

Mayo Clinic Proceedings

Editorial

The Public Health Problem of Increasing Prevalence Rates of Obesity and What Should Be Done About It

The prevalence of obesity has increased astonishingly in most countries of the world, with a prevalence rate in the United States of approximately 20% at the start of the 21st century.^{1,2} The increase in obesity is illustrated strikingly in Figure 1. Scientists and clinicians have given increasing attention to this issue and the consequences of this trend on the public's health and medical care costs in the future.³⁻⁵

The fundamental cause of weight gain is energy intake that persistently exceeds energy expenditure. The rapidly increasing prevalence of obesity indicates that a substantial number of individuals have been in positive energy balance. As the energy balance equation has only 2 components, the essential question is, "What is the cause of this positive energy balance?" Is it attributable to (1) an increase in energy intake, (2) a decrease in energy expenditure, or (3) a combination of both? Below we examine these 3 options.

Increase in Energy Intake

Two major sources of data can be used to address the question of whether average daily energy intake has increased in recent years—food disappearance balance sheets and individual dietary surveys.

Food Disappearance Balance Sheets.—Food disappearance data have been monitored by the US Department of Agriculture (USDA) for more than a century. (Information on national trends in food consumption can be found on the USDA Web site.⁶) Food disappearance is estimated from food inventories, domestic food production, food im-

ports and exports, and food used for nonhuman consumption. The assumption is that the food disappears because it is consumed, and it is thus possible to estimate per capita dietary patterns. The trend in energy intake inferred from food disappearance data suggests a decline in consumption in the United States during most of the 20th century, reaching the nadir about 1960 with an increase from then to the 1990s. However, we need to consider the limitations of the food balance sheet method. Food balance sheets represent the theoretical amount of per capita energy available for consumption without taking into consideration the differing physiological needs of different segments of the population. Also, use of the food balance sheet method limits accurate calculation of the amount of waste, especially for fat, a major source of ingested energy, that occurs at both the manufacturing and personal levels. These limitations most likely lead to overestimates of daily per capita energy intake, and this overestimation is likely to have increased over time because of changing practices, especially by consumers.

See also pages 114, 122, and 165.

Individual Dietary Surveys.—Survey data are available on individual dietary practices, including 24-hour dietary recalls or 3-day food records, from representative samples of the US population or from other cohorts. Sources of error for individual-level surveys include incomplete or inaccurate recall, deliberate underestimation by survey participants, and failure to include sufficient probes during the interview or other limitations of survey methods. Estimates of daily energy intake from 2 of the individual-level surveys conducted by the USDA are shown in Figure 2. The data for all adults reflect a numerical increase in energy intake from the 1977-1978 measurement interval to the 1994-1996 interval; however, the small changes are probably not significant. Further, there was no

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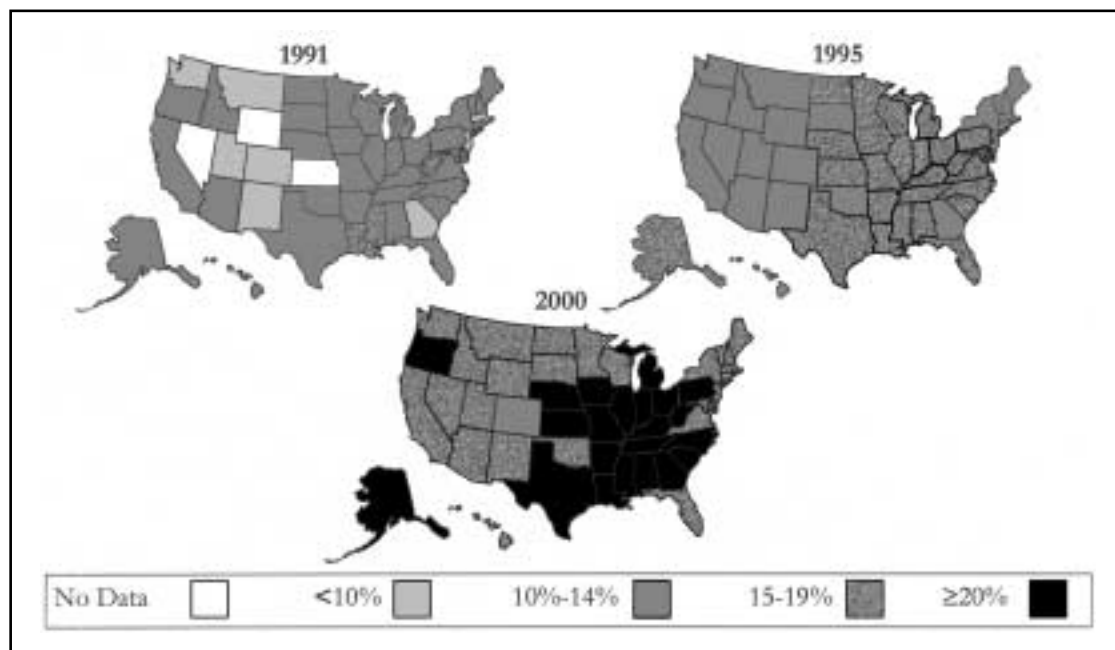


Figure 1. Obesity trends among US adults based on the Behavioral Risk Factor Surveillance Survey, 1991, 1995, and 2000. Obesity is defined as a body mass index of 30.0 kg/m² or higher. The data are taken from Mokdad et al.^{1,2}

change in food consumption in the subset of older women and men, even though the prevalence of obesity increased in older persons as well as in the overall population.⁹

Trends in dietary intake have been monitored in other cohorts as well. Three independent cross-sectional surveys were conducted in the Minneapolis-St Paul, Minn, metropolitan area from 1980 to 1992, with 24-hour dietary recalls used to estimate intake.¹⁰ During this period total energy intake did not change, although the macronutrient composition of the diet changed dramatically, with a reduction in energy from fat and an increase in carbohydrate intake. Despite no change in energy intake and an improved quality of diet, a significant increase in body mass index occurred for both women and men. In a similar study, Prentice and Jebb¹¹ reported that in England per capita energy intake actually decreased coincident with an increase in the prevalence of obesity.

Summary of Energy Intake Trends.—Questions about the available data on dietary intake over the past 25 years limit our certainty about whether US adults have increased their daily per capita energy intake. The evidence suggests that energy intake in the United States has not increased during the past 40 years, a period during which the prevalence of obesity has increased dramatically. Furthermore, if energy intake has really increased, the data are not sufficient to provide an accurate estimate of the magnitude of such an increase, and thus quantifying the extent to which possible changes in intake might account for the

increase in the prevalence of obesity is impossible. On the basis of the available evidence, we think that the recent increase in the prevalence of obesity is unlikely to be due to increases in daily energy intake.

Decrease in Energy Expenditure

Has the average per capita daily energy expenditure decreased during the period of increasing prevalence of obesity? Unfortunately, no data are available from representative population samples on average daily energy expenditure. Periodic surveys of self-reported physical activity habits of adults show that the prevalence of sedentary habits, defined as failure to report regular participation in some form of physical activity and the prevalence of participation in various sports and fitness activities, has been constant over the last 25 years of the 20th century.¹² However, these surveys did not include sufficient detail to estimate total energy expenditure (ie, energy expended not just for sports or fitness activities but for all life activities).

We believe that the average energy expenditure has probably declined, despite the fact that participation in sports and fitness activities appears to have remained constant. Clearly physical activity has decreased because of increasing mechanization on the job, labor-saving devices at home, and changing personal practices.^{13,14} Examples of how physical activity has been engineered out of daily life are illustrated in Table 1. These activities show alternative ways of accomplishing everyday tasks, a sedentary way

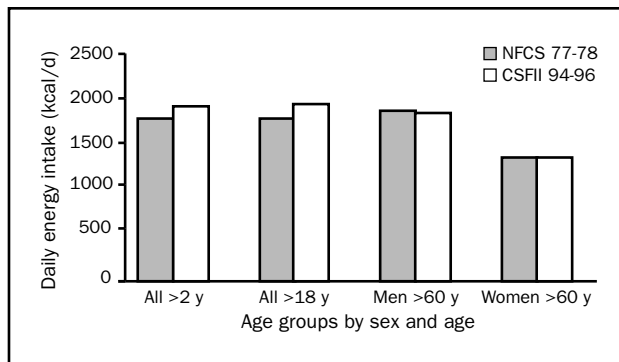


Figure 2. Average daily energy intake in the United States, estimated from the Nationwide Food Consumption Survey (NCFCS) in 1977-1978⁷ and the Continuing Survey of Food Intakes by Individuals (CSFII) in 1994-1996.⁸ Based on data derived from US Department of Agriculture Web site.⁶

and an active way. For the 20 activities listed in the table, a person who always chose the sedentary way would expend 1700 kcal over the course of a month and a person who always chose the active way would expend 10,500 kcal over the course of the month, for a difference of 8800 kcal. This difference in expenditure is the energy equivalent of 2½ pounds of body fat, which would equate to 30 pounds in a year. The point of this example is that there are dozens of similar examples for many ordinary activities. Although only a few kilocalories can be related to any specific sedentary activity compared with its active counterpart, the end result is a substantial weight change over time. The positive energy balance leading to the weight gain can occur even in the face of stable or decreasing energy intake and certainly in the instance of higher energy intake. These examples are hypothetical, and as stated above, we do not know what has happened to energy expenditure trends over the past few decades. However, it is reasonable to assume that many of us are becoming increasingly more sedentary.

Chakravarthy et al,¹⁶ in this issue of the *Proceedings*, present a compelling case for the importance of physical inactivity as a cause of many chronic health conditions. Human beings did not evolve to live in an environment where food is available everywhere at low cost and where physical activity has been engineered out of daily life. Regardless of the specific contributions of inactivity to the prevalence of obesity, physicians should aggressively promote activity to their patients. The benefits of activity go well beyond the effect on weight control or on other conventional risk factors for chronic health conditions. We find that a fit and active way of live reduces mortality risk in virtually all subgroups—the middle-aged and the elderly, women and men, the fat and the thin, and those with hypertension and those with normal blood pressure.¹⁷⁻²⁰

Summary of Energy Balance Data and Obesity

Other investigators have evaluated both diet and physical activity as predictors of weight change.²¹⁻²⁴ In general, changes in dietary measures fail to predict weight change, but changes in various measures of physical activity are significant predictors. Numerous investigators have reported that changes in physical activity²⁵⁻²⁷ or cardiorespiratory fitness^{28,29} are predictors of weight change. All these studies show that regular participation in physical activity or increases in activity are associated with low weight gain or actual weight loss over time. Improvement in cardiorespiratory fitness is a particularly strong predictor of weight loss in these studies. Another important point is that regular physical activity may be especially important for weight control for those with a genetic predisposition for weight gain³⁰ or those eating a high-fat diet.³¹

Although the available data have limitations, we believe that the evidence suggests that declines in physical activity are more likely than increases in energy intake as the explanation for the recent increase in obesity prevalence.

Strategies for Dealing With the Increasing Prevalence of Obesity

Effective strategies for dealing with the increasing prevalence of obesity depend on a better understanding of the causes. If the causes of the national obesity epidemic were related primarily to increases in energy intake, the appropriate strategy would focus on efforts to get individuals to reduce their energy intake. Conversely, if the causes were attributable primarily to low energy expenditure, a different set of strategies would be required. Given the lack of adequate data to evaluate the options presented here, improved surveillance of both energy intake and energy expenditure will identify more precisely their relative contributions to the development of obesity. However, regardless of the specific contributions of energy intake and energy expenditure to the development of obesity, intervention strategies emphasizing both a healthful diet and regular physical activity are indicated.^{32,33} Current guidelines present a clear consensus of what the content of these interventions should be. A plant-based diet with no more than 30% of energy from fat clearly provides important health benefits and will likely reduce the risk of unhealthy weight gain.^{33,34} Likewise, at least 30 minutes of moderate-intensity physical activity over the course of most (preferably all) days of the week will lead to improved health and function and should aid in weight maintenance, although the precise amount of activity necessary to prevent unhealthy weight gain is still unknown.^{12,35-37}

Unfortunately, as shown in 3 articles in this issue of the *Proceedings*,^{16,38,39} most adults do not follow the consensus public health recommendations for a healthful diet and

Table 1. Examples of Sedentary and Active Energy Expenditures for Common Activities*

Sedentary	kcal	Active	kcal
Using remote control device to change television channel	<1	Getting up and changing channel	3
Reclining for 30 min of phone calls	4	Standing for 3 10-min phone calls	20
Using garage door opener	<1	Raising garage door 2×/d	2-3
Hiring someone to clean and iron	0	Ironing and vacuuming each for 30 min	152
Waiting 30 min for pizza delivery	15	Cooking for 30 min	25
Buying presliced vegetables	0	Washing, slicing, chopping vegetables for 15 min	10-13
Using a leaf blower for 30 min	100	Raking leaves for 30 min	150
Using a lawn service	0	Gardening and mowing each for 30 min/wk	360
Using car wash 1×/mo	18	Washing and waxing car, 1 h/mo	300
Letting dog out the back door	2	Walking dog for 30 min	125
Driving 40 min, walking 5 min (parking)	22	Walking 15 min to bus stop 2×/d	60
Sending e-mail to colleague, 4 min	2-3	Walking 1 min, talking (standing) 3 min	6
Taking elevator up 3 flights	0.3	Walking up 3 flights	15
Parking as close as possible, 10-s walk	0.3	Parking in 1st spot, walking 2 min, 5×/wk	8
Letting cashier unload shopping cart	2	Unloading full shopping cart	6
Riding escalator 3×	2	Climbing 1 flight of stairs, 3×/wk in mall	15
Shopping online 1 h	30	Shopping at mall, walking 1 h	145-240
Sitting in car at drive-in window, 30 min	15	Parking and walking inside, 3×/wk, total of 30 min	70
Paying at the pump	0.6	Walking into station to pay, 1×/wk	5
Sitting and listening to lecture, 60 min	30	Giving lecture	70

*Data for this table were adapted from Beil.¹⁵

regular physical activity. Intervention studies in recent years show that it is possible to help sedentary individuals become and stay more physically active and to make diet-related behavioral changes leading to weight loss.⁴⁰⁻⁴² However, our increasingly toxic environment for adopting and maintaining these health behaviors makes it difficult for many individuals to meet current recommendations.⁴³⁻⁴⁶ In addition to counseling and advice from health professionals, public health interventions, and the individual actions by more people, we need to consider legislative and policy initiatives that will make it easier for more persons to lead healthful lifestyles.

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