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## Why People Become Overweight

*(This article was first printed in the Special Health Report from Harvard Medical School "Weigh Less, Live Longer, to order, visit [www.health.harvard.edu/WL](http://www.health.harvard.edu/WL).)*

Everyone knows some people who can eat ice cream, cake, and whatever else they want and still not gain weight. How come? Why? What allows one person to remain thin without effort but demands that another has lost previously?

On a very simple level, your weight depends on the number of calories you consume, how many of those calories are influenced by a combination of genes and environment. Both can affect your physiology (such as how fast you choose to eat, for instance). The interplay between all these factors begins at the moment of your conception.

### The calorie equation

The balance of calories stored and burned depends on your genetic makeup, your level of physical activity, and your resting energy expenditure (the number of calories your body burns while at rest). If you consistently burn all of the calories that you consume in the course of a day, you will maintain your weight. If you consume more energy (calories) than you expend, you will gain weight.

Excess calories are stored throughout your body as fat. Your body stores this fat within specialized fat cells (adipose tissue) — either by enlarging fat cells, which are always present in the body, or by creating more of them. If you decrease your food intake and consume fewer calories than you burn up, or if you exercise more and burn up more calories, your body will reduce some of your fat stores. When this happens, fat cells shrink, along with your waistline.

### Genetic influences

To date, more than 400 different genes have been implicated in the development of overweight or obesity, all of which influence in many ways, by affecting appetite, satiety (the sense of fullness), metabolism, food cravings, and mood with stress.

A 2006 report in *Science* that studied more than 900 people showed that those who have two copies of a specific BMI higher than 30. Researchers believe the gene variant affects the regulation of another gene involved in fat metabolism (including people with Western European ancestry, African Americans, and children), they found that about 1

In another 2006 study, published in the *Proceedings of the National Academy of Sciences*, researchers studied people who were normal weight, overweight, or obese. They took fat samples from around the participants' midriffs (known as gene expression) in the different samples. In overweight people, increased expression of several genes and related studies have helped researchers better understand how and why obesity occurs. They mi

The strength of the genetic influence on weight disorders varies quite a bit from person to person. Research shows a predisposition to be overweight, while for others the genetic influence is as high as 70% to 80%. Having a predisposition in terms of treating your weight problems.

### How much of your weight depends on your genes?

Genes are probably a significant contributor to your obesity if you have most or all of the following characteristics:

- You have been overweight for much of your life.
- One or both of your parents or several other blood relatives are significantly overweight. If both of your parents have obesity, your likelihood of developing obesity is as high as 80%.
- You can't lose weight even when you increase your physical activity and stick to a low-calorie diet for many months.

Genes are probably a lower contributor to you if you have most or all of the following characteristics:

- You are strongly influenced by the availability of food.
- You are moderately overweight, but you can lose weight when you follow a reasonable diet and exercise program.
- You regain lost weight during the holiday season, after changing your eating or exercise habits, or at times when you experience psychological or social problems.

These circumstances suggest that you have a genetic predisposition to be heavy, but it's not so great that you can't overcome it with some effort.

At the other end of the spectrum, you can assume that your genetic predisposition to obesity is modest if your weight is normal and doesn't increase even when you regularly indulge in high-calorie foods and rarely exercise.

People with only a moderate genetic predisposition to be overweight have a good chance of losing weight or exercising more often. These people are more likely to be able to maintain this lower weight.

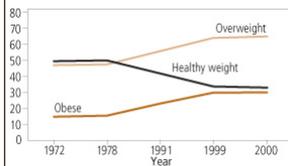
### What are thrifty genes?

When the prey escaped or the crops failed, how did our ancestors survive? Those who could store body fat to live off during the lean times lived, and those who couldn't, perished. This evolutionary adaptation explains why most modern humans — about 85% of us — carry so-called thrifty genes, which help us conserve energy and store fat. Today, of course, these thrifty genes are a curse rather than a blessing. Not only is food readily available to us nearly around the clock, we don't even have to hunt or harvest it!

In contrast, people with a strong genetic predisposition to obesity may not be able to lose weight with the usual diet and exercise. For people with a very strong genetic predisposition, sheer willpower typically, these people can maintain weight loss only under a doctor's guidance. They are also the most likely to gain weight back.

The prevalence of obesity among adults in the United States has been rising since the 1970s (see Figure 1). The genetic predisposition to be overweight varies widely from person to person, the rise in body mass index among adults. These findings underscore the importance of changes in our environment that contribute to the epidemic of obesity.

**Figure 1: Trends in adult weight**



Percent of adults ages 20–74\* who were at a healthy weight, overweight, or obese†  
\*Data are age-adjusted to the 2000 U.S. standard population.

†Healthy weight, body mass index (BMI) = 18.5–24; overweight, BMI = 25–29; obese, BMI ≥30.

Sources: National Health and Nutrition Examination Survey (National Center for Health Statistics); *Cancer* (2005).

## Environmental influences

Genetic factors are the forces inside you that help you gain weight and stay overweight; environmental factors encompass anything in our environment that makes us more likely to eat too much or exercise too little. Take force for the dramatic increase in obesity.

Environmental influences come into play very early, even before you're born. Researchers sometimes call them "in utero" influences. Babies whose mothers smoked during pregnancy are more likely to become overweight than those whose mothers didn't smoke. Researchers believe these conditions may somehow alter the growing baby's metabolism in ways that show up later in life.

After birth, babies who are breast-fed for more than three months are less likely to have obesity as adolescents.

Childhood habits often stick with people for the rest of their lives. Kids who drink sugary sodas and eat high-fat, high-calorie foods continue eating them as adults, which tends to promote weight gain. Likewise, kids who watch television and play video games tend to be sedentary as adults.

Many features of modern life promote weight gain. In short, today's "obesogenic" environment encourages a sedentary lifestyle and a diet of high-calorie, high-fat, and high-sugar foods. Broader aspects of the way we live — such as how much we sleep, our stress levels, and other psychological factors — also contribute to weight gain.

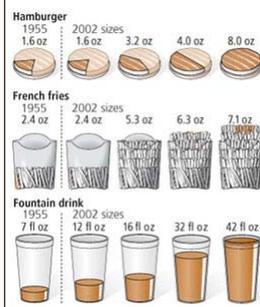
## The food factor

According to the Centers for Disease Control and Prevention (CDC), Americans are eating more calories on average than ever before. The average man added 168 calories to his daily fare, while the average woman added 335 calories a day. What's driving this increase? Availability, bigger portions, and more high-calorie foods.

Practically everywhere we go — shopping centers, sports stadiums, movie theaters — food is readily available. Convenience stores, even gyms and health clubs. Americans are spending far more on foods eaten out of the home than ever before. By 2006, that percentage had risen to 46%.

In the 1950s, fast-food restaurants offered one portion size. Today, portion sizes have ballooned (see Figure 2) and are now a major factor in the increase in obesity. A typical serving of French fries from McDonald's contains three times as many calories as a typical serving of French fries from the 1950s. A typical "meal" may contain 1,500–2,000 calories — all the calories that most people need for an entire day. And even if they're already full.

**Figure 2: Portion inflation**



Portion sizes for foods commonly consumed outside the home have increased over the years, and many people are eating more calories than ever before. Consider a typical fast-food meal that consists of a hamburger, French fries, and a soda. In 1955, a typical meal contained about 400 calories. Today, a typical meal contains about 1,000 calories. The chart above shows how all these portions compare, adjusting for size inflation over time.

Based on data from the *Journal of the American Dietetic Association*, February 2003, pp. 231–34.

Not surprisingly, we're also eating more high-calorie foods (especially salty snacks, soft drinks, and pizza), and we're eating less of the low-calorie foods (vegetables, fruits, and whole grains). Fat isn't necessarily the problem; in fact, research shows that the fat content of our diets is actually decreasing. The problem is that many of our foods are very high in calories because they contain large amounts of sugar to improve their taste and palatability. These foods are not low fat.

In one year, the average American adult eats 40 pounds of white bread, 41 pounds of potatoes, 30 pounds of wheat, and washes it all down with 52 gallons of soda. True, vegetable consumption has risen by about 12% since 1955 (including chips, fries, and mashed potato), iceberg lettuce, and other low-nutrient choices. In all, the Department of Agriculture reports that food consumption rose by 8%, or about 140 pounds per person per year, and the food industry spends \$30 billion a year to be sure it does not go to waste. It works: In just three decades.

## The exercise equation

The government's current recommendations for exercise call for an hour of moderate to vigorous exercise a day. In the late 1980s, more people were exercising than in the late 1980s. According to a 2004 CDC report, the percentage of people who exercised (including walking, golfing, or gardening) dropped from a high of 32% in 1989 to 25% in 2002.

Our daily lives don't offer many opportunities for activity. Children don't exercise as much in school, often because they have to sit at a computer terminal. Because we work long hours, we have trouble finding time to exercise. The widespread use of vacuum cleaners, dishwashers, leaf blowers, and a host of other appliances has also reduced our physical activity.

Instead of walking to local shops and toting shopping bags, we drive to one-stop megastores, where we park and drive home. The widespread use of vacuum cleaners, dishwashers, leaf blowers, and a host of other appliances has also reduced our physical activity.

## The trouble with TV: Sedentary snacking

The average American watches about four hours of television per day, a habit that's been linked to overweight or obesity in a number of studies. Data from the National Health and Nutrition Examination Survey, a long-term study monitoring the health of American adults, revealed that people who are overweight and obese spend more time watching television and playing video games than people of normal weight. Watching television more than two hours a day also raises the risk of overweight in children, even in those as young as three years old.

Part of the problem may be that people are watching television instead of exercising or doing other activities that burn more calories (watching TV burns only slightly more calories than sleeping, and less than other sedentary pursuits such as sewing or reading). But food advertisements also may play a significant role. The average hour-long TV show features about 11 food and beverage commercials, which encourage people to eat. And studies show that eating food in front of the TV stimulates people to eat more calories, and particularly more calories from fat. In fact, a study that limited the amount of TV kids watched demonstrated that this practice helped them lose weight — but not because they became more active when they weren't watching TV. The difference was that the children ate more.

snacks when they were watching television than when doing other activities, even sedentary ones.

## Stress and related issues

Obesity experts now believe that a number of different aspects of American society may conspire to promote obesity. For example, these days it's commonplace to work long hours and take shorter or less frequent vacations. In addition, for families to shop, prepare, and eat healthy foods together. Round-the-clock TV news means we hear more about stress; it also makes parents more reluctant to allow children to ride their bikes or do other structured activities, which means less activity for the kids and more stress for parents. Time pressures — whether it's to eat on the run and to sacrifice sleep, both of which can contribute to weight gain.

Some researchers also think that the very act of eating irregularly and on the run may contribute to obesity. The body's internal pacemaker that controls numerous other daily rhythms in our bodies — may also help to regulate hunger and satiety. They should prompt us to eat when our body fat falls below a certain level or when we need more body fat (i.e., when we are hungry and should eat). Close connections between the brain's pacemaker and the appetite control system are affected by temporal cues. Irregular eating patterns may disrupt the effectiveness of these cues in a way that contributes to weight gain.

Similarly, research shows that the less you sleep, the more likely you are to gain weight. Lack of sufficient sleep. A 2004 study of more than 1,000 volunteers, researchers found that people who slept less than eight hours a night were more likely to gain weight than people who slept the fewest hours weighed the most.

Stress and lack of sleep are closely connected to psychological well-being, which can also affect diet and appetite. Feeling anxious or sad can attest. Studies have demonstrated that some people eat more when affected by stress and obesity themselves can promote emotional disorders: If you repeatedly try to lose weight and fail, or if you experience tremendous frustration over time, which can cause or worsen anxiety and depression. A cycle of increasingly severe emotional difficulties.

### A widespread problem



Sixty percent of adults in the U.S. are overweight



One-third of Americans are overweight

## Other causes of obesity

Clearly, our responses to today's obesity-promoting environment, in tandem with genetic influences, are the primary causes. However, drug side effects, illnesses, and genetic disorders can also play a role.

### Drug side effects

Several prescription drugs can cause weight gain as a side effect by increasing appetite or slowing metabolism. These include: corticosteroids (used to reduce inflammation); estrogen and progesterone (used in oral contraceptives); anti-cancer medications; and drugs such as olanzapine (Zyprexa), haloperidol (Haldol), lithium (Eskalith, Lithobid), and others.

Paradoxically, weight gain can also be a side effect of some drugs used to treat conditions that result from other causes. For example, these are treatments for diabetes, which is common among people with weight disorders. Several tricyclic antidepressants such as imipramine (Tofranil) or desipramine (Norpramin, Pertofrane), monoamine oxidase inhibitors (MAOIs) such as phenelzine (Nardil), and selective serotonin reuptake inhibitors (SSRIs) such as paroxetine (Paxil), citalopram (Celexa), escitalopram (Lexapro), sertraline (Zoloft), fluvoxamine (Luvox), and others.

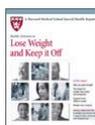
When used to treat depression, SSRIs may cause weight loss initially, but within six months of treatment the weight gain often returns. Sibutramine (Meridia), another drug that stimulates serotonin (like the SSRIs), is an appetite suppressant. SSRIs such as Prozac actually cause weight loss, making them useful as a therapy for weight disorders. The connection between weight regulation and serotonin (a key chemical communicator in the brain and elsewhere in the body) is still being studied.

### Illnesses that affect weight

A few illnesses that are characterized by an imbalance or an abnormality in your endocrine glands can also affect weight. These include: hypothyroidism, polycystic ovarian syndrome, and certain unusual tumors of the pituitary gland, adrenal glands, or thyroid. Most are extremely rare. Hypothyroidism, which is the most common, is a condition in which the thyroid gland does not produce enough thyroid hormone, while medically necessary, does not usually cause a significant weight reduction.

### Genetic disorders

Obesity is also a symptom of some rare and complex disorders caused by genetic defects. These disorders often have additional medical problems. One such disorder is Prader-Willi syndrome, a form of obesity associated with a deletion of a portion of chromosome 15. People with this disorder are unusually hungry and prone to binge eating. Bardet-Biedl syndrome, is similar to Prader-Willi syndrome, but is caused by abnormalities in different genes and accounts for only a tiny fraction of all weight disorders.



### Weigh Less, Live Longer: Strategies for Successful Weight Loss

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