



## Chapter 2

# Balancing Calories to Manage Weight

Achieving and sustaining appropriate body weight across the lifespan is vital to maintaining good health and quality of life. Many behavioral, environmental, and genetic factors have been shown to affect a person's body weight. *Calorie balance over time is the key to weight management.* Calorie balance refers to the relationship between calories consumed from foods and beverages and calories expended in normal body functions (i.e., metabolic processes) and through physical activity. People cannot control the calories expended in metabolic processes, but they can control what they eat and drink, as well as how many calories they use in physical activity.

Calories consumed must equal calories expended for a person to maintain the same body weight. Consuming more calories than expended will result in weight gain. Conversely, consuming fewer calories than expended will result in weight loss. This can be achieved over time by eating fewer calories, being more physically active, or, best of all, a combination of the two.

Maintaining a healthy body weight and preventing excess weight gain throughout the lifespan are highly preferable to losing weight after weight gain. Once a person becomes obese, reducing body weight back to a healthy range requires significant effort over a span of time, even years. People who are most successful at losing weight and keeping it off do so through continued attention to calorie balance.

The current high rates of overweight and obesity among virtually all subgroups of the population in the United States demonstrate that many Americans are in *calorie imbalance*—that is, they consume more calories than they expend. To curb the obesity epidemic and improve their health, Americans need to make significant efforts to decrease the total number of calories they consume from foods and beverages and increase calorie expenditure through physical

**FOR MORE INFORMATION**  
See **Chapter 5** for discussion of healthy eating patterns that meet nutrient needs within calorie limits.

activity. Achieving these goals will require Americans to select a healthy eating pattern that includes nutrient-dense foods and beverages they enjoy, meets nutrient requirements, and stays within calorie needs. In addition, Americans can choose from a variety of strategies to increase physical activity.



## Key Recommendations

Prevent and/or reduce overweight and obesity through improved eating and physical activity behaviors.

Control total calorie intake to manage body weight. For people who are overweight or obese, this will mean consuming fewer calories from foods and beverages.

Increase physical activity and reduce time spent in sedentary behaviors.

Maintain appropriate calorie balance during each stage of life—childhood, adolescence, adulthood, pregnancy and breastfeeding, and older age.

## AN EPIDEMIC OF OVERWEIGHT AND OBESITY

The prevalence of overweight and obesity in the United States is dramatically higher now than it was a few decades ago. This is true for all age groups, including children, adolescents, and adults. One of the largest changes has been an increase in the number of Americans in the obese category. As shown in Table 2-1, the prevalence of obesity has doubled and in some cases tripled between the 1970s and 2008.

The high prevalence of overweight and obesity across the population is of concern because individuals who are overweight or obese have an increased risk of many health problems. Type 2 diabetes, heart disease, and certain types of cancer are among the conditions most often associated with obesity. Ultimately, obesity can increase the risk of premature death.

These increased health risks are not limited to adults. Weight-associated diseases and conditions that were once diagnosed primarily in adults are now observed in children and adolescents with excess body fat. For example, cardiovascular disease risk factors, such as high blood cholesterol and hypertension, and type 2

### OVERWEIGHT AND OBESE: WHAT DO THEY MEAN?

Body weight status can be categorized as underweight, healthy weight, overweight, or obese. Body mass index (BMI) is a useful tool that can be used to estimate an individual's body weight status. BMI is a measure of weight in kilograms (kg) relative to height in meters (m) squared. The terms overweight and obese describe ranges of weight that are greater than what is considered healthy for a given height, while underweight describes a weight that is lower than what is considered healthy for a given height. These categories are a guide, and some people at a healthy weight also may have weight-responsive health conditions. Because children and adolescents are growing, their BMI is plotted on growth charts<sup>25</sup> for sex and age. The percentile indicates the relative position of the child's BMI among children of the same sex and age.

Category	Children and Adolescents (BMI for Age Percentile Range)	Adults (BMI)
<b>Underweight</b>	Less than the 5th percentile	Less than 18.5 kg/m <sup>2</sup>
<b>Healthy weight</b>	5th percentile to less than the 85th percentile	18.5 to 24.9 kg/m <sup>2</sup>
<b>Overweight</b>	85th percentile to less than the 95th percentile	25.0 to 29.9 kg/m <sup>2</sup>
<b>Obese</b>	Equal to or greater than the 95th percentile	30.0 kg/m <sup>2</sup> or greater

Adult BMI can be calculated at <http://www.nhlbisupport.com/bmi/>. A child and adolescent BMI calculator is available at <http://apps.nccd.cdc.gov/dnpabmi/>.

25. Growth charts are available at <http://www.cdc.gov/growthcharts>.

**TABLE 2 1. Obesity in America... Then and Now**

Obesity Then	Obesity Now
In the early 1970s, the prevalence of obesity was 5% for children ages 2 to 5 years, 4% for children ages 6 to 11 years, and 6% for adolescents ages 12 to 19 years.	In 2007–2008, the prevalence of obesity reached 10% for children ages 2 to 5 years, 20% for children ages 6 to 11 years, and 18% for adolescents ages 12 to 19 years.
In the late 1970s, 15% of adults were obese.	In 2008, 34% of adults were obese.
In the early 1990s, zero States had an adult obesity prevalence rate of more than 25%.	In 2008, 32 States had an adult obesity prevalence rate of more than 25%.
<p>Sources:                      Flegal KM, Carroll MD, Ogden CL, Curtin LR. Prevalence and trends in obesity among U.S. adults, 1999–2008. <i>JAMA</i>. 2010;303(3):235–241.                      Ogden CL, Flegal KM, Carroll MD, Johnson CL. Prevalence and trends in overweight among U.S. children and adolescents, 1999–2000. <i>JAMA</i>. 2002;288(4):1728–1732.                      Ogden CL, Carroll MD, Curtin LR, Lamb MM, Flegal KM. Prevalence of high body mass index in U.S. children and adolescents, 2007–2008. <i>JAMA</i>. 2010;303(3):242–249.                      Centers for Disease Control and Prevention. U.S. Obesity Trends. Available at: <a href="http://www.cdc.gov/obesity/data/trends.html">http://www.cdc.gov/obesity/data/trends.html</a>. Accessed August 12, 2010.                      [Note: State prevalence data based on self-report.]</p>	

diabetes are now increasing in children and adolescents. The adverse effects also tend to persist through the lifespan, as children and adolescents who are overweight and obese are at substantially increased risk of being overweight and obese as adults and developing weight-related chronic diseases later in life. Primary prevention of obesity, especially in childhood, is an important strategy for combating and reversing the obesity epidemic.

All Americans—children, adolescents, adults, and older adults—are encouraged to strive to achieve and maintain a healthy body weight. Adults who are obese should make changes in their eating and physical activity behaviors to prevent additional weight gain and promote weight loss. Adults who are overweight should not gain additional weight, and most, particularly those with cardiovascular disease risk factors, should make changes to their eating and physical activity behaviors to lose weight. Children and adolescents are encouraged to maintain calorie balance to support normal growth and development without promoting excess weight gain. Children and adolescents who are overweight or obese should change their eating and physical activity behaviors so that their BMI-for-age percentile does not increase over time. Further, a health care provider should be consulted to determine appropriate weight management for the child or adolescent. Families, schools, and communities play important roles in supporting changes in eating and physical activity behaviors for children and adolescents.

Maintaining a healthy weight also is important for certain subgroups of the population, including women who are capable of becoming pregnant, pregnant women, and older adults.

- Women are encouraged to achieve and maintain a healthy weight before becoming pregnant. This may reduce a woman’s risk of complications during pregnancy, increase the chances of a healthy infant birth weight, and improve the long-term health of both mother and infant.
- Pregnant women are encouraged to gain weight within the 2009 Institute of Medicine (IOM) gestational weight gain guidelines.<sup>26</sup> Maternal weight gain during pregnancy outside the recommended range is associated with increased risks for maternal and child health.
- Adults ages 65 years and older who are overweight are encouraged to not gain additional weight. Among older adults who are obese, particularly those with cardiovascular disease risk factors, intentional weight loss can be beneficial and result in improved quality of life and reduced risk of chronic diseases and associated disabilities.

### **CONTRIBUTING TO THE EPIDEMIC: AN OBESOGENIC ENVIRONMENT**

The overall environment in which many Americans now live, work, learn, and play has contributed to the obesity epidemic. Ultimately, individuals

26. Institute of Medicine (IOM) and National Research Council (NRC). *Weight gain during pregnancy: reexamining the guidelines*. Washington (DC): The National Academies Press; 2009.

choose the type and amount of food they eat and how physically active they are. However, choices are often limited by what is available in a person's environment, including stores, restaurants, schools, and worksites. Environment affects both sides of the calorie balance equation—it can promote overconsumption of calories and discourage physical activity and calorie expenditure.

The food supply has changed dramatically over the past 40 years. Foods available for consumption increased in all major food categories from 1970 to 2008. Average daily calories available per person in the marketplace increased approximately 600 calories,<sup>27</sup> with the greatest increases in the availability of added fats and oils, grains, milk and milk products,<sup>28</sup> and caloric sweeteners. Many portion sizes offered for sale also have increased. Research has shown that when larger portion sizes are served, people tend to consume more calories. In addition, strong evidence shows that portion size is associated with body weight, such that being served and consuming smaller portions is associated with weight loss.

Studies examining the relationship between the food environment and BMI have found that communities with a larger number of fast food or quick-service restaurants tend to have higher BMIs. Since the 1970s, the number of fast food restaurants has more than doubled. Further, the proportion of daily calorie intake from foods eaten away from home has increased,<sup>29</sup> and evidence shows that children, adolescents, and adults who eat out, particularly at fast food restaurants, are at increased risk of weight gain, overweight, and obesity. The strongest association between fast food consumption and obesity is when one or more fast food meals are consumed per week. As a result of the changing food environment, individuals need to deliberately make food choices, both at home and away from home, that are nutrient dense, low in calories, and appropriate in portion size.

On the other side of the calorie balance equation, many Americans spend most of their waking hours engaged in sedentary behaviors, making it difficult for them to expend enough calories to maintain calorie balance. Many home, school, work, and community environments do not facilitate a physically active

lifestyle. For example, the lack of sidewalks or parks and concerns for safety when outdoors can reduce the ability of individuals to be physically active. Also, over the past several decades, transportation and technological advances have meant that people now expend fewer calories to perform tasks of everyday life. Consequently, many people today need to make a special effort to be physically active during leisure time to meet physical activity needs. Unfortunately, levels of leisure-time physical activity are low. Approximately one-third of American adults report that they participate in leisure-time physical activity on a regular basis, one-third participate in some leisure-time physical activity, and one-third are considered inactive.<sup>30</sup> Participation in physical activity also declines with age. For example, in national surveys using physical activity monitors, 42 percent of children ages 6 to 11 years participate in 60 minutes of physical activity each day, whereas only 8 percent of adolescents achieve this goal.<sup>31</sup> Less than 5 percent of adults participate in 30 minutes of physical activity each day, with slightly more meeting the recommended weekly goal of at least 150 minutes.

#### FOR MORE INFORMATION

See **Chapter 6** for a discussion of changes to the food and physical activity environment involving families, peers, and the community that can help Americans achieve calorie balance.

## CURRENT DIETARY INTAKE

The current dietary intake of Americans has contributed to the obesity epidemic. Many children and adults have a usual calorie intake that exceeds their daily needs, and they are not physically active enough to compensate for these intakes. The combination sets them on a track to gain weight. On the basis of national survey data, the average calorie intake among women and men older than age 19 years are estimated to be 1,785 and 2,640 calories per day, respectively. While these estimates do not appear to be excessive, the numbers are difficult to interpret because survey respondents, especially individuals who are overweight or obese, often underreport dietary intake. Well-controlled studies suggest that the actual number of calories consumed may be higher than these estimates.

27. Adjusted for spoilage and other waste. ERS Food Availability (Per Capita) Data System. <http://www.ers.usda.gov/Data/FoodConsumption/>. Accessed August 12, 2010.

28. Milk and milk products also can be referred to as dairy products.

29. Stewart H, Blisard N, Jolliffe D. Let's eat out: Americans weigh taste, convenience, and nutrition. U.S. Department of Agriculture, Economic Research Service; 2006. Economic Information Bulletin No. 19. <http://www.ers.usda.gov/publications/eib19/eib19.pdf>.

30. Pleis JR, Lucas JW, Ward BW. Summary health statistics for U.S. adults: National Health Interview Survey, 2008. *Vital Health Stat.* 2009;10(242):1-157.

31. Troiano RP, Berrigan D, Dodd KW, Mâsse LC, Tilert T, McDowell M. Physical activity in the United States measured by accelerometer. *Med Sci Sports Exerc.* 2008;40(1):181-188.

**TABLE 2. Top 25 Sources of Calories Among Americans Ages 2 Years and Older, NHANES 2005-2006<sup>a</sup>**

Rank	Overall, Ages 2+ yrs (Mean kcal/d; Total daily calories = 2,157)	Children and Adolescents, Ages 2-18 yrs (Mean kcal/d; Total daily calories = 2,027)	Adults and Older Adults, Ages 19+ yrs (Mean kcal/d; Total daily calories = 2,199)
1	Grain-based desserts <sup>b</sup> (138 kcal)	Grain-based desserts (138 kcal)	Grain-based desserts (138 kcal)
2	Yeast breads <sup>c</sup> (129 kcal)	Pizza (136 kcal)	Yeast breads (134 kcal)
3	Chicken and chicken mixed dishes <sup>d</sup> (121 kcal)	Soda/energy/sports drinks (118 kcal)	Chicken and chicken mixed dishes (123 kcal)
4	Soda/energy/sports drinks <sup>e</sup> (114 kcal)	Yeast breads (114 kcal)	Soda/energy/sports drinks (112 kcal)
5	Pizza (98 kcal)	Chicken and chicken mixed dishes (113 kcal)	Alcoholic beverages (106 kcal)
6	Alcoholic beverages (82 kcal)	Pasta and pasta dishes (91 kcal)	Pizza (86 kcal)
7	Pasta and pasta dishes <sup>f</sup> (81 kcal)	Reduced fat milk (86 kcal)	Tortillas, burritos, tacos (85 kcal)
8	Tortillas, burritos, tacos <sup>g</sup> (80 kcal)	Dairy desserts (76 kcal)	Pasta and pasta dishes (78 kcal)
9	Beef and beef mixed dishes <sup>h</sup> (64 kcal)	Potato/corn/other chips (70 kcal)	Beef and beef mixed dishes (71 kcal)
10	Dairy desserts <sup>i</sup> (62 kcal)	Ready-to-eat cereals (65 kcal)	Dairy desserts (58 kcal)
11	Potato/corn/other chips (56 kcal)	Tortillas, burritos, tacos (63 kcal)	Burgers (53 kcal)
12	Burgers (53 kcal)	Whole milk (60 kcal)	Regular cheese (51 kcal)
13	Reduced fat milk (51 kcal)	Candy (56 kcal)	Potato/corn/other chips (51 kcal)
14	Regular cheese (49 kcal)	Fruit drinks (55 kcal)	Sausage, franks, bacon, and ribs (49 kcal)
15	Ready-to-eat cereals (49 kcal)	Burgers (55 kcal)	Nuts/seeds and nut/seed mixed dishes (47 kcal)
16	Sausage, franks, bacon, and ribs (49 kcal)	Fried white potatoes (52 kcal)	Fried white potatoes (46 kcal)
17	Fried white potatoes (48 kcal)	Sausage, franks, bacon, and ribs (47 kcal)	Ready-to-eat cereals (44 kcal)
18	Candy (47 kcal)	Regular cheese (43 kcal)	Candy (44 kcal)
19	Nuts/seeds and nut/seed mixed dishes <sup>j</sup> (42 kcal)	Beef and beef mixed dishes (43 kcal)	Eggs and egg mixed dishes (42 kcal)
20	Eggs and egg mixed dishes <sup>k</sup> (39 kcal)	100% fruit juice, not orange/grapefruit (35 kcal)	Rice and rice mixed dishes (41 kcal)
21	Rice and rice mixed dishes <sup>l</sup> (36 kcal)	Eggs and egg mixed dishes (30 kcal)	Reduced fat milk (39 kcal)
22	Fruit drinks <sup>m</sup> (36 kcal)	Pancakes, waffles, and French toast (29 kcal)	Quickbreads (36 kcal)
23	Whole milk (33 kcal)	Crackers (28 kcal)	Other fish and fish mixed dishes <sup>n</sup> (30 kcal)
24	Quickbreads <sup>o</sup> (32 kcal)	Nuts/seeds and nut/seed mixed dishes (27 kcal)	Fruit drinks (29 kcal)
25	Cold cuts (27 kcal)	Cold cuts (24 kcal)	Salad dressing (29 kcal)

a. Data are drawn from analyses of usual dietary intakes conducted by the National Cancer Institute. Foods and beverages consumed were divided into 97 categories and ranked according to calorie contribution to the diet. Table shows each food category and its mean calorie contribution for each age group. Additional information on calorie contribution by age, gender, and race/ethnicity is available at <http://riskfactor.cancer.gov/diet/foodsources/>.

b. Includes cake, cookies, pie, cobbler, sweet rolls, pastries, and donuts.

c. Includes white bread or rolls, mixed-grain bread, flavored bread, whole-wheat bread, and bagels.

d. Includes fried or baked chicken parts and chicken strips/patties, chicken stir-fries, chicken casseroles, chicken sandwiches, chicken salads, stewed chicken, and other chicken mixed dishes.

e. Sodas, energy drinks, sports drinks, and sweetened bottled water including vitamin water.

f. Includes macaroni and cheese, spaghetti, other pasta with or without sauces, filled pasta (e.g., lasagna and ravioli), and noodles.

g. Also includes nachos, quesadillas, and other Mexican mixed dishes.

h. Includes steak, meatloaf, beef with noodles, and beef stew.

i. Includes ice cream, frozen yogurt, sherbet, milk shakes, and pudding.

j. Includes peanut butter, peanuts, and mixed nuts.

k. Includes scrambled eggs, omelets, fried eggs, egg breakfast sandwiches/biscuits, boiled and poached eggs, egg salad, deviled eggs, quiche, and egg substitutes.

l. Includes white rice, Spanish rice, and fried rice.

m. Includes fruit-flavored drinks, fruit juice drinks, and fruit punch.

n. Includes muffins, biscuits, and cornbread.

o. Fish other than tuna or shrimp.

Source: National Cancer Institute. Food sources of energy among U.S. population, 2005-2006. Risk Factor Monitoring and Methods. Control and Population Sciences. National Cancer Institute; 2010. <http://riskfactor.cancer.gov/diet/foodsources/>. Updated May 21, 2010. Accessed May 21, 2010.

Table 2-2 provides the top sources of calories among Americans ages 2 years and older.<sup>32</sup> The table reveals some expected differences in intake between younger (ages 2 to 18 years) and adult (ages 19 years and older) Americans. For example, alcoholic beverages are a major calorie source for adults, while fluid milk provides a greater contribution to calorie intake for children and adolescents. Further, while not shown in the table,<sup>33</sup> there is additional variability in calorie sources among children, adolescents, and adults of different ages. For example, sugar-sweetened beverages<sup>34</sup> and pizza are greater calorie contributors for those ages 9 to 18 years than for younger children. Also, dairy desserts<sup>35</sup> and ready-to-eat cereals provide a greater contribution to calorie intake for those ages 71 years and older than they do among younger adults.

Although some of the top calorie sources by category are important sources of essential nutrients, others provide calories with few essential nutrients. Many of the foods and beverages most often consumed within these top categories are in forms high in solid fats and/or added sugars, thereby contributing excess

#### **FOR MORE INFORMATION**

See **Chapters 3, 4, and 5** for detailed discussions of solid fats and added sugars, additional information about the current dietary intake of Americans, and recommendations for improvement.

calories to the diet. For example, many grain-based desserts<sup>36</sup> are high in added sugars and solid fats, while many chicken dishes<sup>37</sup> are both breaded and fried, which adds a substantial number of calories to the chicken.

## **CALORIE BALANCE: FOOD AND BEVERAGE INTAKE**

Controlling calorie intake from foods and beverages is fundamental to achieving and attaining calorie balance. Understanding calorie needs, knowing food sources of calories, and recognizing associations between foods and beverages and higher or lower body weight are all important concepts when building an eating pattern that promotes calorie balance and weight management. Many Americans are

unaware of how many calories they need each day or the calorie content of foods and beverages.

### **Understanding calorie needs**

The total number of calories a person needs each day varies depending on a number of factors, including the person's age, gender, height, weight, and level of physical activity. In addition, a desire to lose, maintain, or gain weight affects how many calories should be consumed. Table 2-3 provides estimated total calorie needs for weight maintenance based on age, gender, and physical activity level. A more detailed table is provided in Appendix 6. Estimates range from 1,600 to 2,400 calories per day for adult women and 2,000 to 3,000 calories per day for adult men, depending on age and physical activity level. Within each age and gender category, the low end of the range is for sedentary individuals; the high end of the range is for active individuals. Due to reductions in basal metabolic rate that occurs with aging, calorie needs generally decrease for adults as they age. Estimated needs for young children range from 1,000 to 2,000 calories per day, and the range for older children and adolescents varies substantially from 1,400 to 3,200 calories per day, with boys generally having higher calorie needs than girls. These are only estimates, and estimation of individual calorie needs can be aided with online tools such as those available at MyPyramid.gov.

Knowing one's daily calorie needs may be a useful reference point for determining whether the calories that a person eats and drinks are appropriate in relation to the number of calories needed each day. The best way for people to assess whether they are eating the appropriate number of calories is to monitor body weight and adjust calorie intake and participation in physical activity based on changes in weight over time. A calorie deficit of 500 calories or more per day is a common initial goal for weight loss for adults. However, maintaining a smaller deficit can have a meaningful influence on body weight over time. The effect of a calorie deficit on weight does not depend on how the deficit is produced—by reducing calorie intake, increasing expenditure, or both. Yet, in research studies, a greater proportion of

32. Data are drawn from analyses of usual dietary intakes conducted by the National Cancer Institute. Source: National Cancer Institute. Food sources of energy among U.S. population, 2005-2006. Risk Factor Monitoring and Methods. Cancer Control and Population Sciences. 2010. <http://riskfactor.cancer.gov/diet/foodsources/>. Updated May 21, 2010. Accessed May 21, 2010.

33. Additional information on the top calorie contributors for various age groups, as well as by gender and race/ethnicity, are available at <http://riskfactor.cancer.gov/diet/foodsources/>.

34. Sodas, energy drinks, sports drinks, and sweetened bottled water including vitamin water.

35. Includes ice cream, frozen yogurt, sherbet, milk shakes, and pudding.

36. Includes cake, cookies, pie, cobbler, sweet rolls, pastries, and donuts.

37. Includes fried or baked chicken parts and chicken strips/patties, chicken stir-fries, chicken casseroles, chicken sandwiches, chicken salads, stewed chicken, and other chicken mixed dishes.

the calorie deficit is often due to decreasing calorie intake with a relatively smaller fraction due to increased physical activity.

### Carbohydrate, protein, fat, and alcohol

Carbohydrate, protein, and fat are the main sources of calories in the diet. Most foods and beverages contain combinations of these macronutrients in varying amounts. Alcohol also is a source of calories.

Carbohydrates provide 4 calories per gram and are the primary source of calories for most Americans. Carbohydrates are classified as simple, including sugars, or complex, including starches and fibers. Some sugars are found naturally in foods (such as lactose in

milk and fructose in fruit), whereas others are added to foods (such as table sugar added to coffee and high fructose corn syrup in sugar-sweetened beverages). Similarly, fiber can be naturally occurring in foods (such as in beans and whole grains) or added to foods. Most carbohydrate is consumed in the form of starches, which are found in foods such as grains, potatoes, and other starchy vegetables. A common source of starch in the American diet is refined grains. Starches also may be added to foods to thicken or stabilize them. Added sugars and added starches generally provide calories but few essential nutrients. Although most people consume an adequate amount of total carbohydrates, many people consume too much added sugar and refined grain and not enough fiber.

**TABLE 2-3. Estimated Calorie Needs per Day by Age, Gender, and Physical Activity Level<sup>a</sup>**

Estimated amounts of calories needed to maintain calorie balance for various gender and age groups at three different levels of physical activity. The estimates are rounded to the nearest 200 calories. An individual's calorie needs may be higher or lower than these average estimates.

Gender	Age (years)	Physical Activity Level <sup>b</sup>		
		Sedentary	Moderately Active	Active
<b>Child (female and male)</b>	2-3	1,000-1,200 <sup>c</sup>	1,000-1,400 <sup>c</sup>	1,000-1,400 <sup>c</sup>
<b>Female<sup>d</sup></b>	4-8	1,200-1,400	1,400-1,600	1,400-1,800
	9-13	1,400-1,600	1,600-2,000	1,800-2,200
	14-18	1,800	2,000	2,400
	19-30	1,800-2,000	2,000-2,200	2,400
	31-50	1,800	2,000	2,200
	51+	1,600	1,800	2,000-2,200
<b>Male</b>	4-8	1,200-1,400	1,400-1,600	1,600-2,000
	9-13	1,600-2,000	1,800-2,200	2,000-2,600
	14-18	2,000-2,400	2,400-2,800	2,800-3,200
	19-30	2,400-2,600	2,600-2,800	3,000
	31-50	2,200-2,400	2,400-2,600	2,800-3,000
	51+	2,000-2,200	2,200-2,400	2,400-2,800

a. Based on Estimated Energy Requirements (EER) equations, using reference heights (average) and reference weights (healthy) for each age/gender group. For children and adolescents, reference height and weight vary. For adults, the reference man is 5 feet 10 inches tall and weighs 154 pounds. The reference woman is 5 feet 4 inches tall and weighs 126 pounds. EER equations are from the Institute of Medicine. Dietary Reference Intakes for Energy, Carbohydrate, Fiber, Fat, Fatty Acids, Cholesterol, Protein, and Amino Acids. Washington (DC): The National Academies Press; 2002.

b. Sedentary means a lifestyle that includes only the light physical activity associated with typical day-to-day life. Moderately active means a lifestyle that includes physical activity equivalent to walking about 1.5 to 3 miles per day at 3 to 4 miles per hour, in addition to the light physical activity associated with typical day-to-day life. Active means a lifestyle that includes physical activity equivalent to walking more than 3 miles per day at 3 to 4 miles per hour, in addition to the light physical activity associated with typical day-to-day life.

c. The calorie ranges shown are to accommodate needs of different ages within the group. For children and adolescents, more calories are needed at older ages. For adults, fewer calories are needed at older ages.

d. Estimates for females do not include women who are pregnant or breastfeeding.

Protein also provides 4 calories per gram. In addition to calories, protein provides amino acids that assist in building and preserving body muscle and tissues. Protein is found in a wide variety of animal and plant foods. Animal-based protein foods include seafood, meat, poultry, eggs, and milk and milk products. Plant sources of protein include beans and peas, nuts, seeds, and soy products. Inadequate protein intake in the United States is rare.

Fats provide more calories per gram than any other calorie source—9 calories per gram. Types of fat include saturated, *trans*, monounsaturated, and polyunsaturated fatty acids. Some fat is found naturally in foods, and fat is often added to foods during preparation. Similar to protein, inadequate intake of total fat is not a common concern in the United States. Most Americans consume too much saturated and *trans* fatty acids and not enough unsaturated fatty acids.

Alcohol contributes 7 calories per gram, and the number of calories in an alcoholic beverage varies widely depending on the type of beverage consumed.

**FOR MORE INFORMATION**

See **Chapters 3 and 4** for additional discussion about the macronutrients and alcohol.

Alcoholic beverages are a source of calories but provide few nutrients. Alcohol is a top calorie contributor in the diets of many American adults.

*Does macronutrient proportion make a difference for body weight?*

The Institute of Medicine has established ranges for the percentage of calories in the diet that should come from carbohydrate, protein, and fat. These Acceptable Macronutrient Distribution Ranges (AMDR) take into account both chronic disease risk reduction and intake of essential nutrients (Table 2-4).

To manage body weight, Americans should consume a diet that has an appropriate total number of calories and that is within the AMDR. Strong evidence shows that there is no optimal proportion of macronutrients that can facilitate weight loss or assist with maintaining weight loss. Although diets with a wide range of macronutrient proportions have been documented to promote weight loss and prevent weight regain after loss, evidence shows that the critical issue is not the relative proportion of macronutrients in the diet, but whether or not the eating pattern is reduced in calories and the individual is able to maintain a reduced-calorie intake over time. The total number of calories consumed is the essential dietary factor relevant to body weight. In adults, moderate evidence suggests that diets that are less than 45 percent of total calories as carbohydrate or more than 35 percent of total calories as protein are generally no more effective than other calorie-controlled diets for long-term weight loss and weight maintenance. Therefore, individuals who wish to lose weight or maintain weight loss can select eating patterns that maintain appropriate calorie intake and have macronutrient proportions that are within the AMDR ranges recommended in the Dietary Reference Intakes.

**Individual foods and beverages and body weight**

For calorie balance, the focus should be on total calorie intake, but intake of some foods and beverages that are widely over- or underconsumed has been associated with effects on body weight. In studies that have held total calorie intake constant, there is little evidence that any individual food groups or beverages have a unique impact on body weight. Although total calorie intake is ultimately what affects calorie balance, some foods and beverages can be easily overconsumed, which results in a higher total calorie intake. As individuals vary a great deal in their dietary intake, the

**TABLE 2-4. Recommended Macronutrient Proportions by Age**

	<b>Carbohydrate</b>	<b>Protein</b>	<b>Fat</b>
Young children (1-3 years)	45-65%	5-20%	30-40%
Older children and adolescents (4-18 years)	45-65%	10-30%	25-35%
Adults (19 years and older)	45-65%	10-35%	20-35%

Source: Institute of Medicine. Dietary Reference Intakes for Energy, Carbohydrate, Fiber, Fat, Fatty Acids, Cholesterol, Protein, and Amino Acids. Washington (DC): The National Academies Press; 2002.



best advice is to monitor dietary intake and replace foods higher in calories with nutrient-dense foods and beverages relatively low in calories. The following guidance may help individuals control their total calorie intake and manage body weight:

- **Increase intake of whole grains, vegetables, and fruits:** Moderate evidence shows that adults who eat more whole grains, particularly those higher in dietary fiber, have a lower body weight compared to adults who eat fewer whole grains. Moderate evidence in adults and limited evidence in children and adolescents suggests that increased intake of vegetables and/or fruits may protect against weight gain.
- **Reduce intake of sugar-sweetened beverages:** This can be accomplished by drinking fewer sugar-sweetened beverages and/or consuming smaller portions. Strong evidence shows that children and adolescents who consume more sugar-sweetened beverages have higher body weight compared to those who drink less, and moderate evidence also supports this relationship in adults. Sugar-sweetened beverages provide excess calories and few essential nutrients to the diet and should only be consumed when nutrient needs have been met and without exceeding daily calorie limits.
- **Monitor intake of 100% fruit juice for children and adolescents, especially those who are overweight or obese:** For most children and adolescents, intake of 100% fruit juice is not associated with body weight. However, limited evidence suggests that increased intake of 100% juice has been associated with higher body weight in children and adolescents who are overweight or obese.
- **Monitor calorie intake from alcoholic beverages for adults:** Moderate evidence suggests that moderate drinking of alcoholic beverages<sup>38</sup> is not associated with weight gain. However, heavier than moderate consumption of alcohol over time is associated with weight gain. Because alcohol is often consumed in mixtures with other beverages, the calorie content of accompanying mixers should be considered when calculating the calorie content of alcoholic beverages. Reducing alcohol intake is a strategy that can be used by adults to consume fewer calories.

Strong evidence in adults and moderate evidence in children and adolescents demonstrates that consumption of milk and milk products does not play a special role in weight management. Evidence also

suggests that there is no independent relationship between the intake of meat and poultry or beans and peas, including soy, with body weight. Although not independently related to body weight, these foods are important sources of nutrients in healthy eating patterns.

**FOR MORE INFORMATION**  
See **Chapters 3 and 4**  
for recommendations for  
individual food groups and  
components.

### Placing individual food choices into an overall eating pattern

Because people consume a variety of foods and beverages throughout the day as meals and snacks, a growing body of research has begun to describe overall eating patterns that help promote calorie balance and weight management. One aspect of these patterns that has been researched is the concept of calorie density, or the amount of calories provided per unit of food weight. Foods high in water and/or dietary fiber typically have fewer calories per gram and are lower in calorie density, while foods higher in fat are generally higher in calorie density. A dietary pattern low in calorie density is characterized by a relatively high intake of vegetables, fruit, and dietary fiber and a relatively low intake of total fat, saturated fat, and added sugars. Strong evidence shows that eating patterns that are low in calorie density improve weight loss and weight maintenance, and also may be associated with a lower risk of type 2 diabetes in adults. The USDA Food Patterns and the DASH Eating Plan, described in Chapter 5, are examples of eating patterns that are low in calorie density.

Although total calories consumed is important for calorie balance and weight management, it is important to consider the nutrients and other healthful properties of food and beverages, as well as their calories, when selecting an eating pattern for optimal health. When choosing carbohydrates, Americans should emphasize naturally occurring carbohydrates, such as those found in whole grains, beans and peas, vegetables, and fruits, especially those high in dietary fiber, while limiting refined grains and intake of foods with added sugars. Glycemic index and glycemic load have been developed as measures of the effects of carbohydrate-containing foods and beverages on blood sugar levels. Strong evidence shows that glycemic index and/or glycemic load are not associated with body weight; thus, it is not necessary to consider

38. Moderate alcohol consumption is the consumption of up to one drink per day for women and up to two drinks per day for men.

these measures when selecting carbohydrate foods and beverages for weight management. For protein, plant-based sources and/or animal-based sources can be incorporated into a healthy eating pattern. However, some protein products, particularly some animal-based sources, are high in saturated fat, so non-fat, low-fat, or lean choices should be selected. Fat intake should emphasize monounsaturated and polyunsaturated fats, such as those found in seafood, nuts, seeds, and oils.

#### FOR MORE INFORMATION

See **Chapter 5** for additional discussion of eating patterns that meet nutrient needs within calorie limits.

Americans should move toward more healthful eating patterns. Overall, as long as foods and beverages consumed meet nutrient needs and calorie intake is

appropriate, individuals can select an eating pattern that they enjoy and can maintain over time. Individuals should consider the calories from *all* foods and beverages they consume, regardless of when and where they eat or drink.

### CALORIE BALANCE: PHYSICAL ACTIVITY

Physical activity is the other side of the calorie balance equation and should be considered when addressing weight management. In 2008, the U.S. Department of Health and Human Services released a comprehensive set of physical activity recommendations for Americans ages 6 years and older. Weight management along with health outcomes, including premature (early) death, diseases (such as coronary heart disease, type 2 diabetes, and osteoporosis), and risk factors for disease (such as high blood pressure and high blood cholesterol) were among the outcomes considered in developing the *2008 Physical Activity Guidelines for Americans*.<sup>39</sup> Getting adequate amounts of physical activity conveys many health benefits independent of body weight.

Strong evidence supports that regular participation in physical activity also helps people maintain a healthy weight and prevent excess weight gain. Further, physical activity, particularly when combined with reduced calorie intake, may aid weight loss and maintenance of weight loss. Decreasing time spent in sedentary behaviors also is important as well. Strong evidence shows that more screen time, particularly television viewing,

is associated with overweight and obesity in children, adolescents, and adults. Substituting active pursuits for sedentary time can help people manage their weight and provides other health benefits.

The *2008 Physical Activity Guidelines for Americans* provides guidance to help Americans improve their health, including weight management, through appropriate physical activity (see Table 2-5). The amount of physical activity necessary to successfully maintain a healthy body weight depends on calorie intake and varies considerably among adults, including older adults. To achieve and maintain a healthy body weight, adults should do the equivalent<sup>40</sup> of 150 minutes of moderate-intensity aerobic activity each week. If necessary, adults should increase their weekly minutes of aerobic physical activity gradually over time and decrease calorie intake to a point where they can achieve calorie balance and a healthy weight. Some adults will need a higher level of physical activity than others to achieve and maintain a healthy body weight. Some may need more than the equivalent of 300 minutes per week of moderate-intensity activity.

For children and adolescents ages 6 years and older, 60 minutes or more of physical activity per day is recommended. Although the Physical Activity Guidelines do not include a specific quantitative recommendation for children ages 2 to 5 years, young children should play actively several times each day. Children and adolescents are often active in short bursts of time rather than for sustained periods of time, and these short bursts can add up to meet physical activity needs. Physical activities for children and adolescents of all ages should be developmentally appropriate and enjoyable, and should offer variety.

### PRINCIPLES FOR PROMOTING CALORIE BALANCE AND WEIGHT MANAGEMENT

To address the current calorie imbalance in the United States, individuals are encouraged to become more conscious of what they eat and what they do. This means increasing awareness of what, when, why, and how much they eat, deliberately making better choices regarding what and how much they consume, and seeking ways to be more physically active. Several behaviors and practices have been shown to help people manage their food and beverage intake and calorie expenditure and ultimately manage body

39. U.S. Department of Health and Human Services. *2008 Physical Activity Guidelines for Americans*. Washington (DC): U.S. Department of Health and Human Services; 2008. Office of Disease Prevention and Health Promotion Publication No. U0036. <http://www.health.gov/paguidelines>. Accessed August 12, 2010.

40. One minute of vigorous-intensity physical activity counts as two minutes of moderate-intensity physical activity toward meeting the recommendations.

**TABLE 2-5. 2008 Physical Activity Guidelines**

Age group	Guidelines
<b>6 to 17 years</b>	<p>Children and adolescents should do 60 minutes (1 hour) or more of physical activity daily.</p> <ul style="list-style-type: none"> <li>▪ Aerobic: Most of the 60 or more minutes a day should be either moderate<sup>a</sup>- or vigorous<sup>b</sup>-intensity aerobic physical activity, and should include vigorous-intensity physical activity at least 3 days a week.</li> <li>▪ Muscle-strengthening:<sup>c</sup> As part of their 60 or more minutes of daily physical activity, children and adolescents should include muscle-strengthening physical activity on at least 3 days of the week.</li> <li>▪ Bone-strengthening:<sup>d</sup> As part of their 60 or more minutes of daily physical activity, children and adolescents should include bone-strengthening physical activity on at least 3 days of the week.</li> <li>▪ It is important to encourage young people to participate in physical activities that are appropriate for their age, that are enjoyable, and that offer variety.</li> </ul>
<b>18 to 64 years</b>	<ul style="list-style-type: none"> <li>▪ All adults should avoid inactivity. Some physical activity is better than none, and adults who participate in any amount of physical activity gain some health benefits.</li> <li>▪ For substantial health benefits, adults should do at least 150 minutes (2 hours and 30 minutes) a week of moderate-intensity, or 75 minutes (1 hour and 15 minutes) a week of vigorous-intensity aerobic physical activity, or an equivalent combination of moderate- and vigorous-intensity aerobic activity. Aerobic activity should be performed in episodes of at least 10 minutes, and preferably, it should be spread throughout the week.</li> <li>▪ For additional and more extensive health benefits, adults should increase their aerobic physical activity to 300 minutes (5 hours) a week of moderate-intensity, or 150 minutes a week of vigorous-intensity aerobic physical activity, or an equivalent combination of moderate- and vigorous-intensity activity. Additional health benefits are gained by engaging in physical activity beyond this amount.</li> <li>▪ Adults should also include muscle-strengthening activities that involve all major muscle groups on 2 or more days a week.</li> </ul>
<b>65 years and older</b>	<ul style="list-style-type: none"> <li>▪ Older adults should follow the adult guidelines. When older adults cannot meet the adult guidelines, they should be as physically active as their abilities and conditions will allow.</li> <li>▪ Older adults should do exercises that maintain or improve balance if they are at risk of falling.</li> <li>▪ Older adults should determine their level of effort for physical activity relative to their level of fitness.</li> <li>▪ Older adults with chronic conditions should understand whether and how their conditions affect their ability to do regular physical activity safely.</li> </ul>

a. Moderate-intensity physical activity: Aerobic activity that increases a person's heart rate and breathing to some extent. On a scale relative to a person's capacity, moderate-intensity activity is usually a 5 or 6 on a 0 to 10 scale. Brisk walking, dancing, swimming, or bicycling on a level terrain are examples.

b. Vigorous-intensity physical activity: Aerobic activity that greatly increases a person's heart rate and breathing. On a scale relative to a person's capacity, vigorous-intensity activity is usually a 7 or 8 on a 0 to 10 scale. Jogging, singles tennis, swimming continuous laps, or bicycling uphill are examples.

c. Muscle-strengthening activity: Physical activity, including exercise, that increases skeletal muscle strength, power, endurance, and mass. It includes strength training, resistance training, and muscular strength and endurance exercises.

d. Bone-strengthening activity: Physical activity that produces an impact or tension force on bones, which promotes bone growth and strength. Running, jumping rope, and lifting weights are examples.

Source: Adapted from U.S. Department of Health and Human Services. *2008 Physical Activity Guidelines for Americans*. Washington (DC): U.S. Department of Health and Human Services; 2008. ODPHP Publication No. U0036. <http://www.health.gov/paguidelines>. Accessed August 12, 2010.

weight. The behaviors with the strongest evidence related to body weight include:

- **Focus on the total number of calories consumed.** Maintaining a healthy eating pattern at an appropriate calorie level within the AMDR is advisable for weight management. Consuming an eating pattern low in calorie density may help to reduce calorie intake and improve body weight outcomes and overall health.

- **Monitor food intake.** Monitoring intake has been shown to help individuals become more aware of what and how much they eat and drink. The Nutrition Facts label found on food packaging provides calorie information for each serving of food or beverage and can assist consumers in monitoring their intake. Also, monitoring body weight and

#### FOR MORE INFORMATION

See **Appendix 4** for more information about the Nutrition Facts label.

physical activity can help prevent weight gain and improve outcomes when actively losing weight or maintaining body weight following weight loss.

- **When eating out, choose smaller portions or lower-calorie options.** When possible, order a small-sized option, share a meal, or take home part of the meal. Review the calorie content of foods and beverages offered and choose lower-calorie options. Calorie information may be available on menus, in a pamphlet, on food wrappers, or online. Or, instead of eating out, cook and eat more meals at home.

- **Prepare, serve, and consume smaller portions of foods and beverages, especially those high in calories.** Individuals eat and drink more when provided larger portions. Serving and consuming smaller portions is associated with weight loss and weight maintenance over time.

- **Eat a nutrient-dense breakfast.** Not eating breakfast has been associated with excess body weight, especially among children and adolescents. Consuming breakfast also has been associated with weight loss and weight loss maintenance, as well as improved nutrient intake.

- **Limit screen time.** In children, adolescents, and adults, screen time, especially television viewing, is directly associated with increased overweight and obesity. Children and adolescents are encouraged to spend no more than 1 to 2 hours each day watching television, playing electronic games, or using the computer (other than for homework). Also, avoid eating while watching television, which can result in overeating.

Research has investigated additional principles that may promote calorie balance and weight management. However, the evidence for these behaviors is not as strong. Some evidence indicates that beverages are less filling than solid foods, such that the calories from beverages may not be offset by reduced intake of solid foods, which can lead to higher total calorie intake. In contrast, soup, particularly broth or water-based soups, may lead to decreased calorie intake and body weight over time. Further, replacing added sugars with non-caloric sweeteners may reduce calorie intake in the short-term, yet questions remain about their effectiveness as a weight management strategy. Other behaviors have been studied, such as snacking and frequency of eating, but there is currently not enough evidence to support a specific recommendation for these behaviors to help manage body weight.

## IMPROVING PUBLIC HEALTH THROUGH DIET AND PHYSICAL ACTIVITY

This chapter has focused on the two main elements in calorie balance—calories consumed and calories expended. These elements are critical for achieving and maintaining an appropriate body weight throughout the lifespan, and they also have broader implications for the health of Americans.

Although obesity is related to many chronic health conditions, it is not the only lifestyle-related public health problem confronting the Nation. Eating patterns that are high in calories, but low in nutrients can leave a person overweight but malnourished. Nutritionally unbalanced diets can negatively affect a person's health regardless of weight status. Such diets are related to many of the most common and costly health problems in the United States, particularly heart disease and its risk factors and type 2 diabetes. Similarly, a sedentary lifestyle increases risk of these diseases. Improved eating patterns and increased physical activity have numerous health benefits beyond maintaining a healthy weight.

Improved nutrition, appropriate eating behaviors, and increased physical activity have tremendous potential to decrease the prevalence of overweight and obesity, enhance the public's health, reduce morbidity and premature mortality, and reduce health care costs.