CLINICAL APPLICATIONS

by Paul M. Ribisl, Ph.D., FACSM

Toxic "Waist" Dump: Our Abdominal Visceral Fat

More than 50 years ago, a French physician, Dr. Jean Vague, noted that complications in his obese patients had more to do with where the fat was deposited than how much was deposited (1). Dr. Vague is credited with developing the terms "android" and "gynoid" obesity. Android is the high-risk type of obesity typically found in males, where the fat is deposited centrally (apple shape). Gynoid is a low-risk type of obesity typically found in females, where the fat is deposited in the gluteofemoral region, that is, the buttocks and thighs (pear shape). Whereas this concept of the apple- and pear-shaped obesity has been around for more than half a century, it is only recently that researchers have uncovered mechanisms underlying the health risks of differing fat deposition sites.

A Serious Global Threat to Our Health

The increase in obesity is a global phenomenon that is even being addressed by the World Health Organization (2), as well as by medical and government organizations in the United States. The WHO estimates that approximately half of all health costs in developed nations can be attributed to the unhealthy behaviors of poor diet and physical inactivity, and the organization's concern is that these problems have now extended to developing countries around the world as well. One of the most alarming reports in recent months comes from Dr. Sturm (3), who revealed that between 1986 and 2000, the prevalence of the morbidly obese (Body Mass Index [BMI] > 40) has quadrupled from approximately 1 in 200 adult Americans to 1 in 50; the prevalence of the super obese (BMI > 50) has quintupled, whereas the prevalence of the clinically obese (BMI > 30) has doubled. In concert with the increase in BMI, waist circumference (WC) also has been increasing at an alarming rate. This measurement is an index for assessing abdominal obesity or visceral fat. Dr. Ford and others (4) found that WC has increased significantly in U.S. adults over a 20 year period, and now individuals with a high-risk WC exceed those individuals with a high-risk BMI, with approximately 37% of men and 55% of women now being categorized as being at high-risk based upon their WC.

Health-Care Costs of Abdominal Visceral Obesity

The health-care costs of obesity are excessive, and it is expected that in the near future, obesity will replace smoking as the #1 preventable cause of death in the United States. Further support of this trend comes from another study by Dr. Sturm (5), which reveals that obese individuals spend more on both services for health care and medication than daily smokers or even heavy drinkers. More specifically, Dr. Cornier and colleagues (6) have targeted excessive visceral obesity as being even more indicative of health-care costs than the standard measure of BMI. In a year-long study within a medical clinic, it was found that total annual health care charges were significantly greater in those patients in the highest WC quartile in comparison with those in the lower WC quartiles; that is, annual costs were $8,699 in those with a WC >103.5 cm (> 40-inch waist) compared to $6,062 in those with a WC < 83.3 cm (< 33-inch waist). In general, those with the highest level of visceral obesity generated 85% more in-patient charges than those with the lowest level of visceral obesity; these differences were statistically significant (p = 0.047).

How Is Abdominal Visceral Obesity Related to Waist Circumference?

There has been considerable research over the previous 25 years that has addressed this issue. In 1994, Dr. Pouliot and colleagues (7) demonstrated that WC was a better measure of abdominal visceral adipose tissue than the commonly used waist-to-hip ratio (WHR) in a mixed sample of men and women (n = 151). In addition, they found that higher WC levels were associated with potentially "atherogenic" metabolic disturbances, that is, increased risk of premature atherosclerosis and cardiovascular disease. The validity of the WC as an indicator of abdominal visceral obesity has been confirmed by multiple studies using sophisticated but expensive and time-consuming instrumentation, such as dual-energy

X-ray absorptiometry (DEXA), computerized tomography (CT scans), and magnetic resonance imaging (MRI). Dr. Snijder and colleagues (8) studied a sample of 150 subjects of mixed ethnic background and found that the simple anthropometric measures of WC and sagittal abdominal diameter (SAD = distance between the abdomen and back) predicted visceral fat (as determined by CT) as accurately as the sophisticated DEXA method. Dr. Zamboni and colleagues (9) found similar results for SAD when compared with CT scans. Whereas the BMI remains the most widely used measure of overweight and obesity, these studies provide the rationale for incorporating the WC and SAD into our standard measures in health exams, whereas WHR is no longer recommended. This view is further supported by Dr. Ho and colleagues (10), who studied the association between BMI, WC, and WHR and cardiovascular risk factors. They found that both BMI and WC provided unique and independent information and were closely related to cardiovascular risk; in contrast, WHR added nothing new.

Why Is Abdominal Visceral Obesity Important?

The more recent emphasis on abdominal visceral obesity comes from a wealth of research that is directed at finding mechanisms that would help us understand the connection between obesity and chronic disease. Historically, clinicians have focused primarily on a patient's body weight and more recently the BMI, but few have incorporated a measure of central adiposity into their routine profile of measurements collected on their patients. Jean-Pierre Despres and colleagues (11) have written an excellent clinical review that is worth reading for anyone who wants to gain a better understanding of this issue. In this review, they make a convincing case for why we should add waist circumference to our standard list of measures; they argue that excess visceral adipose tissue is the culprit, rather than simply being overweight. In this review, they explain how visceral obesity is closely related to the development of type 2 diabetes, primarily through the mechanisms of insulin resistance and glucose intolerance that result in elevated levels of blood insulin and blood sugar (hyperinsulinemia and hyperglycemia). It is not the *total amount of body fat* that creates this problem but rather the *location* of the fat. Earlier studies (7, 12) by these authors compared two groups of obese individuals: those with excess abdominal fat versus those with excess subcutaneous fat deposits. Whereas both groups had similar BMI levels, those with the high accumulation of visceral fat had the highest glycemic and insulinemic responses to an oral glucose challenge. In other words, when they were given a large oral dose of sugar (*i.e.*, glucose challenge), their body responded with an unhealthy response that resulted in the excess production and release of insulin into the bloodstream (hyperinsulinemia) without lowering the high blood sugar level (hyperglycemia). Individuals with this characteristic response are at the highest risk for developing type 2 diabetes, the metabolic syndrome, and subsequent cardiovascular complications, including retinopathy, nephropathy, neuropathy, macular

degeneration, and cardiovascular disease (11).

Abdominal Visceral Obesity and the Metabolic Syndrome

There is growing concern within the medical community about a disorder that has emerged in parallel with the obesity epidemic. The metabolic syndrome, also known as Syndrome X or the insulin resistance syndrome, represents a clustering of plasma lipid, glucose, and blood pressure risk factors and abdominal obesity. The metabolic syndrome has become increasingly common in the United States and it is estimated that approximately 20% to 25% of U.S. adults have it; however, in some older groups this may even approach 50% (13). The metabolic syndrome is related to high morbidity/mortality risk, and according to the latest National Cholesterol Education Program (NCEP/ATP III) guidelines, the metabolic syndrome is defined as having 3 or 4 of the following: abdominal obesity or WC greater than 102 cm in men and 88 cm in women; hypertriglyceridemia greater than or equal to 150 mg/dL; low high density lipoprotein (HDL) cholesterol concentration less than 40 mg/dL in men or 50 mg/dL in women; high blood pressure greater than or equal to 130/85 mm Hg; and elevated fasting glucose concentration greater than or equal to 110 mg/dL. One might ask, "How do WC and visceral obesity influence the metabolic syndrome?" The answer to this question is highlighted in the study by Dr. Janssen and others (14) that demonstrated that, in men and women, it is the WC and not the BMI that explains the increased risk of developing the metabolic syndrome with increasing weight. The authors concluded that "for a given WC value, overweight and obese persons have a health risk that is comparable with that of normal-weight persons."

Where Do We Go from Here and What Should We Do for Our Clients?

It is quite evident from the wealth of information gained from these studies that WC has emerged as a simple but very important measurement that, along with height, weight, and blood pressure, should become part of every clinical exam performed in the physician's office. But how about the health and fitness professional? The 2000 *ACSM's Guidelines for Exercise Testing and Prescription* (6th edition) includes a wide variety of body composition measures for consideration, including densiometry (hydrostatic weighing and plethysmography), anthropometry (BMI, WHR, and skin-fold measurement), and other techniques (bioelectric impedence, DEXA, and near-infrared interactance). All of these measures, except BMI and WHR, are time consuming and expensive, in addition to having a low prognostic value for future health risk. The health/fitness professional is left

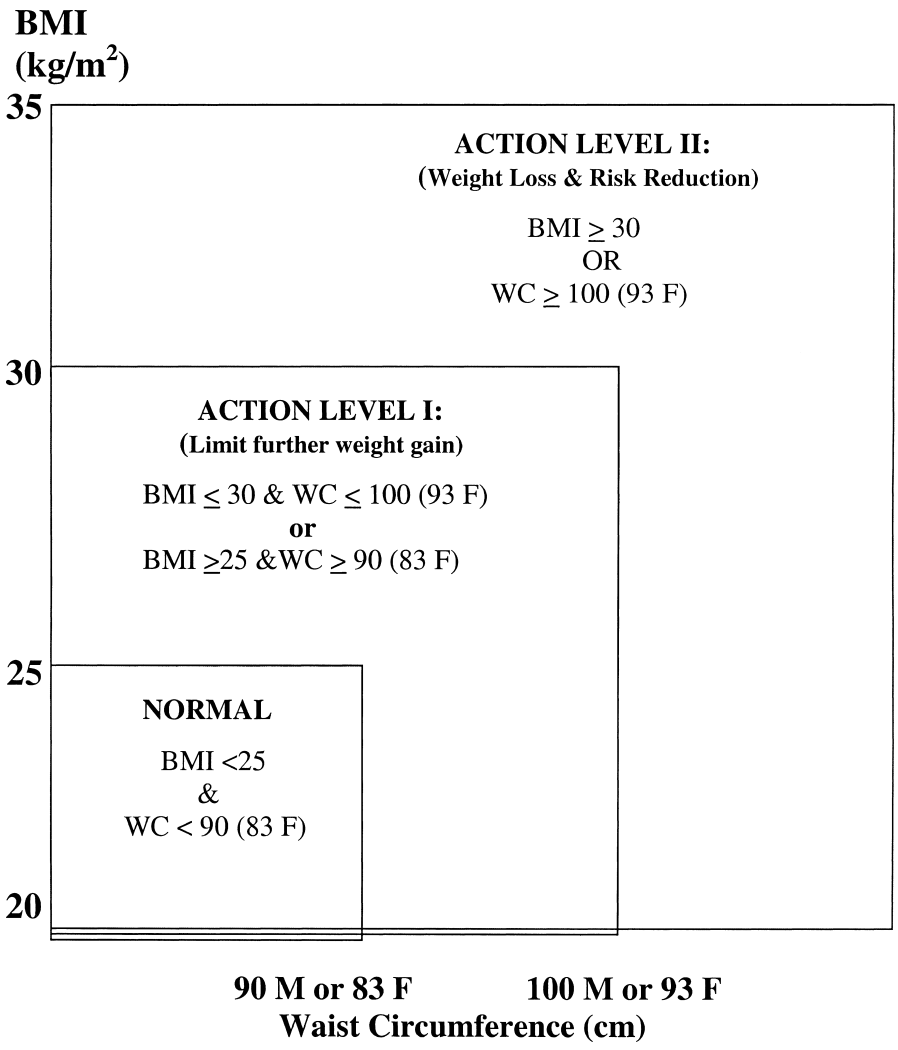
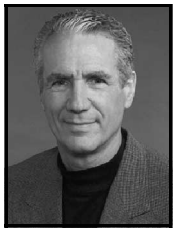


Figure. Schematic for a combined measure of BMI and WC using current cut-off points. F, female; M, male. Adapted from Zhu S., S. Heshka, Z. Wang, et al. Combination of BMI and waist circumference for identifying cardiovascular risk factors in whites. Obesity Research 12(4):633–645, 2004.

on his or her own to pick and choose from this cornucopia of complex measurements. Currently, the ACSM's Health/Fitness Instructor® certification practical exam places emphasis on skin-fold measurement, although subcutaneous fat deposits have not been demonstrated to be predictive of health outcomes. It has been suggested to the senior editor of the next edition of ACSM's *Guidelines for Exercise Testing and Prescription* to consider the relative status of WC by assigning it the highest priority in the measurement of body composition and by adding it to a standard set of essential measurements that health/fitness professionals should use in the evaluations of their clients. The National Institutes of Health published the *Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults* in 1998, and these remain the definitive guidelines on this topic. The NIH guidelines recommend only BMI and WC measurement; skin-fold measurements are not even mentioned. Most recently, Dr. Zhu and colleagues (15) have proposed an approach in which cutoffs for waist circumference in adults can be used in conjunction with BMI in assigning chronic disease risk. These cutoffs are presented in the Figure and warrant serious consideration by ACSM for use by health/fitness professionals in the evaluation of health risks in their clients where action levels dictate limiting further weight gain (Action Level I) or instituting weight loss and risk reduction strategies (Action Level II).



Paul M. Ribisl, Ph.D., FACSM, is a professor and chair in the Department of Health and Exercise Science at Wake Forest University. He is an exercise physiologist who was a cofounder of the Cardiac Rehabilitation Program at Wake Forest University, which he directed from 1975 to 1991. In 1997, he completed a mini-fellowship in gerontology at Stanford University and is now involved in three research trials. Dr. Ribisl currently serves as an associate editor for ACSM's Health & Fitness Journal®.

References

1. Vague, J. La differenciation sexuelle, facteur determinant de formes de l'obesite. *Presse Med* 30:339–340, 1947.
2. WHO. Integrated prevention of non-communicable diseases: draft global strategy on diet, physical activity and health. Provisional agenda item 3.7, 113th Session. EB113/33 Add.1; November 27, 2003.
3. Sturm, R. Increases in clinically severe obesity in the United States, 1986–2000. *Archives of Internal Medicine* 163:2146–2148, 2003.
4. Ford, E.S., A.H. Mokdad, and W.H. Giles. Trends in waist circumference among U.S. adults. *Obesity Research* 11(10): 1223–1231, 2003.
5. Sturm, R. The effects of obesity, smoking, and problem drinking on chronic medical problems and health care costs. *Health Affairs* 21(2):245–253, 2002.
6. Cornier, M.A., C.W. Tate, G.K. Grunwald, et al. Relationship between waist circumference, body mass index, and medical care costs. *Obesity Research* 10(11): 1167–1172, 2002.
7. Pouliot, M.C., J.P. Despres, S. Lemieux, et al. Waist circumference and abdominal sagittal diameter: best simple anthropometric indexes of abdominal visceral adipose tissue accumulation and related cardiovascular risk in men and women. *The American Journal of Cardiology* 73(7):460–468, 1994.
8. Snijder, M.B., M. Visser, J.M. Dekker, et al. The prediction of visceral fat by dual-energy X-ray absorptiometry in the elderly: a comparison with computed tomography and anthropometry. *International Journal of Obesity* 26:984–993, 2002.
9. Zamboni, M., E. Turcato, F. Armellini, et al. Sagittal abdominal diameter as a practical predictor of visceral fat. *International Journal of Obesity* 22:655–660, 1998.
10. Ho, S., Y.M. Chen, J.L.F. Woo, et al. Association between simple anthropometric indices and cardiovascular risk factors. *International Journal of Obesity* 25:1689–1697, 2001.
11. Despres', J.P., I. Lemieux, and D. Prud'homme. Treatment of obesity: need to focus on high risk abdominally obese patients. *BMJ* 322:716–720, 2001.
12. Pouliot, M.C., J.P. Depres, A. Nadeau, et al. Visceral obesity in men. Associations with glucose tolerance, plasma insulin, and lipoprotein levels. *Diabetes* 41:826–834, 1992.
13. Ford, E.S., W.H. Giles, and W.H. Dietz. Prevalence of the metabolic syndrome among US adults. *JAMA* 287:356–359, 2002.
14. Janssen, I., P.T. Katzmarzyk, and R. Ross. Waist circumference and not body mass index explains obesity-related health risk. *American Journal of Clinical Nutrition* 79(3):379–384, 2004.
15. Zhu, S., S. Heshka, Z. Wang, et al. Combination of BMI and waist circumference for identifying cardiovascular risk factors in whites. *Obesity Research* 12(4):633–645, 2004.