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Health Benefits of Exercise and Weight Loss in Obese Elderly Veterans

The veteran population has been particularly affected by America's obesity epidemic. Recent estimates indicate that, for those older than age 65, 76% of men and 71% of women meet the criteria for overweight (a body mass index [BMI] of 25 to 29.9 kg/m^2), while 32% of men and 39% of women meet the criteria for obesity (a BMI of 30 kg/m^2 or greater).[1] And it's estimated that 73% of veterans receiving outpatient care are overweight and 33% are obese.[2]

These statistics are all the more dire given that obesity is associated with insulin resistance, metabolic syndrome, diabetes, cardiovascular disease (CVD), and increased mortality in elderly patients. Insulin resistance, a metabolic condition highly related to central obesity, is associated with dyslipidemia, hypertension, and type 2 diabetes. This constellation of components defines metabolic syndrome, which, in turn, heightens CVD risk. Metabolic syndrome's prevalence increases with age and rose by 16% between 1994 and 2000. At present, the syndrome affects approximately 40% of Americans over age 50.[3]

The skyrocketing increases in the prevalence of type 2 diabetes and metabolic syndrome make these conditions among the most significant health problems for older veterans. Although VA data on metabolic syndrome are unavailable, national data reveal that more than one million veterans, or nearly 20% of those using the VA health care system, have type 2 diabetes on their medical problem list.[4] Furthermore, 55% of veterans are estimated to have hypertension, and 52% have dyslipidemia.[5] These conditions increase older veterans' risks of such disabling and deadly atherosclerosic complications as myocardial infarction, stroke, peripheral arterial disease (PAD), and heart failure.

Since the inception of the Baltimore Geriatric Research, Education and Clinical Center (GRECC) in 1992, its investigators have focused on understanding how exercise and weight loss interventions improve metabolic risk factors for CVD and diabetes in older veterans with obesity, type 2 diabetes, metabolic syndrome, stroke, or heart disease. The Baltimore GRECC focuses on preventing and aggressively managing these interrelated diseases and their risk factors among the older veteran population. Our clinical and basic science research staff strive to learn how the various cardiovascular and metabolic interventions affect specific disease subsets, such as PAD and hemiparetic stroke. The GRECC also has used novel exercise and nutritional protocols to study mechanisms by which exercise, weight loss, and task-oriented rehabilitation models improve lipid and glucose metabolism, reduce CVD risk factors, and improve health and function in older, obese, or stroke-disabled veterans. Our interdisciplinary focus and "bedside to bench to bedside" approach to patient-oriented clinical investigation has allowed us to develop and implement structured interventions that improve fitness, health, CVD risk factors, and function in older veterans.

RESEARCHING WEIGHT LOSS AND EXERCISE EFFECTS

One productive line of investigation has been into the effects of weight loss and aerobic exercise training on glucose and lipid metabolism in obesity. By conducting clinical studies on patients with obesity,[6,7] impaired glucose tolerance and metabolic syndrome,[8] stroke,[9–11] PAD,[12,13] and heart disease, Baltimore GRECC researchers identified cellular and genetic factors

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The VHA's Geriatric Research, Education and Clinical Centers (GRECCs) are designed for the advancement and integration of research, education, and clinical achievements in geriatrics and gerontology throughout the VA health care system. Each GRECC focuses on particular aspects of the care of aging veterans and is at the forefront of geriatric research and clinical care. For more information on the GRECC program, visit the web site (http://www1.va.gov/grecc/). This column, which is contributed monthly by GRECC staff members, is coordinated and edited by Kenneth Shay, DDS, MS, director of geriatric programs for the VA Office of Geriatrics and Extended Care, VA Central Office, Washington, DC.

Continued on page 21

Continued from page 18

in adipose and muscle tissue through which aerobic exercise training and weight loss improve glucose and lipid metabolism in obese patients who are middle-aged and older.

GRECC investigators recently completed a six-month behavioral lifestyle intervention of hypocaloric diets and low- to moderate-intensity aerobic exercise training designed to reduce risk factors for CVD in 76 obese, postmenopausal women.[6] We found racial differences in the relationships between gluteal fat cell size, metabolism, and intra-abdominal fat and metabolic risk factors for CVD. Our results suggested that abnormalities in gluteal adipocyte metabolism were related to development of metabolic syndrome in the black patients but not in the white patients.[7] We noted that, while weight loss was related directly to adherence to the diet and exercise regimen (which was exhibited to a greater degree in white patients than in black patients), all patients showed increases in maximal aerobic capacity and minimal loss of lean body mass. White patients had more intra-abdominal visceral adipose tissue ($P < .05$) and less subcutaneous fat ($P < .01$) than black patients at baseline, and the intervention decreased visceral adipose tissue and subcutaneous fat by similar amounts. All patients had similar increases from baseline in high-density lipoprotein cholesterol (HDL-C) and high-density lipoprotein 2 cholesterol levels. They also had similar reductions in plasma triglyceride (TG) levels, total and low-density lipoprotein cholesterol (LDL-C) levels, and glucose metabolism ($P < .05$) after the intervention.

Regardless of race, women with the worst metabolic profiles at baseline improved most with treatment. Changes in lipids and glucose metabolism were related to changes in total adiposity (weight and fat percentage), while changes in HDL-C were related directly to changes in visceral adipose tissue. Despite the black patients' greater degrees of obesity and subcutaneous abdominal fat and the white patients' greater degrees of visceral adipose tissue, there were no racial differences in the metabolic responses to weight loss and exercise. We concluded that low intensity aerobic exercise training plus weight loss in obese older adults has similar CVD risk factor benefits across different ethnic populations. This conclusion confirmed the applicability of our exercise and weight loss programs to the multiethnic VA population.

Next, we expanded the investigation to test the hypothesis that aerobic and resistive training affect insulin sensitivity through different muscle cellular mechanisms. We assigned 17 obese, older men to either aerobic exercise training (walking or jogging on a treadmill) or resistive training (focusing on the upper and lower body) programs held three days per week for six months. Our findings indicated that aerobic exercise training and resistive training produced comparable improvements in glucose metabolism and insulin signaling to enhance insulin sensitivity (as measured by the glucose clamp), but that only aerobic exercise training increased insulin activation of glycogen synthase.[8]

In other studies, visceral adipose tissue and intramuscular fat decreased similarly after six months of moderate weight loss without exercise or weight loss combined with aerobic exercise training in obese, postmenopausal women.[14] Aerobic exercise training plus weight loss, however, resulted in greater increases in glucose utilization and insulin sensitivity. These findings underscore the importance of combining aerobic exercise training with weight loss to achieve maximal improvements in glucose metabolism.[14] They also suggest that aerobic exercise training and resistive training combined with weight loss could be synergistic in reducing risk factors for CVD in obese veterans.

RESEARCHING EXERCISE EFFECTS AFTER STROKE

Baltimore GRECC investigators also developed an academic, rehabilitation, research program to examine the cardiovascular, metabolic, and neuromotor effects of treadmill exercise in community dwelling patients undergoing chronic stroke rehabilitation.

In one study, 66% of 364 patients had three inadequately controlled CVD risk factors, 80% had two such factors, and 99% had one or more such factors.[15] The most prevalent risk factors were hypertension (80%), overweight (67%), hypercholesterolemia (60%), low HDL-C levels (35%), and smoking (14% current smokers and 54% former smokers). Using patients' medical histories and oral glucose tolerance test (OGTT) results, we found that 77% of the patients had either impaired glucose tolerance (IGT) or type 2 diabetes. Fasting plasma glucose was only 49% sensitive for predicting OGTT abnormalities[9]—a finding that suggests abnormal lipid and glucose metabolism are highly prevalent, yet seriously underdiagnosed, after stroke. The finding also underscores the importance of extensive screening for and aggressive management of CVD risk factors in patients who've had a stroke.

In another study, we examined the effects of six months of treadmill exercise training on maximal aerobic capacity and glucose tolerance in 46 patients who had experienced stroke. Of these patients, 26 were randomly assigned to the treadmill exercise training group and 20 were used as sedentary controls. Members of the training group exercised on the treadmill three times each week, with individual exercise routines varying according to ability.

Continued on next page

Continued from previous page

OGTTs indicated that, at baseline, 12 of the training patients and 11 of the control patients had either IGT or diabetes. By the end of the study, seven patients with IGT in the training group showed improved glucose tolerance, compared with one patient with IGT in the control group ($P < .05$).[16] Overall, the study suggests that treadmill exercise training has the potential to reduce hemiparetic stroke survivors' risk of developing type 2 diabetes. Thus, long-term access to rehabilitation services for stroke survivors may improve ambulatory capacity and reduce the incidence of diabetes—a major risk factor for recurrent CVD.

TRANSLATING RESEARCH INTO PRACTICE

The Managing Overweight/Obesity for Veterans Everywhere (*MOVE!*) program, developed by the VA National Center for Disease Prevention, strives for aggressive management of veterans' CVD risk factors through weight loss efforts. The program encourages weight loss primarily through lifestyle and behavioral modification, but it also offers pharmaceutical, residential, and surgical options. After serving as one of the pilot testing sites for *MOVE!*, the Baltimore GRECC successfully implemented the program. We invite primary care, cardiology, and specialty clinics to refer high risk veterans with poorly controlled lipids, diabetes, and hypertension to the program.

As of January 2008, nearly 430 veterans (mean age, 65) have been evaluated by a nurse practitioner, an exercise physiologist, and a dietitian for *MOVE!*. Of these patients, 36% were overweight, 25% were obese, 89% had hypertension, 74% had hyperlipidemia, and 30% had diabetes. Of the 130 diabetic patients, 33% had LDL-C levels greater than 100 mg/dL, 34% had TG levels greater than 150 mg/dL, 51% had a systolic blood pressure measurement greater than 130 mm Hg, and 30% had a hemoglobin A_{1c} (HbA_{1c}) value greater than 9% upon program initiation. In 29 of the diabetic patients, treatment with medication adjustments, walking, and overall weight loss reduced the average HbA_{1c} level to less than 8%. These patients decreased their average TG levels by 5%, average LDL-C levels by 11%, average systolic blood pressure by 12%, and average diastolic blood pressure by 5%, while increasing their average HDL-C levels by 6%.

GRECC resources facilitated the implementation of *MOVE!* and continue to complement its growth within the VA Maryland Health Care System.

THE ONGOING GRECC MISSION

When the VA established the national GRECC program, its goal was to promote investigations of the aging process and the diseases affecting elderly patients in order to improve older veterans' health care management and quality of life. Using state-of-the-art research methods to unlock pathophysiologic connections and set the stage for clinical models that test efficacy of the ensuing care strategies, the Baltimore GRECC is doing its part to fulfill an ambitious but important mission: aggressive management of CVD risk in obese veterans to improve health and quality of life. ●

Author disclosures

The authors report no actual or potential conflicts of interest with regard to this column.

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