.ExerciseCareers.com](http://www.ExerciseCareers.com) and [www.TheFitnessNomad.com](http://www.TheFitnessNomad.com). He also runs the Wellcoaches job board at [www.WellnessCoachCareers.com](http://www.WellnessCoachCareers.com).

Go to [www.wellcoach.com](http://www.wellcoach.com) for more information on Wellcoaches and its coach training and certification programs for health and fitness professionals.

The Coaching News column is sponsored by Wellcoaches Corporation, the leader in health, fitness, and wellness coach training and delivery of wellness coaching services, in partnership with ACSM. To learn more about this topic or other topics on coaching health, fitness, and wellness, visit [www.wellcoach.com](http://www.wellcoach.com).



# Metabolic Syndrome: Fast Track to the End of the Road

Barbara Hogan, M.Ed. and Matt Owings, M.S.



Metabolic Syndrome (MetS) has been described as an epidemic, a national “crisis” and an alarming trend.

Urgent action is needed to reverse and prevent MetS and Fitness Professionals (FP) should be in “alarm mode” in fighting obesity, diabetes and other diseases that are closely associated. This article will discuss the Metabolic Syndrome and explain why it is important for FP to learn more about this life-threatening condition. If there ever was a need to have an emergency call for action in our profession, this is it.

## Introduction to the metabolic syndrome

The MetS may appear to be current news but it was first introduced in 1923, when E. Kylin described a syndrome involving hypertension, hyperuricaemia (too much uric acid in the blood), and hyperglycemia.<sup>12</sup> Sixty five years later, Gerald Reaven, M.D., introduced the concept of insulin resistance during his 1988 Banting Lecture at the annual meeting

of the American Diabetes Association.<sup>15</sup> He labeled the condition “Syndrome X,” but it is also known as the Metabolic Syndrome (MetS) and the Insulin Resistance Syndrome (IRS).

## Definitions and Descriptions

MetS is defined as a combination of three or more of the following factors:<sup>16</sup>

- Large waist circumference (>40 inches in men, >35 inches in women)
- Blood Pressure > 130/85 mm Hg or on medication
- Elevated triglycerides (<150 mg/dL) or on medication
- Low HDL cholesterol (<40 mgs/dL in men, <50 mg/dL in women) or on medication
- Elevated fasting blood glucose 100-125 mg/dl or on medication

Notice that four of these five markers are listed as primary risk factors for cardiovascular disease in ACSM's *Guidelines for Exercise Testing and Prescription*, Seventh Edition. Of these five factors, large waist circumference is the chief predictor of the MetS.<sup>17</sup>

**Insulin resistance** is the diminished ability of cells to respond to insulin's signal to transport glucose (sugar) from the bloodstream into muscle and other tissues.

**Body weight classification of normal, overweight, or obese** is determined by the body mass index (BMI) as follows:

- BMI 18.5 – 24.9 = normal
- BMI 25-29.9 = overweight
- BMI  $\geq$  30 = obese

In ACSM's *Guidelines for Exercise Testing and Prescription*, Seventh Edition, BMI>30 is identified as a primary risk factor for cardiovascular disease. However, BMI does not account for body composition. Some individuals who are well-trained strength/power athletes such as bodybuilders or football players may have BMIs>30 with high fitness levels and low percent body fat. Likewise, there are individuals who have BMIs<25 who have poor fitness levels and relatively high percent body fat. Population-wide, there are few

individuals who fit either of these descriptions<sup>5</sup>. The vast majority of individuals whose BMI exceed 30 are, in fact, obese. With few exceptions, BMI is a valid assessment of obesity in the general population.

Clients with the MetS generally exhibit android obesity or “apple-shape,” where much of their fat mass is concentrated around the waist. Android obesity is more strongly associated with cardiovascular disease risk than is lower-body or gynoid obesity, the “pear-shaped body.”<sup>5</sup>

Take an opportunity during the initial consultation with your clients to explain the risks associated with android obesity. This discussion could prove to be a “turning point” for your client leading to health benefits that could potentially last a life-time.

## Prevalence

Immediate action for treating the MetS is important because it is associated with an increased risk of Type 2 Diabetes, cardiovascular disease, and premature mortality. Currently, 64.5 percent of U.S. adults, age 20 years and older, are overweight and 30.5 percent are obese, according to the Department of Health and Human Services<sup>8</sup>. Since overweight and obese individuals are at higher risk of having the MetS, the implications are important for the FP to note.

Ford et al. estimated that 47 million or 25 percent of U.S. adults have the MetS.<sup>8</sup> Some experts estimate that at least half of persons over age 60 meet the criteria for the MetS. Young Americans are also at risk. A recent analysis found that about 30 percent of overweight adolescents have the MetS.<sup>2</sup> Prevalence rates also differ across ethnic groups. The highest overall prevalence is found in Mexican Americans (32 percent), who make up a rapidly growing segment of the U.S. population<sup>7</sup> The lowest prevalence is among whites (23.8 percent), African Americans (21.6 percent) and people reporting an “other” race or ethnicity (20.3 percent)<sup>8</sup>.

## MetS, CVD, and Physical Activity

Men who have the MetS are 29 percent more likely to die of any cause and 89 percent more likely to die of CVD than men without the condition.<sup>11</sup> The risk of having the MetS is higher in those with lower levels of cardiorespiratory fitness. In 2004, The Aerobic Center Longitudinal Study<sup>10</sup> provided data indicating that cardiorespiratory fitness strongly protects against CVD and mortality in individuals with the MetS. Between 1979 and 1995, 19,223 men (average age = 43), completed a maximum stress test on a treadmill and were screened for CVD, stroke, and cancer.

**Metabolic Syndrome... Continued from Page 9**

Participants were assigned to either unfit or fit categories. Men in the lower quintile (20 percent) were classified as least fit, whereas men in the upper four quintiles (80 percent) were classified as most fit. Of the 19,223 participants, there were 15,466 healthy men (80.5 percent) and 3,757 men with the metabolic syndrome (19.5 percent). A total of 480 deaths (161 due to CVD) occurred; 5.5 percent of men with the MetS died during this period while only 1.6 percent of men without the MetS died. However, after adjustment for fitness level, the difference in mortality was not different between those with and without MetS, suggesting that fitness had a protective effect on mortality.

**Recognizing the MetS Client**

As stated earlier, abdominal obesity is the first and most important clue that a client may have the MetS. In *ACSM's Guidelines for Exercise Testing and Prescription*, Seventh Edition, primary risk factors for cardiovascular disease include: a waist girth of 40 inches for men and 35 inches for women, a BMI >30, a waist to hip ratio of >0.95 in men and >0.86 in women, and sedentary lifestyle.

When clients first meet with a health and fitness professional, they often have little knowledge about their primary risk factors such as fasting glucose, blood pressure, or blood lipids. According to ACSM's risk stratification, individuals with two of the following signs and symptoms are classified as high risk for cardiovascular disease and should be referred to a physician before beginning an exercise program: the presence of a BMI >30, a large waist circumference (> 40 in. in men and >35 in. in women), a waist to hip ratio of >0.95 in men or >0.86 in women, and/or a sedentary lifestyle.

"Vigorous physical activity" is defined as an intensity >60%  $\dot{V}O_{2max}$ , which is attainable for many clients during brisk walking. Avoid using the term "vigorous" when talking to the client about the initial program because of the possible negative connotation of the word. In place of vigorous, use less threatening words, such as suitable, appropriate, or moderate. Remember, many sedentary people associate exercise with pain, so it is important to create dialog that is psychologically comfortable for them. In addition, it is critical for the FP to record and carefully evaluate any information provided by the physician before initiating a program.

**Exercise Recommendations for the MetS Client**

It has been established that sedentary lifestyle and poor cardiorespiratory fitness increase the risk for the MetS. In fact, Lakka *et al.*, found that men who spent less than one hour per week in physical activity were 60

percent more likely to have the MetS than men who spent three or more hours per week involved in physical activity. The same study found that men who had  $\dot{V}O_{2max}$  values less than 29 mL·kg<sup>-1</sup>·min<sup>-1</sup> were seven times more likely to have the MetS than men who had a  $\dot{V}O_{2max}$  greater than 35 mL·kg<sup>-1</sup>·min<sup>-1</sup>.<sup>10</sup>

Fortunately, endurance training has been shown to reverse risk markers associated with MetS. Evidence from the HERITAGE study indicated that after 20 weeks of endurance training, 30 percent of subjects who originally had MetS no longer met the criteria for the MetS<sup>11</sup> Lakka *et al.*, suggest that exercise intensity prescribed for the client with the syndrome should be set at 4.5 METs or higher. For example, the ACSM metabolic equations associate 4.5 METs with treadmill walking at 3.0 mph and a 3 percent grade.

In addition to endurance training, resistance training is recommended since strength has been shown to be inversely associated with the presence of the MetS<sup>9</sup>. In normal weight men, those with the highest strength to weight ratio in the bench press and leg press were 44 percent less likely to develop the MetS than individuals with the lowest strength to weight ratio<sup>9</sup>. Similarly, in overweight men, those with the highest strength to weight ratio were 39 percent less likely to develop the MetS than those with the lowest strength to weight ratio<sup>9</sup>.

For the client with hypertension, circuit weight training is the resistance training prescription of choice<sup>13</sup>. Circuit training should consist of 8-10 exercises targeting major muscle groups. The load at each exercise station should be 40-60 percent of the client's estimated 1-RM for that exercise. The client should move through the circuit spending a specified amount of time at each station and moving on to the next after 30-45 seconds of recovery. The circuit should begin with large muscle groups and progress to smaller muscle groups. The client may repeat the circuit multiple times. Appreciable gains in both cardiovascular and muscle conditioning result from this type of training. Heavy lifts such as 1-RM testing or sets with loads >70 percent of the estimated 1-RM are not recommended.

A report by Cruz and Goran<sup>3</sup> proposed that programs for children and adolescents with the MetS should include non-weight bearing strength training, especially for those who are overweight or obese. For example, use the seated leg press machine in place of standing squats or lunges. Keep in mind that for this age group, all interventions should focus on insulin resistance, since it appears to be the underlying cause of the MetS, as opposed to programs that primarily target weight loss<sup>4</sup>.

To summarize, a progressive endurance exercise program as described in *ACSM's Guidelines for Exercise Testing and Prescription* is appropriate. Duration per ses-

sion should begin with 20 minutes and progress to 60 minutes over a six-month training period. Similarly, intensities might begin at 40-60 percent  $\dot{V}O_{2max}$  and progress over a six-month period. After initial conditioning, occasional bouts of intensity at 80-85%  $\dot{V}O_{2max}$  may be added. Circuit resistance training should be incorporated into the routine 2-3 times a week with loads of 40-60 percent of estimated 1-RM. Emphasis should be focused on time spent per set, rather than load lifted. The FP should set specific guidelines for the client in this type of training, especially if the client works out independently two or more times per week. If the client has a detailed written plan to follow, the chances of a successful workout are enhanced.

Finally, the FP should emphasize exercise consistency and ensure that the client understands that the presence of the MetS increases their risk for Type 2 Diabetes and all of its symptoms, including increased risk for cardiovascular disease, renal disease, and erectile dysfunction<sup>6</sup>.

**Conclusions**

Understanding the MetS is more than simply comparing body types as either apples or pears. It is a complex condition that involves many physiological, metabolic, nutritional, hormonal, and psychological interactions. We have addressed one aspect of intervention — physical activity. There is no quick solution or magic pill, but getting more people to engage in physical activity will certainly be helpful.

**About the Author**

*Babs Hogan has a master's degree in kinesiology and twenty-two years' experience as a personal trainer. She is the Executive Director and writer for the Public Health International Association. In addition, she also writes articles for several university Web sites and various magazines. She is a frequent guest speaker at spas and fitness clubs throughout Texas. Babs is currently ACSM Health & Fitness Instructor® certified. E-mail: bhogan@hsc.unt.edu*

*Matt Owings, M.S., C.S.C.S. Matt has worked in health, fitness and athletics for the past fourteen years as a lecturer and coach at the University of Texas at Tyler and as a personal trainer. Matt is currently a doctoral student in the School of Biomedical Sciences, Department of Integrative Physiology, at the University of North Texas Health Science Center in Ft. Worth, Texas. E-mail: jowings@hsc.unt.edu*

**References**

1. American College of Sports Medicine. *ACSM's Guidelines for Exercise Testing and Prescription*, 7th edition. Philadelphia, PA: Lippincott, Williams and Wilkins, 2006.
2. Cook, S., Weitzman, M., Auinger, P. Prevalence of a Metabolic Syndrome Phenotype in Adolescents. *Archives Pediatric Adolescent Medicine*. 157:821-827, 2003.
3. Cruz, M., Goran, M. The Metabolic Syndrome in Children and Adolescents. *Current Diabetes Reports*. 4:53-62, 2004.
4. Cruz, M., Weigensberg, M., Huang, T. The metabolic syndrome in overweight Hispanic youth and the role of insulin sensitivity. *Journal of Clinical Endocrinological Metabolism*, 89(1):108-113, 2004.
5. Dalton, S., *Overweight and Weight Management*. Gaithersburg, Maryland. Aspen Publishers, Inc., p.28, 1997.

## April/May/June Continuing Education Self-Tests

Credits provided by the American College of Sports Medicine • CEC Credit Offering Expires June 30, 2007

**SELF-TEST #1 (1 CEC):** The following questions were taken from "Lifestyle Management of Hypertension" published in this issue of *ACSM's Certified News*, pages 2-4.

- Which of the following is classified as prehypertension?
  - 140/90 mm Hg
  - 120/90 mm Hg
  - 130/82 mm Hg
  - 140/82 mm Hg
- The average reduction in blood pressure in individuals with hypertension from a single endurance exercise session or regular aerobic training is approximately \_\_\_\_\_ for systolic and diastolic blood pressures.
  - 2-3 mm Hg
  - 4-5 mm Hg
  - 8-10 mm Hg
  - 5-7 mm Hg
- Which of the following medications slows heart rate and may impair thermoregulation?
  - ACE Receptor Blockers
  - Beta Blockers
  - Diuretics
  - Alpha Blockers
- The duration of aerobic physical activity designed to reduce blood pressure should total at least \_\_\_\_\_.
  - 20 minutes
  - 45 minutes
  - 30 minutes
  - 60 minutes
- The DASH eating plan consists of plenty of \_\_\_\_\_ and reduced amounts of \_\_\_\_\_.
  - Whole grains/sodium
  - Whole grains/fruits
  - Fruits/whole grains
  - Red meat/sodium

**SELF-TEST #2 (1 CEC):** The following questions were taken from "Fitness, Physical Activity, and Inflammatory Markers for Cardiovascular Disease" published in this issue of *ACSM's Certified News*, pages 5-7.

- The AHA has identified many risk factors for cardiovascular disease. Which of the following is not one of the original risk factors deemed "primary" more than 40 years ago?
  - High blood pressure
  - Diabetes
  - High cholesterol
  - Smoking
- CRP levels indicative of the highest risk are:
  - Between 0.8 and 1.2 mg/L
  - Less than 2.0 mg/L

- Greater than 100 mmHg
  - Between 3.9 and 15 mg/L
- Many markers in the blood are associated with inflammation. These markers include all of the following except:
    - Plasma volume
    - Fibrinogen
    - Proteins associated with the immune response
    - White blood cell count
  - High CRP levels have been closely associated with all of the following except:
    - Poor fitness
    - The metabolic syndrome
    - Gender
    - Obesity
  - Methods that have been used to lower CRP include the following:
    - Statin therapy
    - Stopping smoking
    - A diet low in fat and high in whole grains
    - All of the above

**SELF-TEST #3 (1 CEC):** The following questions were taken from "Metabolic Syndrome: Fast Track to the End of the Road" published in this issue of *ACSM's Certified News*, pages 9-10, 12.

- Which of the following is the chief predictor that a client may have the MetS?
  - Low cardiorespiratory fitness level
  - High initial levels of upper body strength
  - Large waist circumference
  - Low fasting blood glucose levels
  - Taking antihypertensive medication even though he/she is moderately active
- Circuit resistance training is the recommended resistance training protocol for the client with MetS. Which of the following are true statements about circuit training that the FP should remember?
  - The circuit should include 2-3 stations at which the loads are increased to 90-92% of 1 RM
  - The time the client spends at each station is more important than the load lifted
  - Rest intervals between stations/sets should be short
  - Improvement of cardiorespiratory fitness is not a goal of circuit training for the MetS client
  - There is no evidence that strength gains resulting from circuit training are beneficial in combatting the MetS, only weight loss as a result of endurance training is of any benefit.

- I only
  - II and III only
  - V only
  - I and IV only
  - None of the above are correct
- According to the article, which of the following should be the primary focus of a training program for youth with the MetS?
    - Weight loss
    - Restoration of athletic ability to a level similar to their healthy-weight peers
    - Strength gain
    - Increase in  $\dot{V}O_{2max}$
    - Decrease insulin resistance - increase glucose tolerance
  - The highest overall prevalence rate of the MetS is found in which ethnic group?
    - Asians
    - Hispanics
    - Caucasians
    - Black
  - The metabolic syndrome is also known as:
    - Metabolic fever
    - Obesity factor
    - CRF disorder
    - Syndrome X
    - Y Factor

**SELF-TEST #4 (1 CEC):** The following questions were taken from "Strength Training in Children and Teens: Implementing Safe, Effective & fun Programs-Part Two." published in *ACSM's Health & Fitness Journal*, Volume 9, No. 4, pages 13-18.

- Which of the following should NOT be considered when starting a youth strength training program?
  - Choose creative and fun names for youth programs.
  - Provide rewards for participation, attendance, and achievement of personal goals.
  - Organize the participants into age groups.
  - Encourage competition among the children in the weight room.
- Youth strength training programs should include \_\_\_\_\_.
  - Only weight training
  - All modalities except weight machines
  - A variety of training methods/modes
  - All modalities except free weights
- When initially learning new movement patterns and exercises, use \_\_\_\_\_.
  - Loads that will permit 12-15 repetitions
  - No-load repetitions
  - Loads that will permit 8-12 repetitions
  - Loads that are considered "easy" by the youth (e.g., allowing 20 repetitions)
- Which of the following is NOT a purpose for performing multi-joint, large-muscle mass, complex movements before single-joint, small-muscle mass, simple movements?
  - To avoid use of excessive loads with single-joint movements
  - To prevent training plateaus
  - To increase training efficiency
  - To decrease injury potential
- Which of the following statements is TRUE?
  - Sets should be performed to a point of fatigue, not failure.
  - Progression to performing 4-5 exercises per muscle group has been recommended.
  - In 1993, ACSM recommended that lifting maximal amounts of weight be included in strength training programs for children.
  - A preparticipation medical exam is mandatory for all children and adolescents before participating in strength training.

ACSM's  
**Certified  
News**

To receive credit, circle the best answer for each question, check your answers against the answer key on page 12, and mail entire page with check or money order payable in US dollars to: American College of Sports Medicine, Dept 6022, Carol Stream, IL 60122-6022

ACSM Member (PLEASE MARK BELOW)

Yes-\$15

No-\$20

ID # \_\_\_\_\_ (Please provide your ACSM ID number)

Please Allow 4-6 weeks for processing of CECs

TOTAL \$ \_\_\_\_\_

(\$25 fee for returned checks)

ACSM USE:  
(617861)

PLEASE PRINT OR TYPE REQUESTED INFORMATION

NAME \_\_\_\_\_

ADDRESS \_\_\_\_\_

CITY \_\_\_\_\_

STATE \_\_\_\_\_

ZIP \_\_\_\_\_

BUSINESS TELEPHONE \_\_\_\_\_

E-MAIL \_\_\_\_\_

April/May/June 2006 Issue EXPIRATION DATE: 6/30/07

SELF-TESTS SUBMITTED AFTER THE EXPIRATION DATE WILL NOT BE ACCEPTED.

Federal Tax ID number 23-6390952

Tip: Frequent self-test participants can find their ACSM ID number located on any credit verification letter.



## ACSM's Regional Chapters

Enjoy top-notch educational presentations and unmatched opportunities to network with fellow professionals at ACSM's Regional Chapter meetings. In addition, earn valuable continuing education credits to keep your certification current. Below is a listing of upcoming meetings near you:

- **July 19-22, Alaska Chapter, Sitka, Alaska**  
Contact: Litia Garrison, alaska\_acsm@yahoo.com
- **October 5-7, Midwest Chapter, Mt. Pleasant, Michigan**  
Contact: Tim Kirby, Ph.D., kirby.1@osu.edu, www.mwacsm.org
- **October 12-13, Northland Chapter, Mankato, Minnesota**  
Contact: John Keener, Ph.D., nacsm@d.umn.edu, www.d.umn.edu/~nacsm
- **October 20-21, Central States Chapter, Kansas City, Missouri**  
Contact: Joel Cramer, Ph.D., jcramer@ou.edu, www.centralstatesacsm.org
- **November 9-10, New England Chapter, Providence, Rhode Island**  
Contact: Dino Costanzo, neacsm@nbgh.org, www.neacsm.org
- **November 10-11, Mid-Atlantic Chapter, Harrisburg, PA**  
Contact: W. Craig Stevens, Ph.D., wstevens@wcupa.edu, www.marcaacsm.org
- **November 10-11, Southwest Chapter, San Diego, California**  
Contact: Jack Young, Ph.D., FACSM, jyoung@ccmail.nevada.edu, www.swacsm.org

### Certification Updates... Continued from Page 1

three articles especially relevant to the health/fitness or clinical practitioner. These articles are written by you, the ACSM Certified Professional, and authors whose articles appear in ACSM's *Certified News* receive continuing education credits (CECs) for their efforts. For author guidelines, and/or to propose a future article idea, please e-mail certification@acsm.org.

### NCCA Accreditation Update

By now, most of you are aware of IHRSA's recommendation to their member clubs regarding the hiring of certified professionals whose credential is accredited by the National Commission for Certifying Agencies (NCCA). CCRB submitted the accreditation application for the ACSM Certified Personal Trainer<sup>SM</sup> credential in January of this year, and we expect to receive the results no later than the end of the third quarter this year. Additionally, CCRB will be submitting accreditation applications for all other certifications (HFI, ES, and RCEP) in September. For additional information or updates as to the status of all our applications, please visit the ACSM Web site ([www.acsm.org](http://www.acsm.org)) and follow the links to certification.

### ACSM's Resources for the Personal Trainer, 2nd Edition Available Summer, 2006

The all new, second edition of ACSM's *Resources for the Personal Trainer* is set to publish this Summer. This comprehensive text specifically supports the ACSM Certified Personal Trainer<sup>SM</sup> credential, and can be used for both personal study and as a primary textbook supporting an academic course. For additional information or updates regarding a publication date, please visit the ACSM Web site ([www.acsm.org](http://www.acsm.org)) and follow the links to certification, or the Web site of our

publisher, Lippincott, Williams & Wilkins ([www.lww.com](http://www.lww.com)).

Finally, CCRB will be hosting its annual Certification Colloquium at the ACSM Annual Meeting in Denver. The symposium is scheduled for Wednesday, May 31, from 1-1:50 p.m. If you are planning on attending the Annual Meeting, please make plans to join us as we provide our annual CCRB report.

### Metabolic Syndrome... Continued from Page 10

6. Fonseca, V, and Jawa, A. Endothelial and erectile dysfunction, diabetes mellitus, and the metabolic syndrome: common pathways and treatments? *American Journal of Cardiology*. 96(12B):13M-18M. Dec 26, 2005.
7. Ford, E.S., Giles, W.H., Dietz, W.H. Prevalence of the metabolic syndrome among U.S. adults: Findings from the third National Health and Nutrition Examination Survey. *Journal of the American Medical Association*. 287:356-9, 2002.
8. Ford, E.S., Giles, W.H., Mokdad, A.H. Increasing prevalence of the metabolic syndrome amongst U.S. adults. *Diabetes Care* 27: 2444-9. 2004.
9. Jurca, R., Lamonte, M.J., Barlow, C.E., Kampert, J.B., Church, T.S., Blair, S.N. Association of muscular strength with incidence of metabolic syndrome in men. *Medicine & Science in Sports & Exercise*. 37(11). 1849-1855., Nov. 2005.
10. Katzmarzyk, P.T., Church, T.S., Blair, S.N. Cardiorespiratory fitness attenuates the effects of the metabolic syndrome on all-cause and cardiovascular disease mortality in men. *Archives of Internal Medicine*. 164:1092-1097, 2004.
11. Katzmarzyk, P.T., Leon, A.S., Wilmore, J.H., Skinner, J.S., Rao, D.C., Rankinen, T., Bouchard, C. Targeting the metabolic syndrome with exercise; evidence from the HERITAGE study. *Medicine & Science in Sports & Exercise* 35(10), 1703-1709, Oct. 2003.
12. Kylin, E. Studien ueber das hypertonie-hyperglykemie-hyperurikämiesyndrome. Studies of the hypertension-hyperglycemia-hyperuricemia syndrome. *Zentralblatt fuer Innere Medizin*. 44:105-127, 1923.
13. La Fontaine, T. Resistance training for patients with hypertension. *Strength and Conditioning*. Vol 19(1). 5-9., 1997.
14. Lakka, T.A., Laaksonen, D.E., Lakka, H.M., Mannikko N, Niskanen L.K., Rauramaa R., Salonen J.T. Sedentary lifestyle, poor cardiorespiratory fitness, and the metabolic syndrome. *Medicine & Science in Sports & Exercise*. 35(8). 1279-1286. Aug. 2003.
15. Reaven, G.M. Banting Lecture 1988. Role of insulin resistance in human disease. *Diabetes*. 37:1595-607, 1988.

SELF-TEST ANSWER KEY FOR PAGE 11					
	QUESTION				
	1	2	3	4	5
TEST #1:	C	D	B	C	A
TEST #2:	B	D	A	A	D
TEST #3:	C	B	E	B	D
TEST #4:	D	C	B	A	A



**AMERICAN COLLEGE**  
of SPORTS MEDICINE  
www.acsm.org

ACSM'S Certified News ISSN # 1056-9677  
P.O. Box 1440  
Indianapolis, IN 46206-1440 USA