

# Achieving and Maintaining a Healthful Body Weight

## Chapter Summary

---

A healthful body weight is one that is appropriate for age and physical development, can be achieved and sustained without constant dieting, is acceptable to the individual, is based upon individual genetic background and family history, promotes good eating habits, and allows for regular physical activity. Underweight is having too little body fat to maintain health. Normal weight is having an adequate but not excessive level of body fat for health. Overweight occurs when there is a moderate amount of excess body fat, and obesity occurs when excess body fat adversely affects health. Morbid obesity occurs when weight exceeds 100% of normal.

Body mass index, body composition, and the waist-to-hip ratio and waist circumference are tools that can help evaluate health status. We gain or lose weight based on food intake and energy expenditure. The three components of energy expenditure are basal metabolic rate (BMR), the thermic effect of food, and the energy cost of physical activity. There are many factors that affect the ability to lose or gain weight. Genetic background, childhood weight, behavioral and social factors, and diet composition all influence adult body weight. Physiologic factors that contribute to obesity include alterations in various proteins and hormones that influence hunger and satiety. Obesity is caused by many factors and is linked to chronic diseases, including a series of risk factors known as metabolic syndrome, which increases the risk for heart disease, diabetes, and stroke. The first line of defense in treating obesity is a low-energy diet and regular physical activity. Prescription medications may aid weight loss, but dietary supplements are not recommended, because they have limited safety. For the morbidly obese, surgery may be recommended. Fad weight-loss programs promise rapid, effortless loss but seldom result in long-term maintenance and may be risky. Maintaining a healthful body weight involves healthful dietary approaches and participation in regular physical activity. Weight loss can be accomplished by eating fewer Calories and less fat, doing regular exercise, and modifying behavior where appropriate. Being underweight can increase health risk. Weight gain can be achieved by eating more and performing weight lifting and aerobic exercise. Protein and amino acid supplements for weight gain are ineffective.

Nutrition Myth or Fact addresses the question: High-carbohydrate, moderate-fat diets—have they been oversold?

## Learning Objectives

---

After studying this chapter, the student should be able to:

1. Explain what is meant by a healthful weight (p. 498).
2. Define the terms *underweight*, *normal weight*, *overweight*, *obesity*, and *morbid obesity* and describe three methods you can use to evaluate your body weight (pp. 499-503).
3. Explain the concept of energy balance (pp. 504–511).
4. Discuss techniques used to measure energy expenditure, and three ways that the body expends energy (pp. 504–511).
5. List and describe several biological influences on body weight (pp. 511–515).
6. Discuss cultural, economic, and social influences on body weight (pp. 515–518).
7. Discuss several health risks of obesity and explain why it is considered a multifactorial disease (pp. 518–521).
8. Describe four treatment options for obesity (pp. 521–525).
9. Develop a diet, exercise, and behavioral plan for healthful weight loss (pp. 525–532).
10. Identify four key strategies for gaining weight safely and effectively (pp. 532–533).

## Key Terms

---

bariatric surgery	energy cost of physical activity	morbid obesity
basal metabolic rate (BMR)	energy expenditure	multifactorial disease
body composition	energy intake	normal weight
body fat mass	ghrelin	obesity
body mass index (BMI)	indirect calorimetry	overweight
brown adipose tissue	lean body mass	peptide YY
direct calorimetry	leptin	set-point theory
doubly labeled water	mindful eating	thermic effect of food
	metabolic syndrome	thrifty gene theory
		underweight

## Chapter Outline

---

### I. What Is a Healthful Body Weight?

A. A healthful body weight can be defined as all of the following:

1. A weight appropriate for your age and physical development.
2. A weight that can be achieved and sustained without curtailing food intake or constantly dieting.
3. A weight compatible with normal blood pressure, lipid levels, and glucose tolerance.
4. A weight based upon genetic background and family history of body shape and weight.
5. A weight that is supported by good eating habits and regular physical activity.
6. A weight that is acceptable to you.

## II. How Can You Evaluate Your Body Weight?

- A.** Body mass index is the ratio of body weight to the square of height.
1. BMI provides important clues to person's overall health because it is associated with five weight categories, each of which involves a certain level of risk.
    - a. Underweight is classified as having a BMI less than 18.5 kg/m<sup>2</sup>.
      - i. An underweight person has too little body fat to maintain health.
    - b. Normal weight BMI ranges from 18.5 to 24.9 kg/m<sup>2</sup>.
      - ii. It is associated with the lowest disease risk.
    - c. Overweight is defined as a BMI between 30 and 39.9 kg/m<sup>2</sup>.
      - i. Overweight individuals have a moderate amount of excess body fat that is greater than the accepted standard.
    - d. Obesity is defined as having a BMI between 30 and 39.9 kg/m<sup>2</sup>.
      - i. Obese people have an excess of body fat that adversely affects health.
    - e. Morbid obesity is defined as a BMI greater than or equal to 40 kg/m<sup>2</sup>.
      - i. In morbid obesity, a person's body weight exceeds 100% of normal weight putting him or her at very high risk of serious health consequences.
    - f. BMI greater than 30 is associated with increased risk for many chronic diseases.
  2. There are limitations to the BMI.
    - a. BMI does not distinguish between fat and lean mass, nor does it indicate where fat is stored.
    - b. BMI is not accurate for adults over 65 or for children.
    - c. At the same BMI, people from different ethnic backgrounds have different levels of body fat.
    - d. BMI is limited for those with a disproportionately higher muscle mass for a given height.
- B.** Body composition is an estimate of lean and fat body mass.
1. The range of error for body composition measurements is 3–20%.
  2. Body composition should not be used as the only indicator of health status.
- C.** Fat distribution pattern is known to affect risk for various diseases.
1. Apple-shaped fat patterning significantly increases risk of many chronic diseases.
    - a. Upper-body obesity is associated with increased risk of type 2 diabetes, heart disease, and high blood pressure.
    - b. It is theorized that upper-body obesity causes problems with fat and carbohydrate metabolism.
  2. Pear-shaped fat patterning does not increase risk for chronic disease.
  3. Waist-to-hip ratios higher than 0.9 in men and 0.8 in women indicate a higher risk for chronic disease.
  4. Chronic disease risk increases with a waist circumference of greater than 40 inches in men and greater than 35 inches in women.

**Key Terms:** body mass index (BMI), underweight, normal weight, overweight, obesity, morbid obesity, body composition, body fat mass, lean body mass

**Figures:**

**Figure 13.1:** Estimate your body mass index (BMI) using this graph.

**Figure 13.2:** Overview of various body composition methods.

**Figure 13.3:** Fat distribution patterns.

**Figure 13.4:** Determining your type of fat patterning.

### III. How Does Energy Balance Influence Body Weight?

- A. People gain or lose weight when energy intake and expenditure are out of balance.
1. Energy balance occurs when energy intake equals energy expenditure.
  2. Energy intake is the energy in food and beverages we consume each day.
    - a. The energy content of a food is a function of the carbohydrate, protein, fat, and alcohol it contains.
    - b. An excess intake of approximately 3,500 kcal causes an accumulation of 1 pound.
  3. Energy expenditure includes more than just physical activity.
    - a. There are three components of energy expenditure: basal metabolic rate (BMR), thermic effect of food (TEF), and energy cost of physical activity and activities of daily living.
  4. Energy expenditure can be measured using direct or indirect calorimetry.
    - a. Direct calorimetry measures the heat the body releases, but it is expensive and not very practical for humans.
    - b. Indirect calorimetry estimates energy expenditure by measuring oxygen consumption and carbon dioxide production.
    - c. Using doubly labeled water, energy expenditure can be measured in free-living situations with little inconvenience to the person being measured, but it has limitations.
  5. Basal metabolic rate (BMR) is energy expenditure at rest and accounts for 60–75% of daily energy expenditure.
    - a. BMR varies widely among people with the primary determinant being the amount of a person's lean body mass.
    - b. BMR decreases with age.
  6. The thermic effect of food (TEF) is the energy expended to process food and accounts for 5–10% of total Calories consumed.
    - a. TEF depends on how processed the foods in the meal are.
  7. The energy cost of physical activity is highly variable and is dependent upon body composition and activity. It represents 15% to 35% of our total energy each day.
  8. Research suggests limitations of the energy balance equation.
    - a. Critiques include that it can only be applied when one is weight stable and that it does not explain how people gain and lose weight differently.
    - b. A new proposal takes into account the rates of energy intake and expenditure and their effect on rate of change of energy stores in the body, not simply on body weight overall.

**Key Terms:** energy intake, energy expenditure, direct calorimetry, indirect calorimetry, doubly labeled water, basal metabolic rate (BMR), thermic effect of food (TEF), energy cost of physical activity

## Figures and Tables:

**Figure 13.5:** Energy Balance

**Figure 13.6:** The components of energy expenditure

**Figure 13.7:** Lean body mass varies in people with different body weights and body fat levels.

**Table 13.1:** Factors Affecting Basal Metabolic Rate (BMR)

**Table 13.2:** Energy Costs of Various Physical Activities

## IV. What Factors Influence Body Weight?

**A.** Genetic factors affect body weight in different ways.

1. More than 120 genes are currently thought to be associated with an increased risk for obesity.
2. The fat mass and obesity (FTO)—associated gene appears to stimulate excessive food intake and diminish feeling of satiety.
3. The thrifty gene theory suggests that some people possess a gene or genes that cause them to expend less energy at rest and during activity.
4. The set-point theory suggests that our bodies are designed to maintain weight within a narrow range or “set point” and resist weight changes by adapting.
  - a. The ability to maintain a set point may be influenced by genetics.

**B.** Because the body preferentially stores fat, composition of the diet affects fat storage.

**C.** Metabolic factors affect weight gain and loss.

1. Four metabolic factors have been identified as predictive of a person’s risk for weight gain and resistance to weight loss.
  - a. Relatively low metabolic rate.
  - b. Low level of spontaneous physical activity.
  - c. Low sympathetic nervous system activity.
  - d. Low fat oxidation.
2. An abnormally low level of thyroid hormone, an elevated level of cortisol, and certain medications can also lead to weight gain.

**D.** Physiologic factors affect body weight, including hypothalamic regulation of hunger and satiety.

1. In some people, satiety mechanisms may be too weak to prevent overeating.

**E.** Energy-regulating hormones may affect body weight.

1. Leptin is a protein produced by adipose cells that functions as a hormone. It acts to reduce food intake and cause a decrease in body weight and fat.
  - a. Obese people have very high levels of leptin but are insensitive to its effects.
2. Ghrelin, a protein that contributes to hunger and satiety, is being researched in treatment of obesity.
3. After a meal, peptide YY (or PYY), a protein that decreases appetite and inhibits food intake, is released in amounts proportional to the energy content of the meal.
  - a. Obese individuals tend to have an increase in PYY after a meal indicating that PYY may play a role in the manifestation and maintenance of obesity.

4. People with more uncoupling proteins and brown adipose tissue appear to be more resistant to weight gain.
  5. Various physiologic factors increase satiety or decrease food intake.
    - a. Serotonin, cholecystokinin, increased blood glucose levels, stomach expansion, and nutrient absorption all increase satiety.
    - b. Food intake is increased by beta-endorphins, neuropeptide Y, and decreased blood glucose levels.
- F.** Cultural and economic factors affect food choices and body weight.
1. Food choices and physical activity are often determined by culture and familial factors.
  2. People of lower economic status have a higher incidence of obesity and are less likely to choose healthy diets and regular activity.
  3. There also seems to be an association between educational attainment and BMI.
- G.** Social factors influence behavior and body weight.
1. Appetite is the psychological drive to eat, stimulated by learned preferences and situations that promote eating.
    - a. Social cues relating to timing and size of meals and mood can also affect appetite.
  2. Social factors can encourage people to overeat.
    - a. Social pressure encourages people to overeat.
    - b. Opportunities to eat often and excessively are readily available to Americans.
  3. Many social factors cause people to be less physically active.
    - a. Examples include living in an unsafe community, living in an area with harsh weather conditions, and the increasing use of technology.
  4. The media and societal treatment of obesity encourage many to undereat whether or not they are of normal weight.

**Key Terms:** thrifty gene theory, set-point theory, leptin, ghrelin, peptide YY (PYY), brown adipose tissue

#### **IV. What Makes Obesity Harmful and Why Does It Occur?**

- A.** Obesity is linked to chronic diseases and premature death.
1. A clustering of risk factors that increase one's risk for heart disease, diabetes, and stroke is known as metabolic syndrome. A diagnosis of metabolic syndrome is made if someone has three or more of the following conditions:
    - a. Abdominal obesity
    - b. Higher-than-normal triglyceride levels
    - c. Lower-than-normal HDL-cholesterol levels
    - d. Higher-than-normal blood pressure
    - e. Fasting blood glucose levels greater than or equal to 100 mg/dL
  2. People with metabolic syndrome are twice as likely to develop heart disease and five times more likely to develop type 2 diabetes.
  3. Obesity is associated with an increased risk of premature death.
  4. Obesity is a multifactorial disease.
    - a. Genetic, metabolic, physiologic, and environmental factors affect obesity risk.

- b. Causes of obesity appear to be embedded within highly complex biological and sociological systems.
- c. Variables directly or indirectly influencing energy balance are grouped into seven predominant themes:
  - i. Biology
  - ii. Physical activity environment
  - iii. Individual physical activity
  - iv. Individual psychology
  - v. Societal influences
  - vi. Food environment
  - vii. Food consumption

**Key Terms:** metabolic syndrome, multifactorial disease

**Nutrition Animation:** Increase in Obesity Rates in the United States (located in IR-DVD folder).

**Figures:**

**Figure 13.8:** Abdominal obesity, specifically a high amount of visceral fat stored deep within the abdomen, is one of the risk factors for metabolic syndrome.

**Figure 13.9:** Complexities of the Contributors to Obesity

## V. How is Obesity Treated?

- A. Obesity does respond to diet and exercise.
  - 1. A low-energy diet and regular physical activity are the first line of defense.
  - 2. Physical activity should be gradually increased.
  - 3. Counseling, support groups, and psychotherapy can also be helpful.
- B. Weight loss can be enhanced with prescription medications.
  - 1. Prescription medication is sometimes necessary.
  - 2. It should only be used under the supervision of a physician.
- C. Many supplements used for weight loss contain stimulants.
  - 1. Some products for weight loss may pose a danger because they contain stimulants like caffeine, phenylpropanolamine (PPA), and ephedra that can increase heart rate and blood pressure.
- D. Surgery can be used to treat morbid obesity.
  - 1. For the morbidly obese, surgery may be recommended.
    - a. Bariatric surgery is the surgical alteration of the gastrointestinal tract performed to promote weight loss.
      - i. The most common types of weight-loss surgery are sleeve gastropasty, gastric bypass, and gastric banding.
    - b. The risks of surgery on obese individuals are extremely high.
    - c. Up to one half of all weight-loss surgery patients lose weight and maintain their new weight.
    - d. Liposuction is a cosmetic surgical procedure, involves risk, and does not lead to long-term weight loss.

**Key Term:** bariatric surgery

**Nutrition Animation:** Increase in Obesity Rates in the United States (located in IR-DVD folder).

**Figure:**

**Figure 13.10:** Various forms of bariatric surgery alter the normal anatomy.

## **VI. How Can You Lose Weight Safely and Keep It Off?**

- A.** Healthful weight change involves gradual changes in energy intake, regular physical activity, and behavior modification.
- B.** Fad diets should be recognized and avoided.
  - 1. No scientific data support claims of “new discoveries.”
  - 2. Fads promote rapid weight loss with little effort.
  - 3. Fads include special foods or supplements that are promoted to burn fat or speed up metabolism.
  - 4. Fad diets often promote restricting food and disregarding variety and balance.
- C.** Diets focusing on macronutrient composition may or may not work.
  - 1. Moderate-fat, high-carbohydrate, moderate-protein diets are well researched, safe, and typically well balanced but more gradual in weight lost.
  - 2. High-fat, low-carbohydrate, high-protein diets rely on ketosis.
    - a. Limited research suggests that people lose weight and experience positive metabolic changes.
    - b. Long-term health benefits of this type of diet are unknown at this time.
  - 3. Low-fat and very-low-fat diets were originally intended to decrease heart disease.
    - a. Diets such as Ornish’s and Pritikin’s are difficult to follow because they are very restrictive, providing limited animal products.
    - b. These diets promote healthy blood lipids, insulin levels, and blood glucose, but they are not recommended for diabetics.
    - c. As with vegan diets, vitamin supplements are required.
- D.** Employing specific strategies increases success of self-designed weight-loss plans.
  - 1. Setting realistic goals for gradual weight loss increases success.
    - a. Specific, reasonable goals increase accountability.
    - b. Measurable goals are easier to track.
  - 2. Eating smaller portions of lower-fat foods reduces Caloric intake.
    - a. USDA Food Patterns provide a recommendation of portion size.
    - b. Consuming less fat reduces total Calories.
    - c. Foods that are low in energy and high in fiber, water, and nutrients provide satiety with fewer Calories.
  - 3. Regular physical activity helps people maintain or increase lean body mass and increase BMR.
    - a. Energy restriction without physical activity decreases lean mass.
    - b. No one form of exercise appears to be most beneficial, but a combination of aerobic activity and weight lifting most days have shown good results.
    - c. Regular physical activity improves mood, quality of sleep, self-esteem, and a sense of accomplishment.

4. Incorporating appropriate behavior modifications into daily life improves success of weight loss and long-term maintenance.
  - a. Practice mindful eating by applying a nonjudgmental awareness of the emotional and physical sensations one experiences while eating or in a food-related environment.

**Key Term:** mindful eating

**Figure:**

**Figure 13.11:** Managing Calorie Intake

## VII. What If You Need to Gain Weight?

- A. Being underweight increases one's risk for infections and illness and impairs the body's ability to recover.
- B. For safe and effective weight gain, nutrient dense foods should be chosen.
  1. Diets higher in mono- and polyunsaturated fats can be healthful approach to weight gain.
  2. Key is to eat frequent meals throughout the day and select healthful energy-dense foods.
- C. Amino acid and protein supplements do not increase muscle mass.
  1. Best way to increase muscle mass is through adequate intake of high-quality protein and resistance training.

## Activities

---

1. Prior to the lecture on this topic, define successful weight loss (losing 10% of body weight and maintaining the loss for one year). Ask students to interview someone who has successfully lost weight to learn the method that was used, whether or not weight loss was maintained, and the cause of success or failure in maintenance of their new weight. In class, allow students to share the information they have gathered, and create a list of the many ways that people have successfully lost weight. Discuss failures and successes in maintenance. The lecture and reading should help to explain the reasons that weight loss and maintenance are so individualized.
2. Bring several tape measures to class. Have students measure their waist (at the level of their natural waist) and hip (at the maximal width of the buttocks) circumference. Ask them to:
  - a. calculate their waist-to-hip ratio.
  - b. compare their waist-to-hip ratio to recommended measurements.
  - c. interpret their results.
3. Ask students to look through magazines, newspapers, or on the Web for examples of weight-loss ads. Have them bring the ads to class and discuss whether or not they present a realistic approach to weight loss.
4. In class, view three to five minutes of a reality TV weight-loss program or a trailer for one. Allow students to debate and discuss the effects of such programs and the media attention to obesity. Some discussion questions might include:

- a. Do these programs promote safe and effective weight loss that could be achieved by the viewer? Explain.
  - b. What do these programs do for the emotional/psychological health of the obese viewer?
  - c. Do these programs encourage viewers to see the real benefits of weight management?
  - d. Is weight loss becoming a “spectator sport” much as cooking has become?
  - e. Because “makeover” programs also address weight loss, what are the perceived effects on the obesity epidemic?
5. A variety of research studies have been done on “antifat bias” or prejudice against obese individuals. These studies reveal the bias of healthcare providers toward a population that dominates their livelihood. Either bring examples of these studies to class or have students review several online or in the library. Discuss the question: How can we hope to make headway in the obesity epidemic if those who are treating it cannot overcome their own prejudice?

## Diet Analysis Activity

6. Using the nutritional assessment previously completed, students should note the following:
- a. How many Calories do you consume daily?
  - b. How does this Caloric intake compare to recommendations? How does it compare with your calculated total daily energy (See “You Do the Math,” p. 510, in your textbook)? Why might your calculated total daily energy be different from your analysis recommendations?
  - c. If you wanted to lose weight, which foods in your assessment could you restrict to both decrease Calories and least reduce the amount of food consumed? (Hint: think about nutrient density.) Would the diet be balanced? What foods of low-energy density could you add? Why would it be difficult for you to make these changes?
  - d. If you wanted to gain weight, which foods would you add to your diet to increase the Calories by 500 per day? Would the diet be balanced? What would you need to do to make this addition of Calories easier to accept?

## Nutrition Debate Activity

7. Divide the class in half. Half of the students should prepare to support the view that weight loss is the most practical way to reduce the risk of chronic disease in both obese and overweight individuals. Information can be found on this premise at the NHLBI website, [www.nhlbi.nih.gov/health/dci/Diseases/obe/obe\\_treatments.html](http://www.nhlbi.nih.gov/health/dci/Diseases/obe/obe_treatments.html). The other half of the class should prepare to support the view that regardless of weight, individuals can become healthy by practicing healthy behaviors. Information can be found on this premise at the website [www.healthyweightnetwork.com](http://www.healthyweightnetwork.com). There is plenty of scientific support for both arguments, so the discussion should be lively. You may need to limit time for each side to present arguments. This debate can also be done in small groups.

## Web Resources

---

**Federal Trade Commission, Consumer Information**  
<http://www.consumer.ftc.gov/health>

**Nutrition.gov**

[www.nutrition.gov/weight-management](http://www.nutrition.gov/weight-management)

**Academy of Nutrition and Dietetics**

[www.eatright.org](http://www.eatright.org)

**National Institute of Diabetes and Digestive and Kidney Diseases**

[www.niddk.nih.gov/health/nutrit](http://www.niddk.nih.gov/health/nutrit)

**Society for Nutrition Education and Behavior**

[www.sneb.org](http://www.sneb.org)

**Overeaters Anonymous**

[www.aa.org](http://www.aa.org)

---