The Growing Problem of Obesity

by Len Kravitz, PhD on Nov 01, 2005

Understand the physiological and biological mechanisms of obesity, and examine the components of a successful lifestyle-modification program.

Statistics demonstrate that countries around the globe are experiencing a spectacular increase in obesity. Worldwide there are an estimated 1 billion obese persons (body mass index [BMI] ? 30), and the number has been increasing rapidly over the last two decades (Loos & Bouchard 2003). In the United States 65% of adults are overweight (BMI = 25–29.9), and of these, 31% are obese. In China the prevalence of overweight individuals almost tripled for men and doubled for women from 1989 to 1997 (Hill et al. 2003).

Many factors contribute to this international epidemic, but two elements that may play key roles are the transition from a primarily rural lifestyle to a highly technological urban existence, and the ability of our environment to lure us to eat more and move less. Let's face it: There weren't many food courts to choose from a thousand years ago!

SIDEBAR: Energy Balance Basics

Weight management is impacted primarily by energy balance—energy input, via foods taken in, versus energy expenditure, via physical activity. Energy balance is disrupted when food intake overtakes energy output.

Over the centuries, the human genome has evolved in response to times when food and shelter have been scarce. Historically, food was accessible only periodically, and famine was a constant threat (Loos & Bouchard 2003). In addition, major amounts of physical exertion were necessary to obtain food or to escape a harsh living environment. Thus the human species evolved with a remarkable ability to function biologically with great energy efficiency by storing large amounts of excess fat intake in fat tissue. Our present sedentary, food-abundant circumstances may be a byproduct of our success as a society, but they clearly create an energy imbalance in our lifestyle

that can lead to obesity.

SIDEBAR: The Role of Fat Tissue

Fat tissue has typically been perceived as simply an extra layer of cushioning with few metabolic responsibilities. For years fat was viewed as a balloon that inflated when you ate more food and expended fewer calories and that deflated when you ate less food and were more physically active. But more recent research reveals that fat tissue (composed of adipocyte cells that specialize in fat storage) functions like other endocrine organs in the body, releasing hormones that send signals to the brain. These signals affect several intricate physiological mechanisms that regulate energy expenditure, insulin sensitivity, and fat and carbohydrate metabolism. Two hormones of interest for the regulation of energy metabolism are leptin and adiponectin, while a host of other hormones are involved in the body's immune reactions.

Leptin. Leptin, which resides in all fat cells, communicates directly with the hypothalamus in the brain, providing information about how much energy is currently stored in the body's fat cells. Leptin functions in what is referred to in biology as a "negative feedback loop." When fat cells decrease in size, leptin levels decrease, sending a message to the hypothalamus to direct the body to increase food intake. When fat cells increase in size, leptin levels increase, sending a message to the hypothalamus to decrease food intake. (See "The Regulatory Role of Leptin" for a depiction of this negative feedback loop.) However, it appears that the primary biological role of leptin is to facilitate energy intake when energy storage is low, as opposed to slowing down overconsumption when energy storage is high (Havel 2002).

Leptin production is regulated chiefly by insulin-induced changes in fat-cell metabolism. Havel (2002) notes that the consumption of fat (and fructose) actually results in lower circulating leptin levels, which can lead to overeating and weight gain. Initially, when the role of leptin in the body was discovered, many hoped that it would become the "antifat" miracle drug. However, swallowing leptin pills has not been shown to provide any benefits for overweight individuals, possibly because the digestion process changes this protein's structure and function. (For more information about leptin, see "The Lowdown on Leptin" by Jenna A. Bell-Wilson, MS, RD, LD, in April 2003 *IDEA Health and Fitness Source*.)

Adiponectin. Another specialized hormone secreted by fat is adiponectin, sometimes referred to as the "good-guy hormone" (Liebman 2004). Adiponectin assists insulin in sending blood glucose into the body's cells for storage or use as fuel, thus increasing the cells' insulin sensitivity, or glucose metabolism (Havel 2002). Adiponectin also helps decrease blood levels of triglycerides by working with insulin to stimulate fat breakdown. A person who has a lot of body fat typically has lower levels of adiponectin. While this hormone is predictably low in all overweight individuals, it is especially low in persons with insulin resistance, a cellular condition in which glucose is inhibited from entering the muscle cells. (See "Insulin Resistance and Insulin Sensitivity" on page 46.) However, as yet, adiponectin has not been administered as a pharmacological agent for weight loss.

Immune Hormones. Fat tissue also produces a number of immune-system hormones and cytokines, such as tumor necrosis factor-alpha, interleukin-6, plasminogen activator inhibitor-1, angiotensin II and others (Havel 2002). The cytokines function largely as inflammatory proteins, reacting to areas of infection or injury in the body. However, in persons with excess fat, these inflammatory proteins appear to over-release. Scientists have proposed that this overreaction is caused by the low oxygen content in the clusters of adipocytes, which in obese individuals are somewhat distant from the tissue vascular supply (Trayhurn 2005).

Inflammation is one of the most critical topics in obesity biology. Chronic low-grade inflammation is associated with both obesity and diabetes (Trayhurn 2005); it is also a key factor in heart disease (Liebman 2004). The release of inflammatory proteins may inflame arterial plaque, causing the plaque to rupture and leading to a heart attack or stroke (Liebman 2004). In addition, it appears that inflammatory hormones derived from fat tissue may play a causal role in the development of insulin resistance (Trayhurn 2005). Trayhurn notes that weight loss is accompanied by a corresponding decrease in the circulating levels of these inflammatory proteins.

SIDEBAR: The Gut Hormones

Another component of energy reserve regulation in the body involves some of the hormones that control feeding and appetite—hormones that are located in the gastrointestinal tract, including the pancreas. Specific hunger signals trigger eating, while satiety messages inhibit appetite. These distinct hormones are often referred to as the "gut hormones." They let you know when it is time to eat and when you have had enough.

Grehlin. The hormone grehlin is thought to be particularly associated with obesity (Druce, Small & Bloom 2005). Secreted by the stomach, grehlin plays a major role in appetite regulation and is often referred to as the "hormone of hunger." Grehlin works in a positive feedback loop: High levels during a fasted state generally promote increased food intake, while lower levels are observed after a meal. But food does not appear to suppress grehlin levels in obese individuals, a fact that may contribute to overeating. In addition, for obese individuals, losing weight often results in an elevation of grehlin. This may be one reason that dieters have difficulty maintaining their weight loss.

Peptide YY. When your body feels you have eaten enough, peptide YY is released from the intestines, along with other satiety hormones. Lipids and carbohydrates have an especially stimulating effect on peptide YY (Druce, Small & Bloom 2005). This gut hormone is thought to work with the central nervous system, providing an awareness of satiety and fullness to regulate the cessation of appetite as you eat (Druce, Small & Bloom 2005).

SIDEBAR: Fat Cells Behaving Badly

Researchers have established that fat deposition is highly linked to a person's health. Fat deposited in the hips and thighs, referred to as "gynoid fat," appears to be quite benign and metabolically inactive. On the other hand, fat around the internal organs of the abdomen (the trunk area) is referred to as "visceral fat" or "android fat." This fat has the highest correlation to high blood pressure, diabetes and high blood triglyceride levels, and is much more metabolically active than gynoid fat, producing more of the inflammatory proteins. It is interesting to observe that with exercise, visceral fat is often the first to disappear. The distribution of fat deposits in the body is thought to be determined predominantly by genetics. (See "Fat Deposition and Health Risk" on page 48.)

SIDEBAR: A Successful Obesity Program

The bad news about the increasing prevalence of obesity is balanced by some good news: Even small changes in weight can result in consequential health benefits. Studies show that a 5% – 10% loss of initial body weight is associated with meaningful improvements in cholesterol levels, hypertension and glucose metabolism. In the recent Diabetes Prevention Program study of

3,200 subjects, those who participated in a 4-year lifestyle intervention of physical activity and diet designed to induce a 7% loss of body weight had a 58% lower risk of developing type 2 diabetes compared with a control group (Fabricatore & Wadden 2003). Plus, the preventive effect was seen to hold for members of all racial and ethnic groups and both genders.
Since obesity and type 2 diabetes health consequences seem to parallel each other closely, Fabricatore and Wadden (2003), summarizing the guidelines from the National Heart, Lung, and Blood Institute and the North American Association for the Study of Obesity, suggest the following three lifestyle modifications as components of a successful obesity program:

- dietary intervention
- behavioral therapy
- physical activity

Central to the success of these strategies is the understanding that changes must be made for a lifetime. All too often, individuals view a weight loss program as something that takes place over a discrete period of time, during which they go on a diet and take exercise classes or secure a personal trainer to "get in shape." Other individuals attempt diet strategies with very unrealistic expectations for weight loss and give up when these hopes are not met. Clients need to be educated that lifestyle modifications are a means of establishing a new way of life, not a temporary "quick fix" for weight loss. Fitness professionals should emphasize the overall health benefits of lifestyle modifications, rather than allowing clients to dwell on personal appearance.

SIDEBAR: Dietary Intervention

Over the last five decades, the variety of diets has increased remarkably. Many clients will have tried two or more fad diets, with no sustained success, by the time they begin exercising with a fitness professional. In essence, the goal of dietary intervention is to keep the diet nutritionally correct while introducing some doable ways of reducing calorie intake. Modern society has influenced our food consumption so dramatically that this goal can be easily sabotaged. Another problem is that obese individuals tend to underestimate how much they eat by approximately 30%–50% (Fabricatore & Wadden 2003). Accurate self-monitoring is crucial for long-term success of dietary intervention.

Personal trainers and group fitness instructors can offer clients general guidelines on healthy eating. However, fitness professionals must stay within their scope of practice and refer clients to registered dietitians for specific diet plans.

Evidence suggests that low- and moderate-fat, calorie-restricted diets promote weight loss and are nutritionally sound (Boucher, Shafer & Chaffin 2001). Boucher and colleagues note that substantiation is lacking for the benefit of high-protein, high-fat, low-carbohydrate weight loss approaches. According to the American College of Sports Medicine (ACSM) Position Statement on the Appropriate Intervention Strategies for Weight Loss and Prevention of Weight Regain for Adults (Jakicic et al. 2001), the absolute dietary-energy intake should be adjusted based on the individual to elicit an energy deficit of 500–1,000 kilocalories per day. In addition, ACSM recommends reducing dietary fat to less than 30% of total energy intake. With this deficit, a minimum weight loss of 1–2 pounds per week would be realistic.

SIDEBAR: Behavioral Therapy

The behavioral approaches to weight loss are many. Evidence suggests that the following techniques can help clients attain long-term weight control (Costain & Croker 2005):

- proper assessment of clients' readiness to change
- emphasis on accurate self-monitoring of food consumption
- realistic goal setting
- implementation of dietary changes
- promotion of increased physical activity
- stimulus control (teaching clients how to avoid eating triggers and deal with cravings)
- cognitive restructuring (encouraging clients to replace unhealthy or negative thoughts and self-talk with positive affirmations)
- relapse management (promoting the understanding that relapses are a normal part of behavior change, not signs of being a "diet failure")
- ongoing creative communication techniques (e-mail, telephone conversations and websites) that provide support for clients' efforts to sustain lifestyle changes

Again, fitness professionals *must* refer clients to qualified counselors or dietitians when appropriate. See the IDEA Opinion Statement "Benefits of a Working Relationship Between Medical and Allied Health Practitioners and Personal Fitness Trainers" in June 2002 *IDEA Personal Trainer,* page 26.

SIDEBAR: Physical Activity

Although there are various physical activity and exercise approaches to weight control that are evidence-based and highly praised (the 10,000-steps-a-day model, for example), the "accumulated time" approach will be highlighted here. This approach addresses the fact that energy expenditure is a cumulative phenomenon, including both low-intensity activities of daily life—such as stair climbing and housecleaning—and more vigorous exercise, like swimming, elliptical training and cycling. For overweight and obese persons to achieve weight management goals, the evidence suggests the benefit of gradually progressing to 60 minutes per day of accumulated exercise. According to Jakicic & Gallagher, the optimal dose appears to be about 200–280 minutes of accumulated exercise per week (2003). (ACSM recommends progressing to 200–300 minutes of accumulated exercise per week.) Jakicic and Gallagher note that these greater weekly volumes of exercise tend to lead to less food consumption, facilitating weight loss goals. It is important to note that although resistance exercises are highly recommended for enhanced muscular strength and endurance, bodily function and a host of other health benefits, moderate-intensity cardiovascular exercise is what elicits the needed energy expenditure for weight loss and prevention of weight regain (Jakicic et al. 2001).

SIDEBAR: Is Help on the Way?

On a weekly basis we read or hear alarming stories about the increasing incidence of obesity and the possible associations with conditions such as diabetes, heart disease and hypertension. Sound intervention strategies to combat obesity are quickly diffused with trendy diets, quick weight loss schemes and new diet books that are not necessarily based on solid research. From the basic energy balance perspective, obesity may be considered a breakdown in the biological regulatory system that balances the physical activity we perform with the food we eat. Although flaws may exist in some of the physiological mechanisms involved with energy balance, appetite and insulin resistance, the focus of fitness professionals should be on the influence of our changing and "toxic" environment.

It has taken several decades for the obesity epidemic to manifest itself. With the appropriate interventions, will it take just as long to reverse that trend? Research to identify the link between certain genes and obesity, as well as to discover new drugs for treatment, is extensive. But 65%

of the U.S. population is overweight and/or obese. Could we—or would we—put that much of the population on a drug treatment even if one were available?

The obesity alarm has sounded, but we have yet to respond with any organized national strategy. What factors in our environment can be changed to encourage us to move more and eat less—and make healthier food choices? The fitness industry has evolved tremendously in the last few decades to bring exercise techniques and programs to new levels of excellence. Maybe one of the industry's new directions should be to develop and introduce some viable national strategies to combat weight gain. Resolving the obesity epidemic may very well demand the combined talents of the dedicated leaders in the fitness industry and of researchers, clinicians, physicians and public-health advocates to create not one but several innovative approaches and initiatives to deal with this health pandemic.

SIDEBAR: Fat Deposition Health Risk

Since visceral fat, or fat located around the trunk area, has a high correlation to several health risk factors, one way for fitness professionals to assess an individual's health risk is through the use of waist circumference measurements. The waist measurement is made at the narrowest part of the torso between the ribs and the iliac crest. The National Cholesterol Education Program recommends using a waist circumference of > 88 centimeters (35 inches) for women and > 100 centimeters (39 inches) for men to evaluate obesity as a risk factor for metabolic diseases and coronary heart disease.

Topics

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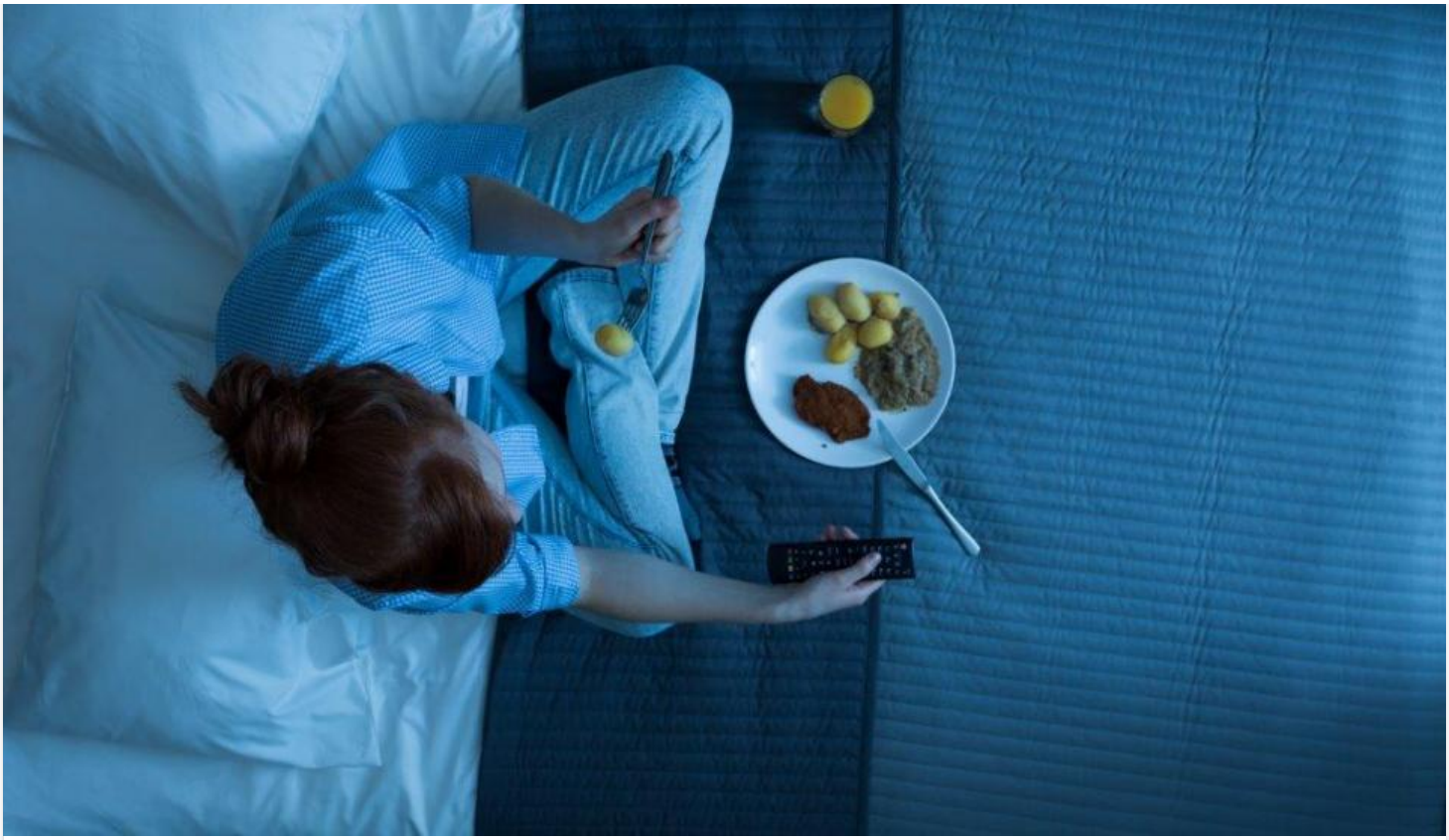

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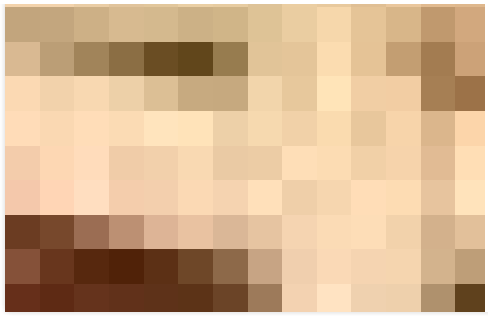

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