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*Environmental Challenges and Assessment**

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Introduction

Several environmental changes, including advances in technology, research, and education, as well as economic improvements have brought about the near disappearance of many nutritional disorders such as pellagra, beriberi, scurvy, and rickets.[1] However, while these nutritional problems have declined, other nutritional disorders have increased. For example, the prevalence of overweight and obesity has increased from 43 to 54% of the U.S. population since 1980 (Figure 38.1).[2] Similar increases have occurred in Europe and other industrialized countries.[3]

In this section, the major environmental factors that have contributed to the rise in obesity are examined. In addition, methods of assessing environmental influences at the population and clinical levels are reviewed.

Etiology of Obesity

Obesity is the result of an energy imbalance in which intake exceeds expenditure. Both biological and behavioral factors play a role in the development of obesity.[4] Research over the past 15 years has underscored the importance of genetic factors.[5,6] However, it is unlikely that changes in the gene pool could account for the significant increase in obesity that has occurred since 1980 in both adults and children (Figures 38.1 and 38.2).[2,3,7-9] People of the same genetic makeup who move to industrialized cultures from less industrialized cultures have a corresponding increase in body weight, suggesting the importance of environmental factors in the development of obesity.[10]

Indeed, the environment of industrialized countries has been viewed as so severely promoting obesity that it has been labeled "toxic."[11,12] In order to combat this toxic environment, extreme measures have been proposed, including a tax on high-fat, low-nutrition foods.[13-15] Clearly, the environment of industrialized nations is obesity-promoting.[4,16,17] In

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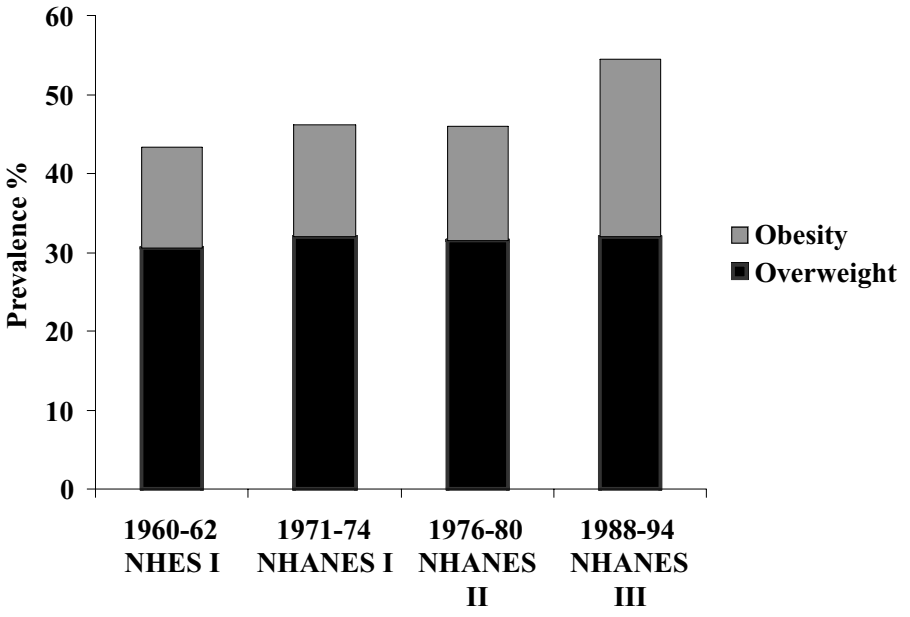


FIGURE 38.1
Prevalence of overweight (BMI ≥ 25–29.9 kg/m^2) and obesity (BMI ≥ 30 kg/m^2) in the U.S. from 1960 to 1994. NHES = National Health Examination Survey; NHANES = National Health and Nutrition Examination Survey. Flegal, K.M., et al., *Int. J. Obes. Relat. Metab. Disord.,* 22: 39; 1998, with permission.

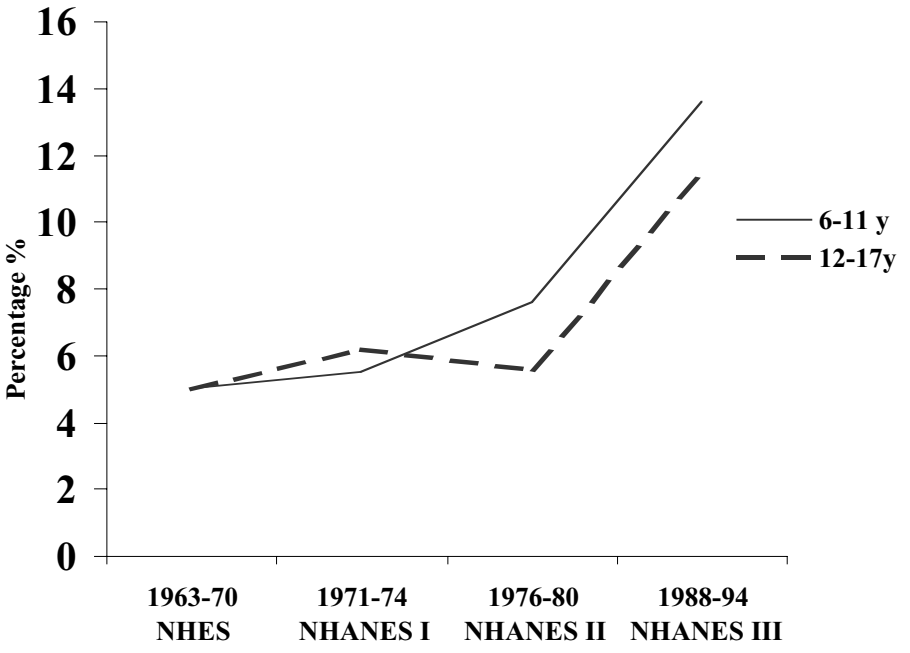


FIGURE 38.2
Prevalence of overweight and obesity (BMI ≥ 95th percentile) in children and adolescents in the U.S., 1963–1994. *Third Report on Nutrition Monitoring in the United States*, U.S. Government Printing Office, Washington, D.C., 1995, 1–51; Troiano, R.P. et al., *Arch. Pediatr. Adolesc. Med.,* 149: 1085; 1995.

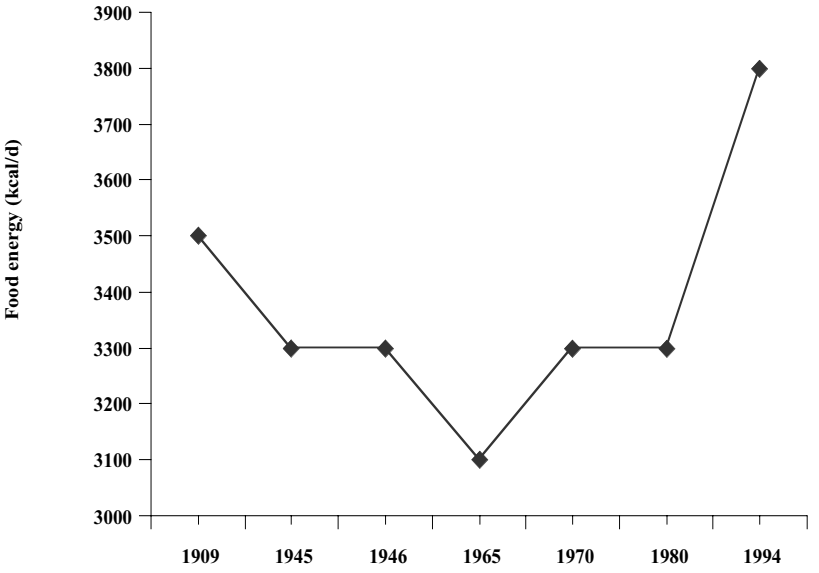


FIGURE 38.3
Food energy per capita per day in the U.S. USDA Center for Nutrition Policy and Promotion, Washington, D.C., 1996, 1–10.

order to better understand the environmental influences on obesity, both energy intake and expenditure must be examined.

Environmental Factors

Energy intake

Despite the increasing prevalence of obesity, U.S. data on food intake suggest only a slight increase or modest decline in energy intake over the past two to three decades.[18,19] Similarly, daily energy intake in England appears to have decreased.[20] However, the interpretation of these data is compromised given the consistent inaccuracy of self-reported food intake.[21-23]

Several other key indicators suggest that energy consumption may have increased. Data from the U.S. Department of Agriculture (USDA) indicate that the food supply has increased substantially over the past century and most significantly over the past few decades (Figure 38.3). Specifically, the amount of food available for consumption per capita per day has increased from 3300 kcalories in 1980 to 3800 kcalories in 1994.[24] Although these data do not measure energy consumption, other indicators, including increases in portion sizes and the widespread availability of high-fat, energy-dense foods, further suggest that increases in energy intake likely account, in part, for the rising prevalence of obesity.[25]

Larger Portions and Decreased Costs

Although little empirical data exist examining secular trends in portion sizes, the "supersizing" of America is ubiquitous. Whereas once only 8 oz servings of soft drinks were

TABLE 38.1

Typical vs. Recommended Serving Sizes

	Typical	USDA
Medium baked potato	7 oz	4 oz
Medium bagel	4 oz	2 oz
Medium muffin	6 oz	2 oz

USDA = United States Department of Agriculture

Young, L.R. and Nestle, M., *JADA,* 98: 458; 1998, with permission.

available, today 16, 32, and 64 oz drinks can be purchased at convenience stores and restaurants nationwide.[11] A McDonald's "medium" serving of French fries was re-classified to "small" in order to make room for a new supersized serving of French fries. In addition, recommended serving sizes are often much smaller than people's perceptions. For example, research participants selected a "medium" bagel that was twice the size of the recommended USDA serving, and chose a "medium" muffin that was three times the recommended serving size (Table 38.1).[26]

Consumption of larger portions is further enhanced by attractive size/quantity discounts. "Value meals" offering larger burgers, fries, and soft drinks for only a small increase in cost have continued to gain in popularity. Similarly, a 22 oz soft drink at a movie theatre costs $2.50 while a drink twice the size (i.e., 44 oz) costs only 50 cents more. In addition, marketing data suggest that supersizing and multiple unit pricing (i.e., "2 for $1.00" instead of "50 cents each") translate into greater food consumption.[11] In one study,[27] subjects poured themselves 20% more bottled water when it came in a two-liter container than when it came in a one-liter container. Interestingly, when the containers were labeled "tap water," participants poured the same amount from each container, suggesting that consumption is influenced by perceived cost/value. Other research has shown that reducing the price of health foods increases sales of these items.[28,29]

High-Fat, Energy-Dense Foods

Of all the nutrients, fat is the most energy dense, providing 9 kcalories per gram compared to 7 for alcohol and 4 for protein and carbohydrate. Since fat is the most energetically dense macronutrient, its consumption is likely to increase the risk of subsequent weight gain.[30-33]

Surprisingly, secular data on food consumption show that the percentage of kcalories from fat has actually declined steadily over the past 30 years in the U.S.[34] and Britain.[20] However, other indicators suggest that consumption of high-fat foods is on the rise. For example, the amount of fats and oils in the food supply has nearly doubled in the U.S. since 1909 (Figure 38.4).[24] In addition, the increased availability of high-fat, energy-dense food is observable in the proliferation of food courts, service station minimarts, fast food restaurants, and drive-through windows. Increasingly, fast food restaurants are found in schools and hospital cafeterias. McDonald's stated goal is to have no American more than four minutes from one of their restaurants. Furthermore, an estimated three new McDonald's restaurants are opened each day.[12]

Food retailers spend billions of dollars each year advertising high-fat, energy-dense foods that bring in the most profit.[17] Correspondingly, consumer purchases of high-fat foods are on the rise. The proportion of money spent at fast-food and other restaurants has risen from 26.9% in 1974 to 38.2% in 1994.[35] A recent study suggests that eating food away from home, controlling for multiple other factors, is associated with higher weights.[36] In addition, home purchases of high-fat, energy-dense foods have risen. Specifically, the

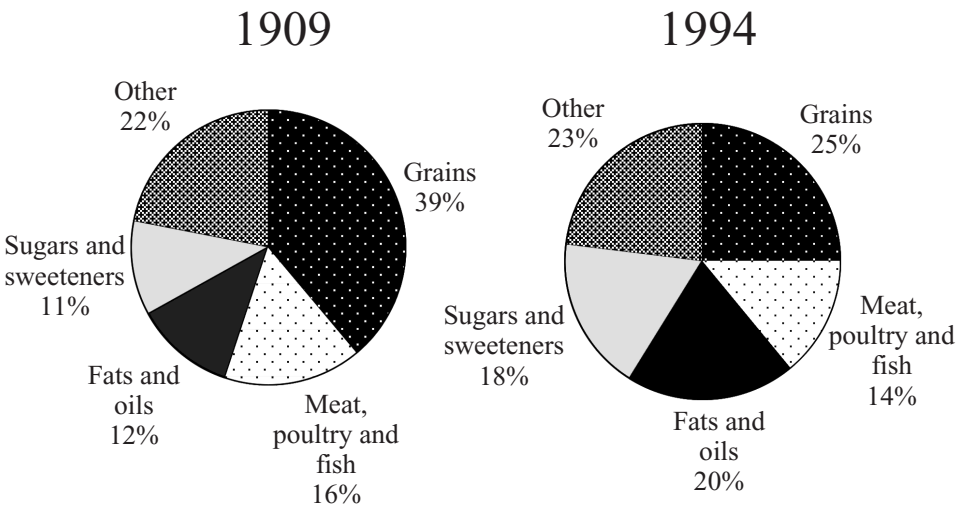


FIGURE 38.4
Sources of food energy in the U.S. food supply. USDA Center for Nutrition Policy and Promotion, Washington, D.C., 1996, 1–10.

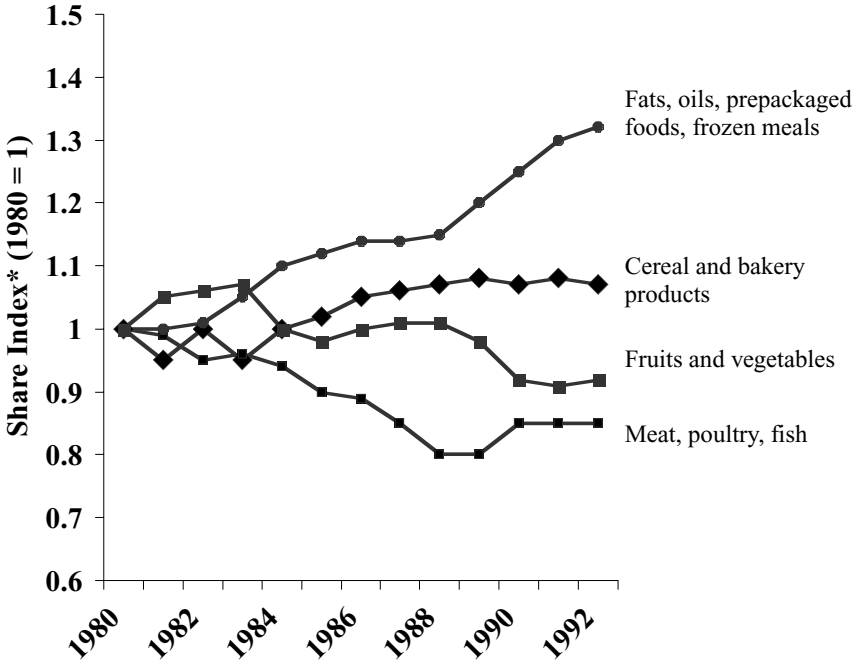


FIGURE 38.5
Relative changes in amount of home foods purchased, 1980 to 1992. U.S. Bureau of Labor Statistics, *Monthly Labor Review,* December: 3–32. * reflects food purchasing habits adjusted for price changes.

proportion of home food purchases of fats, oils, prepackaged foods, and frozen meals has increased more than any other category of food since the 1980s, even after controlling for changes in food prices.[37] The second largest increase was in cereal and bakery products, including cookies, cakes, and doughnuts (Figure 38.5). Interestingly, the percentage of Americans consuming low-fat products has also increased from 19% in 1978 to 76% in

1991.[38] The added sugars in low-fat foods and the belief that larger portions are more acceptable may offset any caloric benefit of consuming low-fat products.[39]

Summary

The available research, based principally on self-report, does not reveal significant increases in dietary intake over the past few decades. However, several indicators suggest that the environment has promoted increased energy intake. Two principal factors appear to be responsible: 1) increasing portion sizes; and, 2) accessibility to high-fat, energy-dense foods at affordable prices.

Energy Expenditure

Although about one-fourth of U.S. adults do not engage in any physical activity during their leisure time, there is little evidence that physical activity levels have changed significantly over the past decade (Figure 38.6).[40] Nonetheless, it is generally accepted that with the modernization of society, energy expenditure has decreased and is at least partly responsible for the increasing prevalence of obesity.[20,41,42] The decrease in energy expenditure is most likely due to changes in activities of daily living.[41] While data in the U.S. are lacking, evidence from Finland and Britain support that decreases in energy spent on activities of daily living and work have indeed occurred.[43]

Table 38.2 lists some of the ways time (and energy) is saved each day. While little data have documented trends in the use of such energy-saving devices, consumer purchases suggest a proliferation. Automobiles are clearly the preferred mode of travel over walking in both the U.S. (Figure 38.7)[44] and the United Kingdom.[45] Purchases of cable television and videocassette rentals have increased dramatically (Figure 38.8).[46] While longitudinal

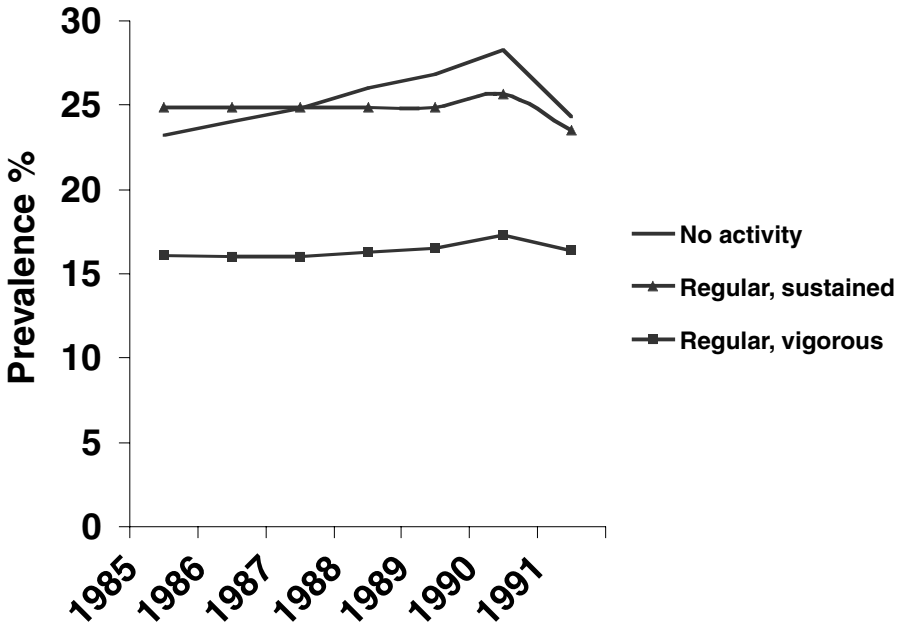
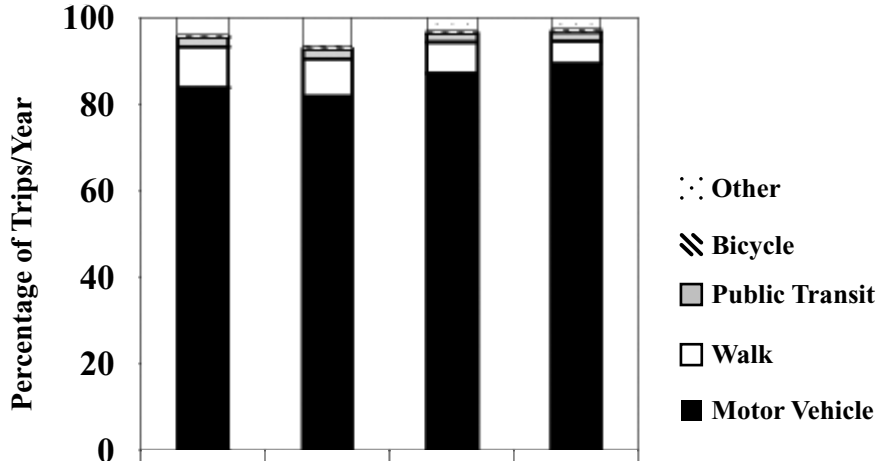


FIGURE 38.6
Trends in leisure-time physical activity of adults age 18+ years. U.S. Department of Health and Human Services, Washington, D.C., 1996, 88-50210, Government Printing Office.

TABLE 38.2

Energy Savers

Personal computers
Telecommuting
Cellular phones
E-mail/Internet
Shopping by phone
Food delivery services
Phone extensions
Dishwashers
Escalators/Elevators
Cable movies
Drive-thru windows
Computer games
Intercoms
Moving sidewalks
Remote controls
Garage door openers



	1977	1983	1990	1995
Other	3.8	6.5	3	2.4
Bicycle	0.6	0.8	0.7	0.9
Public Transit	2.4	2.2	2	1.8
Walk	9.3	8.5	7.2	5.5
Motor Vehicle	83.9	82	87.1	89.3

FIGURE 38.7

Mode of travel in the U.S. from 1977 to 1995. Pickrell, D., and Schimek, P., *Nationwide Personal Transportation Survey*, Dept. of Transportation, Washington, D.C., 1998.

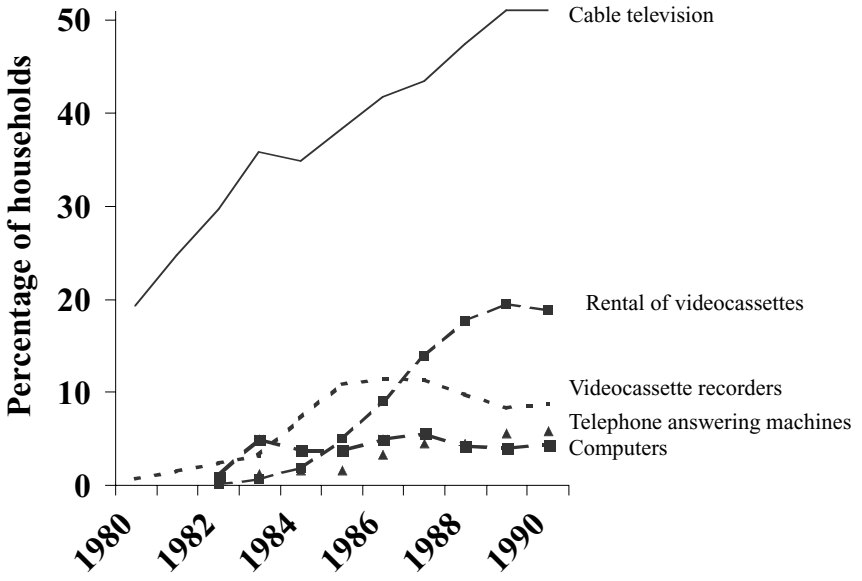


FIGURE 38.8
Percentage of households reporting expenditures, 1980 to 1990. U.S. Bureau of Labor Statistics, *Monthly Labor Review,* May 18–26, 1992.

data on television viewing in the U.S. are lacking, television viewing in England has increased from 13 hours per week in the 1960s to 26 hours per week today.[20] In the U.S., television viewing is strongly related to the increasing prevalence of obesity among children[47-49] and to the level of obesity in adults.[50,51] Research is needed from other countries and for other sedentary activities such as video watching and computer work.

Cultural and Social Factors

The increasing prevalence of overweight is also associated with cultural and social factors. The prevalence of obesity in the U.S. is greatest among non-Hispanic blacks and Mexican-American women (Figure 38.9).[8] This may reflect cultural values and beliefs that limit the motivation for weight control and effectiveness of weight control programs or specific behaviors such as lower levels of physical activity.[52,53] Recent research also suggests that metabolic factors play a role, including decreased energy expenditure among obese African-American women relative to Caucasian women.[54]

Obesity is also more common among low-income populations.[55] Low-income populations often experience differential access to health care services[56,57] due to cost barriers, unavailability of health insurance, and discrimination in health care.[58,59] Economic status may also impact families' nutritional patterns, level of concern about nutrition, and knowledge of foods to purchase and consume.[1,60,61]

Assessment of Environmental Challenges

A detailed review of measures of food intake and physical activity can be found in Sections 3 and 7 of this book and other comprehensive texts (e.g., St. Jeor, 1997[62]). Therefore, only a brief review of assessment tools will be provided here.

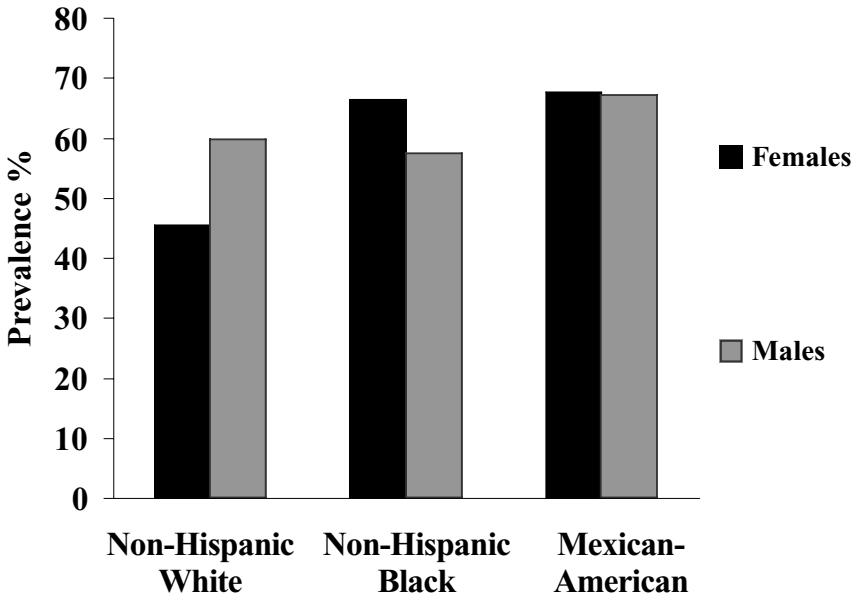


FIGURE 38.9
Prevalence of overweight (BMI ≥ 25 kg/m^2) in the U.S. by race-ethnic group for men and women age 20–74 years, 1998–1994. Flegal, K.M., et al., *Int. J. Obes. Relat. Metab. Disord.,* 22: 39; 1998, with permission.

Epidemiologic Assessment

Physical Activity

Although physical activity tends to be over-reported,[23,40] questionnaires are frequently used in epidemiologic studies to classify levels of physical activity.[63,64] Although several physical activity measures exist (e.g., diaries, retrospective histories), recall surveys appear to be the least likely to influence behavior and generally require the least amount of effort by respondents.[40,63] Among the most frequently used measures are the Physical Activity Recall (PAR)[65] and the Paffenbarger.[66] The PAR is available in interviewer- and self-administered versions[65] and categorizes activities by their intensity; the Paffenbarger is a one-page questionnaire that evaluates habitual daily and weekly activity. Measures of sedentary-promoting behaviors, such as television viewing and computer use, are only beginning to be utilized and validated. However, sedentary behavior can be simply assessed by the number of reported minutes per day spent in sedentary behaviors (e.g., watching television, using the computer, video games, and driving).

Food Intake

As noted earlier, food intake tends to be underreported, particularly in obese individuals.[22] Nonetheless, several methods of assessment exist to measure nutrient intake. The 24-hour recall has been used in many large-scale studies (e.g., the National Health and Nutrition Examination Surveys) to assess nutrient intake. The 24-hour recall is typically administered by trained interviewers. It takes about 20 minutes to complete, requires no record keeping on the part of respondents, and, unlike other measures (e.g., food diaries), does not cause subjects to alter their intake.[67] Alternatively, if assessment of subjects' average, long-term intake is needed (rather than a more precise measurement of short-term consumption), food frequency questionnaires (FFQ) are an appropriate alternative. FFQ (e.g.,

the Block[68]) assess the frequency and quantity of habitual consumption of food items listed on a questionnaire in reference to the past week or month. These are easy to administer and do not require trained interviewers.

Clinical Assessment

Physical Activity

The questionnaires reviewed above (i.e., PAR[65] and the Paffenbarger[66]) may also be useful in assessing physical activity in the clinical setting. Alternatively, a few simple questions may provide a practical and efficient means of assessing physical activity. These include: "How many minutes do you spend each week in planned physical activity?"; "Approximately how many city blocks do you walk each day?"; and "How many flights of stairs do you climb each day?" Television viewing, computer and video game use, and driving time may also be evaluated in the clinical setting by weekly number of minutes for each activity. Finally, pedometers, which provide a count of the total number of steps taken each day, can be very useful in monitoring changes in physical activity.

Food Intake

The most commonly used means to assess energy and nutrient intake in the clinical setting is the food record. Food records are patients' daily notations of the type, quantity, and calories of food and liquid consumed. Patients are instructed to record all meals, drinks, and snacks immediately after eating. Patients may also record the number of fat grams consumed, place of consumption, and minutes of television viewing per day. It should also be noted that food records are commonly used as an intervention tool.[69] If a less reactive and more immediate assessment of intake is required, FFQ or 24-hour recalls may be used. Restaurant eating can be assessed at the time of the clinic assessment with the question, "How many times per week, on average, do you eat at restaurants?".

Assessment Model

The ultimate challenge of environmental assessment is to integrate the multiple factors that influence obesity. As Figure 38.10 illustrates, food intake and physical activity may result from a combination of influences (e.g., large portion sizes, use of labor-saving devices) that interact with cultural and social factors to promote obesity. In this model, excess food intake may be due to larger portion sizes at restaurants, but other factors must also be considered. For example, cultural taste preferences and economic status may also influence restaurant selection. Although distinguishing among the several overlapping environmental influences can be difficult, an awareness of such interrelationships is critical for designing public health and clinical interventions aimed at decreasing the prevalence of obesity.

Summary and Conclusion

In summary, obesity is due to an imbalance of energy intake and expenditure. Both biological and behavioral factors are implicated. Several environmental changes have

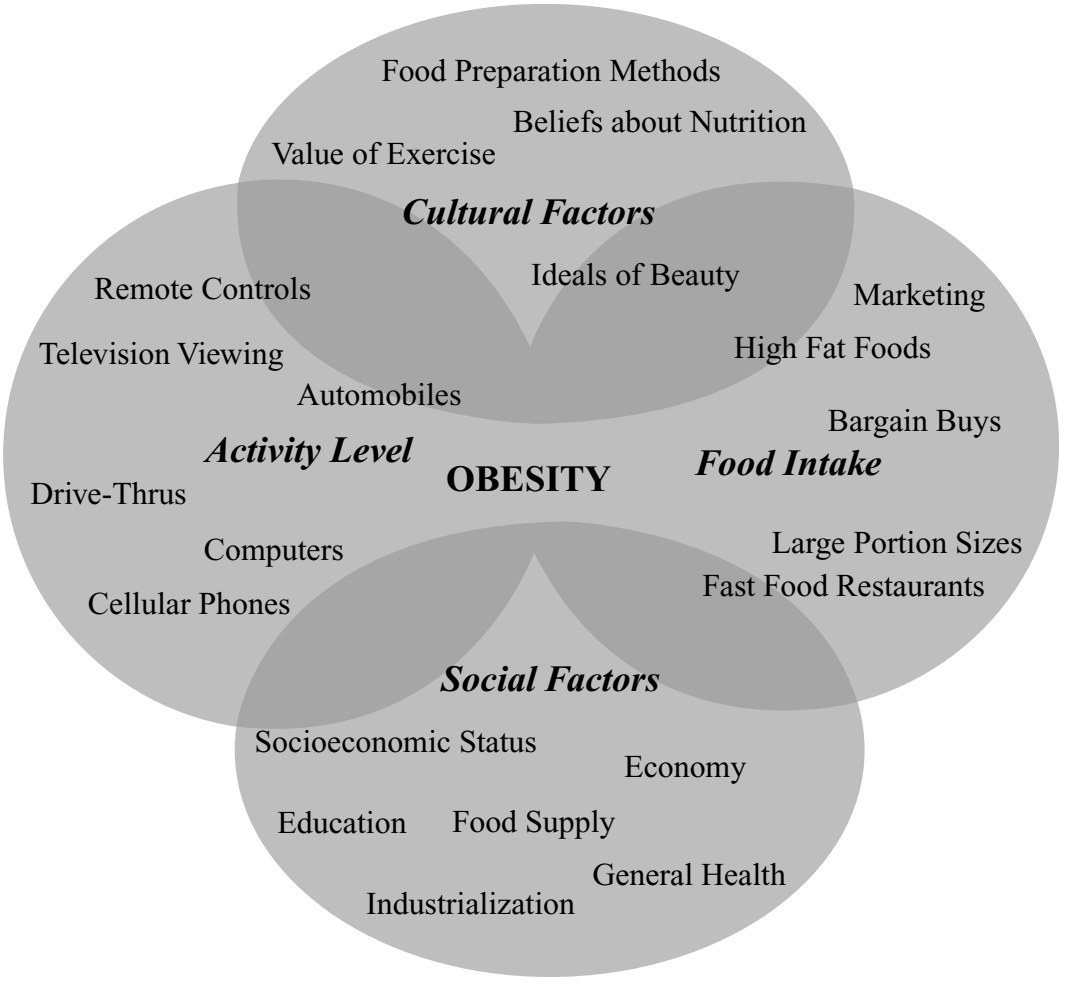


FIGURE 38.10
Environmental influences on obesity.

occurred over the past few decades that appear to contribute to the increase in obesity in industrialized nations. In particular, portion sizes are larger, and high-fat, energy-dense foods are heavily marketed and readily available at a low cost. In addition, the amount of energy expended in activities of daily living appears to have declined.

The problem of obesity may be instructive to understanding other nutrition-related disorders affected by environmental factors, including high cholesterol, hypertension, and osteoporosis. As in the case of obesity, it is likely that a combination of cultural, societal, and other environmental forces leads to the development of nutritional problems in the world today. Clearly, promoting healthy nutrition will require targeting multiple environmental components and encouraging a partnership among various sectors of society, including the government, food industry, and the media.[3]

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