

Introduction

A stable weight depends on a balance between the energy you get from food and the energy you use. You use energy during the day in three ways:

- Energy expended during rest (basal metabolism)
- Energy used to break down food (thermogenesis)
- Energy used during physical activity

Basal metabolism accounts for about two-thirds of spent energy. Your body generally uses this energy to keep your temperature steady and the muscles of your heart and intestine working. Thermogenesis accounts for about 10% of spent energy.

When a person consumes more calories than the energy they use, the body stores the extra calories in fat cells. Fat cells function as energy reservoirs. They grow or shrink depending on how people use energy. If people do not balance energy input and output by eating right and exercising, fat can build up. This can lead to weight gain.

Measurement of Obesity

Obesity is determined by measuring body fat, not just body weight. People might be over the weight limit for normal standards, but if they are very muscular with low body fat, they are not obese. Others might be at normal weight or even underweight, but still have excessive body fat. The following measurements and factors are used to determine whether or not a person is overweight to a degree that threatens their health:

- Body mass index (BMI) -- a measure of body fat
- Waist circumference (size around the waist)
- Waist-hip ratio
- Skin fold measurement (anthropometry)
- The presence or absence of other disease risk factors (such as smoking, high blood pressure, unhealthy cholesterol levels, diabetes, and relatives with heart disease)

A person's disease risk factors and their BMI may be the most important components in determining health risks with weight.

The Body Mass Index (BMI). The current standard measurement for obesity is the body mass index (BMI). In general, a BMI of 25 - 29.9 means you are overweight. Obesity is a BMI of 30 and above. Obesity is then classified into three categories:

- Class I: BMI of 30 - 34.9
- Class II: BMI 35 - 39.9
- Class III: BMI of 40 and greater

These guidelines are very important for people at risk for diabetes, heart disease, or certain cancers. It is also used to determine treatment approaches such as when surgery may be appropriate. The higher the BMI, the greater the risk for significant health problems.

Calculating Body Mass Index. A person's body mass index is calculated as follows:

- Multiply one's weight (in pounds) by 703
- Divide that answer by height in inches
- Divide that answer again by height in inches

For example, a woman who weighs 150 pounds and is 5 feet 8 inches (or 68 inches) tall has a BMI of 22.8.

Waist Circumference and Waist-Hip Ratio. The extent of abdominal fat can also be used in assessing risk of disease. Some studies suggest that:

HIGHLIGHTS

Successful Weight loss:

- People who lose at least 10% of their body weight and keep the weight off for more than 1 year share several characteristics, including:

- Exercising for at least 1 hour each day
- Eating a low-fat, low-calorie diet
- Eating breakfast each day
- Weighing themselves regularly

Genetic Risk Factors:

- Studies of twins found that genetic factors have a considerable influence on BMI and obesity. Environmental factors were less influential in older children, but they interacted significantly with genetic factors in younger children.

Overweight Epidemic in Children:

- Weight problems in children and adolescents are rising at an alarming rate. In 2004, 19% of young children aged 6 - 11 were overweight, an increase of 8% from 1994. Among children aged 2 - 5, 13.9% were overweight in 2004, up from 7.2% 10 years earlier.

Obesity and Diet:

- Enough food is produced in the US to supply 3,800 calories every day to each man, woman, and child in the country. This is far more than the average person needs to sustain life. In general, the people who gain weight eat more, and their portions are larger than those who do not gain weight.

Effects of Obesity on the Body:

- Obesity is associated with certain problems related to infertility, such as uterine fibroids and menstrual irregularities. In men, obesity can contribute to lower testosterone levels and erectile dysfunction.
- People who are obese have a higher risk for carpal tunnel syndrome and other problems involving nerves in their wrists and hands.
- The Pickwickian syndrome, named for an overweight character in a Dickens novel, occurs in severe obesity when lack of oxygen produces intense and chronic sleepiness and, eventually, heart failure.

- Women whose waistlines are over 31.5 inches and men whose waists measure over 37 inches should watch their weight.
- A waist size greater than 35 inches in women and 40 inches in men is associated with a higher risk for heart disease, diabetes, and impaired health.

Evidence strongly suggests that more body fat around the abdomen and hips (the apple-shape) is a more consistent predictor of heart problems and health risks than BMI.

The distribution of fat can be evaluated by dividing waist size by hip size. For example, a woman with a 30-inch waist and 40-inch hip circumference would have a ratio of 0.75; one with a 41-inch waist and 39-inch hips would have a ratio of 1.05. The lower the ratio the better. The risk of heart disease rises sharply for women with ratios above 0.8 and for men with ratios above 1.0.

Anthropometry. Anthropometry is the measurement of skin fold thickness in different areas, particularly around the triceps, shoulder blades, and hips. This measurement is useful in determining how much weight is due to muscle or fat.

Causes

Obesity occurs when a person consumes more calories than they need for the energy they use. Several different factors may influence weight gain.

About 90% of people who lose weight through dieting gain every pound back regardless of their weight-loss method.

Some evidence suggests that every person has an inherited weight. This range varies by only about 10% either up or down from some set point. For instance, a man whose "genetically-determined" weight is 200 pounds would tend to swing from 180 - 220 pounds. He would be unlikely to lose or gain more than this.

Genetic factors may play some part in 70 - 80% of obesity cases.

The Biological Pathway to Appetite

Appetite is determined by processes that occur both in the brain and gastrointestinal tract. Eating patterns are controlled by areas in the hypothalamus and pituitary glands (in the brain).

The body produces a number of molecules that increases or decreases appetite, including leptin. Leptin is a hormone that fat cells release. Some scientists think this hormone may also be released by cells in the stomach. Leptin appears to play an important role in insulin resistance and fat storage in the body, but its role in obesity is unclear.

The most likely scenario is that leptin levels rise as the cells store more fat. This increase in leptin levels decreases appetite. Falling levels of leptin make you feel hungry. In people who have genetically lower levels of leptin, however, the brain may be tricked into thinking that it is always starving because there is no leptin to decrease appetite. This can lead to weight gain.

Specific Genetic Factors

Genetics may directly contribute to severe obesity in people with family histories of the problem. Genetic factors such as slow metabolisms may also make people more likely to be overweight, and there have been some genetic mutations identified in rare causes of severe obesity.

Large epidemiological studies have not been able to identify specific location on chromosomes related to the regulation of BMI or the occurrence of obesity. However, recent stud-

ies of thousands of preteen twin pairs found that genetic factors have a considerable influence on BMI and obesity. Environmental factors were less influential in older children, but interacted significantly with genetic factors in younger children. Genetics also determines the number of fat cells a person has. Some people are simply born with more. It should be noted that even when genetic factors are present, a person can still control their diet.

Medical or Physical Causes of Obesity

A number of medical conditions may contribute to being overweight, but rarely are they a primary cause of obesity.

- Hypothyroidism is sometimes associated with weight gain. But, patients with an underactive thyroid generally show only a moderate weight increase of five to 10 pounds.
- Very rare genetic disorders, including Froehlich syndrome in boys, Laurence-Moon-Biedl syndrome, and Prader-Willi syndrome, cause obesity.
- Abnormalities or injury to the hypothalamus gland can cause obesity.
- Cushing's disease is a rare condition caused by high levels of steroid hormones. It results in obesity, a moon-shaped face, and muscle wasting.
- Obesity is also linked to polycystic ovarian syndrome, a hormonal disorder in women.

Effects of Certain Medications

Some prescription medications contribute to weight gain, usually by increasing appetite. Such drugs include:

- Corticosteroids
- Female hormone treatments, including some oral birth control pills (effect is usually temporary), and certain progestins (such as Megestrol) used to treat cancer
- Antidepressants and anti-psychotic drugs, including lithium and valproate
- Insulin and insulin-stimulating drugs used to treat diabetes, a particularly unfortunate conflict of interest for obese individuals with type 2 diabetes

Do NOT stop taking any medications without talking to your health care provider first.

Television and Sedentary Habits

Perhaps the primary reason for the dramatic rise in obesity is the sedentary (inactive) lives led by most Americans, including children and young people. Researchers found that labor saving devices had reduced a person's energy use by over 100 calories a day -- adding up to an extra 11 pounds a year. Half the difference in energy use was due to less walking. At the same time, according to the U.S. Centers for Disease Control and Prevention, between 1970 and 2000 the typical American man increased his caloric intake by 168 calories a day (good for 17 pounds a year) while the average woman added 335 calories a day.

Regular television watching has been singled as the most hazardous pastime. According to a major 2003 study, for every 2 hours a person spends in front of the TV each day, the risk for obesity increases by 23% and for type 2 diabetes by 14%. In the study, TV watching produced the lowest metabolic rates compared to sewing, playing board games, reading, writing, and driving a car. Just the act of watching TV encourages unhealthy snacking and eating patterns. In addition, the advertising on the television complicates the problem by promoting fast foods, cereal, and snack products that are high in salt, fats, and carbohydrates. Even worse,

much of these advertisements are directed at children -- the most vulnerable group.

Modern Diet and Eating Habits

People are not only eating more food than they did 20 years ago but also replacing home cooking with packaged foods, fast food, and dining out. This behavior, according to studies, places people at higher risk for obesity. Fast foods may be more harmful than restaurant cooking. These foods tend to be served in larger portions. They generally contain more calories and unhealthy fats, and fewer nutritious ingredients, than homemade or restaurant meals. Snack foods and sweet beverages, including juice and soft drinks, are specific problems that add to the increasing rates of obesity.

Frequent small, healthy meals (instead of two or three large daily meals) have been associated with lower weights.

Enough food is produced in the US to supply 3,800 calories every day to each man, woman, and child in the country. This is far more than the average person needs to sustain life. In general, the people who gain weight eat more and their portions are larger than those who do not.

Obesity is dramatically increasing in not only American children and adults but also every country that has adopted similar cultural habits. The World Health Organization now considers obesity to be a global epidemic and a public health problem as more nations become "Westernized." In spite of the proven health risks of obesity, the government, insurance companies, and the medical profession do not spend nearly enough money to balance the commercial and cultural pressures that are producing millions of overweight people.

Risk Factors

Where you live plays a role in your risk for obesity. Simply living in the United States makes a person more susceptible to obesity. The prevalence of obesity in America has risen dramatically over the past few years and continues to increase.

- According to the latest figures available, 32.2% of American adults (aged 20 and older) are obese (BMI over 30) -- up from about 23% in the early 1990s.
- The number of Americans aged 20 - 74 who were overweight or obese also increased from about 44.8% in 1960 to 66.3% in 2004.

Risk by Age. People of any age are at risk for obesity. More children and adolescents are overweight in America than ever before. Gaining some weight is inevitable with age, and adding about 10 pounds to a normal base weight over time is not harmful. The current weight gain in American adults over 50, however, is significant. By age 55, the average American has added nearly 40 pounds of fat during the course of adulthood. This condition is made worse by the fact that muscle and bone mass decrease with age.

Risk by Gender. In men, BMI tends to increase until age 50 and then it levels off. In women, weight tends to increase until age 70 before it plateaus. There are three high-risk periods for weight gain in women:

- The first is at the onset of menstruation, particularly if it is early. In fact, a study released in March 2007 found that obesity in young girls results in early puberty -- as early as age 9. This, in turn, increases the risk for more weight gain as girls enter puberty.
- The second is after pregnancy, with higher risk for women who are already overweight.
- Finally, many women gain weight after menopause.

These findings are significant because they may allow women to target high-risk times, and consequently prevent unnecessary weight gain.

Risk by Economic Group. Obesity is more prevalent in lower economic groups. Low income women and their families tend to have fewer fruits and vegetables and are actually taking in more calories a day than higher-income women. However, obesity is increasing in young adults with college education as well as in other groups.

Ethnic Groups. Among ethnic groups in general, African-American women are more overweight than Caucasian women are, but African-American men are less obese than Caucasian men are. Hispanic men and women tend to weigh more than Caucasians.

US Regions. Regionally, the prevalence of obesity is lowest in the Western states and highest in the South.

Dietary Habits that Increase Risk

A number of dietary habits put people at risk for becoming overweight:

- *Night-Eating Syndrome.* Night-eating syndrome is defined as having no appetite in the morning, insomnia, and consuming more than half of the daily food intake after 6 p.m. It is associated with obesity and is difficult to treat. Stress reduction and relaxation techniques may be helpful.
- *Binge Eating and Eating Disorders.* About 30% of people who are obese are binge eaters who typically consume 5,000 - 15,000 calories in one sitting. To be diagnosed as a binge eater, a person has to binge at least twice a week for 6 months. Many experts believe that binge-eating carbohydrates causes an increase in a natural opiate, leading to dependence on carbohydrates. Therefore, this condition should be treated as an addiction. Other eating disorders are bulimia and anorexia. Bulimia is binge eating followed by purging in order to lose weight. Anorexia nervosa is a mental illness in which the person refuses to maintain weight at the normal level. The patient with anorexia has a terrible fear of getting fat, and an abnormal perception of what their body looks like. Both conditions pose risks for serious medical problems, and anorexia nervosa can be life threatening. A combined approach using behavioral therapy and antidepressants may help these individuals. [For more information, see *In-Depth Report #49: Eating disorders.*]
- *Restrained Eating.* Some people, mostly middle-aged women who have normal weight, follow a pattern called restrained eating. This pattern requires a high level of conscious control and usually maintains a lower weight. However, such restraint places these individuals at higher risk for loss of control and subsequent overeating.
- *Infrequent Eating.* Some evidence suggests that eating small frequent meals uses more calories than infrequent large meals. It should be strongly noted, however, that packaged snack foods add calories, and some do not produce a feeling of being full, so that people simply eat more than they should.

Specific Groups at Risk

Anyone with Sedentary Lifestyles. Office workers, drivers, and people who sit for long periods are at higher risk for obesity.

Ex-Smokers. The trend toward weight increase has followed the trend for quitting smoking. Nicotine increases the metabolic rate, and quitting, even without eating more, can cause weight gain, which may be considerable. It is important to note that weight control is not a valid reason to smoke.

People in previous centuries did not smoke cigarettes, nor were they usually obese.

Shift-Workers. A recent study found that individuals who work late shifts (between 4 p.m. and 8 a.m.) tend to eat more and take longer naps than day workers, and they are more likely to gain excess weight.

People with Disabilities. Obesity rates are higher than average in people with physical or mental disabilities. Those with disabilities in the lower part of the body, such as the legs, are at highest risk.

People with Chronic Mental illnesses. People who have a chronic mental illness are at high risk for obesity and diabetes, most likely due to their lifestyle. In addition, many of the medications used to treat chronic mental illnesses can cause weight gain and increase the risk of diabetes.

Overweight Children: Special Considerations

Weight gain in children and adolescents is rising at an alarming rate. In 2004, 19% of young children aged 6 - 11 were overweight, an increase of 8% from 1994. Among children aged 2 - 5, 13.9% were overweight in 2004, up from 7.2% 10 years earlier.

Children and adolescents are considered to be overweight if their BMI is above 95% of the children in their age and sex categories. Ethnic variations, timing of growth spurts, and higher normal fat levels around puberty can affect these measurements.

Lifestyle Factors. Without educational or parental guidance, children are extremely vulnerable to the intense cultural pressures that are largely responsible for the obesity epidemic. The following are some specific problems created by the culture:

- Excessive television watching plays a critical role in obesity in children. Not only is it a sedentary activity, but television also offers innumerable temptations with its advertisements for fast foods, sugar cereals, and unhealthy snacks. In one study obesity rates were lowest in children who watched television 1 hour or less a day and highest in those who watched 4 or more hours.
- Sugar, particularly from soda, other sweetened beverages, and fruit juice, may be the major contributor to childhood obesity. One study reported that drinking soda regularly increases a child's risk for obesity by 60%. The average American adolescent consumes 15 - 20 extra teaspoons of sugar a day just from soda and sugary drinks. (Juice, while better than soda, is still filled with sugar.)
- Less physical exercise and greater sedentary activities play another significant role in obesity in children. A high level of physical activity -- not just using up energy -- is important for weight control in young people. Unfortunately, according to one study, the annual distance walked by children has fallen by nearly 30% since 1972, partially because more parents are driving their children to school out of fear of abduction, molestation, and traffic accidents. Schools are also offering fewer opportunities for daily physical activities than in the past.

Neither the media nor the educational system has strong well-financed programs that encourage healthy alternatives, including exercise and healthy foods.

Family History. Parental obesity more than doubles the risk that a young child, whether thin or overweight, will become obese as an adult. In older children and teenagers, obesity in parents starts to count less as a predictor for body weight than their own weight. The risk for obesity may be due to environmental or genetic factors, or both.

Although some small studies have reported protection against obesity from breastfeeding, evidence is weak. Nevertheless, given the healthful effects of breastfeeding and the possibility that it may have even a slight impact on childhood obesity, it is highly recommended.

Biological Effect of Childhood Obesity on Adult Weight

Achieving a healthy weight becomes more difficult as children get older. The odds of obesity persisting into adulthood range from 20% in 4 year olds to 80% in teenagers. One reason for the persistence is biological. The fat cells change in number or mass depending on a person's age:

- Fat cells themselves multiply during two growth periods: early childhood and adolescence. Overeating during those times increases the *number* of fat cells. Some people are also just born with more fat cells.
- After adolescence, fat cells tend to increase in *mass* rather than quantity, so that adults who overeat and gain weight tend to have larger fat cells, not more of them. This growth in mass may be responsible for the greater risk of persistent obesity among teenagers compared to small children who are overweight. Losing weight after adolescence reduces the size of the fat cells but not their number, so weight loss becomes much more difficult.

Complications

General Adverse Effects of Obesity. Obesity, defined as a BMI of 30 or over, accounts for nearly 300,000 deaths in the U.S. each year. It is associated with more chronic health problems than smoking, heavy drinking, or poverty. Furthermore, given the current increase in obesity, it will surpass smoking as the most important preventable cause of death in America.

Some studies indicate the following health risks by body mass:

- The lowest risks for heart disease, diabetes, and some cancers are in people with BMI values of 21 - 25.
- The risks increase slightly when BMI values are 25 - 27.
- The risks are significant in BMIs 27 - 30.
- The same risks are dramatic at BMIs over 30.

Anyone with chronic health problems, such as heart or lung disease, stroke, or arthritis, should be concerned about extra weight. This same concern also applies to people with known risk factors for these conditions.

- *Metabolic Changes.* As fat stores increase, the fat cells themselves swell and produce chemicals that increase the risk for several diseases, including diabetes, high blood pressure, gallbladder disease, and some cancers.
- *Increased Mass.* The increased body weight itself causes problems that result in injury and diseases, including osteoarthritis and sleep apnea.
- *Harmful Fat Cell Types.* Weight concentrated around the abdomen and in the upper part of the body (the apple shape) poses a higher health risk than fat that settles around the hips and flank (the pear shape). Fat cells in the upper part of the body appear to have different qualities from those found in the lower parts. In fact, studies suggest a higher risk for diabetes in people with the "apple shape" and lower risk in those who are "pear shaped."

General Adverse Effects of Being Overweight (Not Obese). It is still not clear if being overweight (a BMI of 25 - 29.9) hurts healthy people with no risk factors for serious illnesses.

The risk for developing diabetes, gallstones, hypertension, heart disease, stroke, and colon cancer seems to rise according to how much the individuals are overweight. In any case, adults who are overweight in middle age face a poor quality of life as they age, with the quality declining the more they weigh.

Some argue, in fact, that unhealthy diet and sedentary lifestyle cause the harm -- not weight per se -- in anyone who is not severely obese. In support of this argument, a British study found that overweight fit individuals had half the death rate of unfit trim individuals.

Being somewhat overweight may also have some benefits under specific circumstances:

- In older women, some excess fat may produce extra estrogen that helps slow down bone loss, and insulates bones from fall-related injuries. It should be strongly noted, however, that when older overweight women lose weight they report less pain, improved vitality, and improved physical function. The same positive effect of excess weight does not appear to hold in older men.
- Conditioned athletes may have high BMIs because of very dense muscle tissue. Being fit in general may protect many overweight people.

Heart Disease and Stroke

Individuals with a BMI of at least 30 have a 10-50% increased rate of death from all causes, compared with individuals with a BMI of 20 - 25. Mortality rates from many causes are higher in obese people, but heart disease is the primary cause of death. People who are obese have almost three times the risk for heart disease as people with normal weights. Being physically unfit adds to the risk.

As mentioned above, weight concentrated around the abdomen and in the upper part of the body (apple shape) is particularly associated with insulin resistance and diabetes. It is also associated with increased risk of heart disease, high blood pressure, stroke, and unhealthy cholesterol levels. Fat that settles in a pear shape around the hips and lower body appears to have a lower association with these conditions.

Obesity poses many dangers to the heart and circulatory system.

Damage in the Blood Vessels. As people age, changes in body fat (particularly increasing abdominal fat) seem to cause stiffness in the aorta, the major blood vessel leading from the heart. Studies are finding higher levels of a factor called C-reactive protein (CRP) in people with obesity and abdominal fat. CRP is now considered to be a marker for inflammation and damage in the arteries. (Losing weight reduces CRP levels.)

High Blood Pressure. High blood pressure is the health problem most commonly associated with obesity, and the greater the weight, the greater the risk. High blood pressure carries serious risks of stroke, heart attack, and heart failure. The link between obesity and high blood pressure is complex, and may be a combination of genetic, population, and biological factors. Many studies have reported that modest weight loss is beneficial for reducing existing high blood pressure. [For more information, see *In-Depth Report #14: High blood pressure.*]

Heart Failure. Obesity is associated with both hypertension and type 2 diabetes, conditions that place people at risk for heart failure. Evidence strongly suggests that obesity itself is a major risk factor for heart failure, particularly in women. The biological mechanisms involved in obesity

that lead specifically to heart failure are not clear. [For more information, see *In-Depth Report #13: Heart failure.*]

Unhealthy Cholesterol and Lipid Levels. The effect of obesity on cholesterol levels is complex. Although obesity does not appear to be strongly associated with overall cholesterol levels, triglyceride levels (the major form of fat storage in the body) are usually high in obese people, while HDL levels (the "good" cholesterol) tend to be low. Both conditions are risk factors for heart disease. [For more information, see *In-Depth Report #23: Cholesterol.*]

Stroke. Obesity is also associated with a higher risk for stroke. [For more information, see *In-Depth Report #45: Stroke.*]

Insulin Resistance, Type 2 Diabetes, and Metabolic Syndrome

Type 2 Diabetes and Insulin Resistance. Most people with type 2 diabetes are obese and, in fact, studies strongly suggest that weight loss may be the key in controlling the current epidemic of type 2 diabetes. The common factor appears to be insulin resistance. Insulin is a critical hormone in the use of sugar. In type 2 diabetes, different factors cause the body to become insulin resistant -- that is, the body can no longer respond properly to insulin. This has the effect of increasing sugar levels in the blood, the hallmark of diabetes. Both obesity and insulin resistance, at different phases, are marked by high levels of certain chemicals. It is not known yet if the higher levels are simply a product of obesity, or play some role in causing diabetes.

Insulin resistance is also associated with high blood pressure and abnormalities in blood clotting. Some research indicates that obesity, in fact, is the one common element linking insulin resistance, type 2 diabetes, and high blood pressure. [For more information, see *In-Depth Report #60: Diabetes - type 2.*]

Metabolic Syndrome. Metabolic syndrome (also called syndrome X) is a pre-diabetic condition that is significantly associated with heart disease and higher mortality rates from all causes. The syndrome consists of obesity marked by abdominal fat, unhealthy cholesterol levels, high blood pressure, and insulin resistance. A 2002 study estimated that nearly a quarter of the US population now has this condition. Even worse, according to a 2003 study, nearly a million American teenagers have this syndrome. A combination of weight loss and exercise is an effective treatment for this syndrome.

Cancer

The American Cancer Society (ACS) released new cancer prevention guidelines in September 2006. The guidelines stress the importance of keeping a healthy weight throughout life. The ACS indicates that healthy weight is even more important than eating specific healthy foods, when it comes to cancer prevention.

Obesity has been associated with a higher risk for cancer in general and specific cancers in particular. Studies have also suggested that restricting calories reduces the risk for cancer.

One way in which obesity may increase the risk for cancer is its association with high levels of hormones called growth factors, which can trigger rapid cell production, leading to cancer.

Uterine and Breast Cancers. The risk of uterine cancer in obese women appears to be two or three times higher than in thinner women. Increased levels of estrogen, which are present in overweight women, are thought to be the cause of this increase.

Studies are mixed on the association between obesity and breast cancer. A number of studies have linked obesity to breast cancer in postmenopausal women, particularly in women who began to gain weight after age 18.

Prostate Cancer. Studies report that obesity is associated with an increase in prostate cancer mortality in patients with more advanced prostate cancer, although not with the risk for less aggressive forms of prostate cancer.

Gallbladder Cancer. Obese women are at higher risk for gallbladder cancer.

Gastrointestinal Cancers. A number of cancers in the gastrointestinal (digestive) tract have been associated with obesity:

- Cancer of the esophagus may be due to a higher incidence of gastroesophageal reflux disorder (heartburn) in people who are overweight.
- Colon cancer has been linked to increased body mass in both men and women.
- Pancreatic cancer and obesity have been weakly linked, with one study reporting a lower risk in overweight people who are physically active.

Muscles and Bones

Obesity places stress on bones and muscles. Studies report that the incidence of osteoarthritis is significantly increased in people who are overweight. People who are obese are also at higher risk for carpal tunnel syndrome and other problems involving nerves in their wrists and hands.

Eyes and Mouth Disorders

Obesity increases the risk for the following mouth and eye disorders:

- Gum disease
- Cataracts
- Maculopathy, an eye disease related to aging

Reproductive and Hormonal Problems

Infertility. Abnormal amounts of body fat, either 10 - 15% too high or too low, can contribute to infertility in women. Obesity is especially related to certain infertility problems, such as uterine fibroids and menstrual irregularities. In men, obesity can contribute to reduced testosterone levels and erectile dysfunction.

Effect on Pregnancy. Obesity has many dangerous effects on pregnancy. These include high blood pressure, gestational diabetes (diabetes, usually temporary, that occurs during pregnancy), urinary tract infections, blood clots, prolonged labor, and higher fetal death rate in late stages of pregnancy. Obesity is also associated with increased rates of cesarean delivery. Infants of women who are obese are also at higher risk for neural tube birth defects, which affect the brain or spine. Folic acid supplements, ordinarily effective in preventing these conditions, may not be as protective in overweight women. Some evidence suggests an association between obesity and stillbirths, as well.

Effects on the Lungs

Obesity is thought to be a risk factor for symptoms of adult-onset asthma. Though there is evidence that obesity causes wheezing and shortness of breath, it does not appear to be strongly associated with the disease mechanisms in the lungs that cause true asthma.

Obesity also puts people at risk for *hypoxia*, a condition in which there is not enough oxygen to meet the body's needs. Obese people need to work harder to breathe. They tend to have breathing muscles and lungs that do not work as well as those in thinner people.

The Pickwickian syndrome, named for an overweight character in a Dickens novel, occurs in severe obesity when lack of oxygen produces intense and chronic sleepiness and, eventually, heart failure.

Effect on the Liver

Nonalcoholic Fatty Liver Disease. People with obesity, particularly if they also have type 2 diabetes, are at higher risk for a condition called nonalcoholic fatty liver disease, also called nonalcoholic steatohepatitis (NASH). This condition causes liver damage that is similar to liver injury seen in alcoholism. In some people, it can be very serious and require liver transplantation. NASH occurs in about half of people with diabetes, and 20 - 50% of obese people, depending on how severe their obesity is. NASH can also occur in overweight children.

Gallstones. The incidence of gallstones is significantly higher in obese women and men. The risk for stone formation is also high if a person loses weight too quickly. In people on ultra-low calorie diets, taking ursodeoxycholic acid (Actigall) may prevent gallstones.

Sleep Disorders

People who are obese and nap tend to fall asleep faster and sleep longer during the day. At night, however, it takes them longer to fall asleep, and they sleep less than people with normal weights. In an apparent vicious circle, studies have suggested that obesity not only interferes with sleep but that sleep problems may actually contribute to obesity.

Sleep Apnea. Obesity, particularly the apple shape, is strongly associated with sleep apnea, which occurs when the upper throat relaxes and collapses from time to time during sleep. This collapse temporarily blocks the passage of air. Sleep apnea is increasingly being viewed as a potentially serious health problem, which may lead to complications, such as heart disease and stroke. Some studies suggest that among overweight people, those who have sleep apnea have a greater risk of heart disease than those without it. In one study, the more obese a person with sleep apnea was, the higher the pressure on the airway, and therefore the greater the obstruction of the airway. Obstructive sleep apnea may also add to obesity, however, as sleepy people tend to be sedentary. Some studies indicate that treating sleep apnea may help people lose abdominal fat.

Emotional and Social Problems

Depression. A number of studies have reported an association between depression and obesity, particularly in obese women. There may be a number of factors to explain the link. In some cases of atypical depression, people overeat and may gain weight. Overweight people may also become depressed because of social problems and a poor self-image. In these cases, depression usually disappears when people lose weight.

There is evidence, however, that obesity itself may impair levels of tryptophan -- a chemical needed to make serotonin, a brain chemical associated with mental well-being. In one study, even after people lost weight, tryptophan levels were lower than normal.

There does not appear to be any association between depression and obesity in men.

Social Problems. One long-term study reported that overweight young women completed fewer years of school, were 20% less likely to be married, and had 10% higher rates of household poverty than their thinner peers. Obese young men were also less likely to be married, and their incomes were lower than their thinner peers. Nevertheless, studies consistently show that overweight males (both boys and

men) are not as severely emotionally affected as females of any age. Women and girls tend to blame themselves for being heavy, while males tend to blame being overweight on outside factors.

Health Consequences of Childhood Overweight

Children and adolescents who are overweight have poorer health than other children. Studies are reporting unhealthy cholesterol levels and high blood pressure in overweight children and adolescents. Of great concern is the dramatic increase in type 2 diabetes in young people, which is largely due to the increase in overweight children.

Weight gain in children is also linked to asthma, gallbladder problems, sleep apnea, and liver abnormalities. Overweight girls are more likely to enter puberty early, according to a new study, and subsequently be at higher risk for breast cancer. It is not clear yet how many of these childhood problems persist in people who achieve normal weight as adults. Staying overweight into adulthood certainly carries health risks.

Lifestyle Changes and Psychosocial Treatments

Even modest weight loss can reduce the risk factors for heart disease and diabetes. The simplest (but still difficult) approach to weight loss is reducing calories and exercising at least 150 minutes a week. Behavioral and mental changes in eating habits, physical activity, and attitudes about food and weight are also essential to weight management. For people who are very overweight and cannot lose weight through lifestyle changes, a number of effective weight-loss medications are available. For those with severe obesity, surgical procedures are proving to be very beneficial.

Studies show that people who lost at least 10% of their body weight and kept the weight off for more than 1 year share several characteristics, including:

- Exercising for at least 1 hour each day
- Eating a low-fat, low-calorie diet
- Eating breakfast each day
- Weighing themselves regularly and often
- Eating the same diet on weekends as they do on weekdays

Some Tips for Losing Weight. The following are some general suggestions for dieters:

- Start with realistic goals. Diet failure is extremely common, and the odds of significant weight loss are low, particularly in people with the highest weights. People who are able to restrict calories, engage in an exercise program, and get help in making behavioral changes can expect to lose 5 - 10% of their current body weight. That is generally all that is needed to achieve meaningful health changes. Certainly, the distorted image of a super-thin female shape should not be anyone's goal.
- Maintain a regular exercise program, assuming you have no health problems that will stop you. Choose a program that you enjoy. Check with your doctor about any health considerations. [For more information, see *In-Depth Report #29: Exercise.*]
- Do not use hunger pangs as cues to eat. A stomach that has been stretched by large meals will continue to signal hunger for large amounts of food until its size reduces over time with smaller meals.
- Be honest about how much you eat and start by recording all calories in writing. Studies suggest that when many

people report their own caloric intake they significantly underestimate their consumption of high-calorie foods and overestimate intake of low-calorie foods. People who do not carefully note everything they eat tend to take in too many calories when they believe they are dieting.

- Observe weekend eating. People tend to eat more on the weekends. If it is difficult to monitor all meals during the week, it may be useful to at least track eating habits during the weekends.
- Once the pounds are lost, do your best to keep the healthier weight. Make daily, even hourly, conscious decisions about eating and exercising activities. Such thinking, in many cases, can become automatic and not painful.
- Don't give up, even after repeated weight loss failures. Most studies indicate that yo-yo dieting or weight cycling have no bad psychological or physical effects. Repeated dieting also does not harm the body's ability to burn calories efficiently.
- Weight loss, in any case, should not be the only or even the primary goal for people concerned about their health. The success of weight loss efforts should be evaluated according to improvements in disease risk factors or symptoms, and by the adoption of healthy lifestyle habits, not just by the number of pounds lost.

Managing Overweight Children

Childhood obesity is best treated by a non-drug, multidisciplinary approach, including diet, behavior modification, and exercise. Evidence suggests that reducing calories by only 200 - 260 per day would prevent weight gain in most overweight children. Here are some tips for children who are overweight:

- Limit (or avoid, if possible) take out, fast foods, high-sugar snacks, commercial packaged snacks, soda, and sugar-sweetened beverages (including too much juice).
- Let children snack but make sure the snacks are healthy. Eating small frequent healthy meals (instead of two or three large ones) has been associated with being thinner and having a better cholesterol profile.
- Let children choose their own food portions. One study indicated that children naturally ate 25% less when they chose their own portion size. When they were given larger portions their bite sizes were larger and they ate more.
- Do not criticize a child for being overweight. It does not help, and such attitudes could put children at risk for eating disorders, which are equal or even greater dangers to their health.
- Limit television, video games, and computer use to a few hours a week. This can contribute significantly to weight control, regardless of diet and physical activity.
- For young children, try the traffic-light diet. Food is designated with stoplight colors depending on their high caloric content: Green for go (low calories); yellow for "eat with caution" (medium calories); red for "stop" (high calories).
- Try a low glycemic index diet. This may be as beneficial, possibly more, than a standard reduced-fat diet in overweight children. Such a diet focuses on certain carbohydrates (for example, dried beans and soy), which raise blood sugar more slowly than other types of carbohydrates. This diet is sometimes used in diabetes, and as a dietary approach in overweight adults. [For more information, see *In-Depth Report #42: Diabetes Diet.*]

| Key Components of a Lifestyle Change Program | |
|--|--|
| Lifestyle | Reduce rate of eating. Keep food records .Eliminate environmental triggers to eating. Identify high-risk situations for overeating. Separate eating from other activities. |
| Exercise | Face up to emotional barriers to exercise. Understand the link between exercise and weight control. Establish reasonable exercise goals. Develop a plan for regular activity. Add increased activity into daily lifestyle. |
| Attitudes | Develop reasonable weight-loss goals. Avoid "all or none" thinking. Focus attention away from the scale and toward behavior. Uncouple weight from self-esteem. If you "fall off the wagon," take steps to ensure you do not repeat the situation (recover from lapses with constructive action). |
| Relationships | Understand the key role of social support to health. Identify supportive others. Match personal style to support-seeking activities. Be specific in making support requests. Be assertive but reinforcing in drawing help from others. |
| Nutrition | Resist the temptation of popular fad diets. Eat with your health in mind; do not concentrate on what should be "off-limits." Eat with moderation in mind. Maximize fiber. Develop a tailored plan. |
| From Brownell KD. <i>The LEARN Program for Weight Control</i> . 7th ed. Dallas, Tex: American Health Publishing Company; 1998. | |

Support Groups and Behavioral Approaches

Commercial and Nonprofit Support Programs for Weight Loss. There are many different types of weight-loss program. (This report cannot address all of the many commercial and nonprofit weight-loss programs currently available, nor can it assess their claims.)

Taking off Pounds Sensibly (TOPS), a nonprofit support organization with many local chapters, is one of the least expensive programs, costing \$20 a year.

Most of the commercial programs, such as Weight Watchers, Jenny Craig, and NutriSystem, offer individual or group support, lifestyle changes, and packaged meals. These programs tend to be expensive. There are few well-conducted studies on these programs.

Monthly brief personal contact with support groups or individuals provided modest benefit in sustaining weight loss, whereas an interactive technology-based intervention provided early but temporary benefit.

Many regard the inability to follow a diet and lose weight as reflecting a lack of willpower. Unfortunately, these feelings simply reinforce a sense of failure. Some suggest attempting to shift the approach to one of managing where one focuses their attention. Evidence exists that exercise and adequate sleep will enhance the ability to manage and self-regulate behavior.

Short-term specific goals regarding exercise and eating should be approached as something to be learned rather

than performed. Also, planning ahead when invited to eat out or going to another home for food is recommended.

Cognitive Behavioral Approaches. Most support programs use some form of cognitive-behavioral methods to change the daily patterns associated with eating. They are very useful for preventing relapse after initial weight loss. The following is a typical approach:

- The patient first records in a diary all activity related to eating patterns, including the times of day, length of meal, emotional states, companions, and, of course, the kind and amounts of food eaten. Most people -- even professional dieticians, according to one study -- tend to underreport their daily calorie intake. However, writing it down is still a good method for increasing a person's awareness of eating patterns. (One patient said that recording circumstances surrounding relapses was a particularly valuable guide for understanding the stresses leading to her own eating behaviors.)
- The patient reviews the diary with a therapist or group to set realistic goals and identify patterns that the patient can change. For instance, if food is normally eaten while watching television, then the patient may be advised to eat in another room instead.
- Good eating habits are reinforced by rewards. These rewards are other pleasures that substitute the high calorie consumption and sedentary activities.

Behavioral modification has been shown to be helpful particularly for people who have an overly strong response to the taste, smell, and appearance of food. It also may be useful for binge eaters.

Stress-Reduction Techniques. Stress reduction and relaxation techniques may be helpful for some people with obesity, such as those whose weight is related to night-eating syndrome. [For more information, see *In-Depth Report #31: Stress.*]

Changing Sedentary Habits and Exercise

Changing Sedentary Habits. Making even small changes in physical activity can expend energy. For example, simply getting up to turn the TV on and off instead of using the remote, and standing (instead of sitting) while talking on the phone may help a person lose up to five pounds a year. Other suggestions include cooking one's own food (instead of eating take-out or fast food), walking to as many places as possible, using stairs instead of escalators or elevators, and gardening. Even fidgeting may be helpful in keeping pounds off, and, in one study, chewing gum increased energy expenditure.

No one should rely on such mild activities, however, for serious weight loss. Only high levels of physical activity -- not just using up energy -- help prevent obesity.

Interventions to help children and adolescents lose weight and maintain weight loss have yet to show consistent benefit

Approach to Exercise. Exercise, which replaces fat with muscle, is the critical companion for any weight control program. In a one-year study, women who regularly averaged 3.5 days (176 minutes) of exercise each week lost significantly more weight than women who did not exercise regularly. Women who exercised more than 195 minutes a week lost nearly 7% of their abdominal fat.

It should be noted that increasing activity level in daily work and home life helps a great deal. For example, walking down the hall to speak with a coworker, rather than spending the same time sending an e-mail, may result in a loss of 5 kg over a 10-year period.

People who exercise are more apt to stay on a diet plan. Exercise improves psychological well-being and replaces sedentary habits that usually lead to snacking. Exercise may even act as a mild appetite suppressant. Moreover, exercise improves overall health even with modest weight loss.

Be aware, however, that the pounds won't melt off magically. Losing significant weight requires both intensive exercise and calorie restriction. In addition, if a person exercises but doesn't diet, any actual pounds lost may be minimal, because denser and heavier muscle mass replaces fat. Nonetheless, regardless of weight loss, a fit body will look more toned and be healthier. In addition, exercise benefits the heart even with modest weight loss.

The following are some suggestions and observations on exercise and weight loss:

- The more strenuous the exercise, the better the chances for short-term and long-term success. With intense exercise, the metabolism continues to burn calories before returning to its resting level. This state of elevated metabolism can last for as little as a few minutes after light exercise to as long as several hours after prolonged or heavy exercise.
- Of the standard aerobic machines, the treadmill burns the most calories. It may be particularly effective when used in short multiple bouts during the day. In fact, frequent exercise sessions as short as 10 minutes in duration (about

four times a day) may be the most successful exercise program for obese people.

- Resistance or strength training is excellent for replacing fat with muscles. It should be performed two or three times a week.
- As people slim down, their initial level of physical activity becomes easier and they burn fewer calories for the same amount of work. The rate of weight loss slows down, sometimes discouragingly so, after an initial dramatic head start using diet and exercise combinations. People should be aware of this phenomenon and keep adding to their daily exercise program.
- As people age, they also need to exercise more to keep off the same amount of weight.
- Changes in fat and muscle distribution may differ between men and women as they exercise. Men tend to lose abdominal fat (which lowers their risk for heart disease faster than reducing general body fat). Exercise, however, does not appear to have the same effect on weight distribution in women. In one interesting study, women in aerobic and strength training programs lost fat in their arms and trunk, but did not gain muscle tissue in these regions.

Spot Exercising. Anyone seeking to lose weight must expect that the results may not be as cosmetically satisfying as one would wish. Spot exercising (training particular areas of the body) is ineffective in reducing fat in specific locations because exercise draws on fat stores throughout the body. Gimmicky devices such as bust developers, vacuum pants, and exercise belts do absolutely nothing to reduce fat or add bulk in specific locations. Electrical pads wrapped around the waist, arms, or thighs were reported to cause burns and fires.

Warning Note. Because obesity is one of the risk factors for heart disease and diabetes, anyone who is overweight must discuss their exercise program with a doctor before starting. Sudden demanding exercise, in such cases, can be very dangerous. [For more information, see *In-Depth Report #29: Exercise.*]

Dietary Management

There are many approaches to dieting and many claims for great success with various fad diets. To date, although many diets achieve effective immediate weight loss, none has emerged as an effective tool for maintaining healthy weight. The only definite recommendation that can be made about any diet plan is to be sure it includes an exercise program, assuming there are no health problems to forbid it.

Calorie Restriction

Calorie restriction has been the cornerstone of obesity treatment. The standard dietary recommendations for losing weight are as follows:

- As a rough rule of thumb, one pound of body fat is the result of eating about 3,500 calories. A person could lose a pound a week by reducing daily caloric intake by about 500 calories a day. Naturally, the more severe the daily calorie restriction, the faster the weight loss. Very-low calorie diets have also been associated with better success, but extreme diets can have some serious health consequences.
- To determine your daily calories requirements, multiply the number of pounds of ideal weight by 12 - 15 calories. The number of calories per pound depends on gender, age, and activity levels. For instance, a 50-year old woman who wants to maintain a weight of 135 pounds and is

mildly active might require only 12 calories per pound (1,620 calories a day). A 25-year old female athlete who wants to maintain the same weight might need 25 calories per pound 2,025 (calories a day).

- Fat intake should be no more than 30% of total calories. Most fats should be in the form of monounsaturated fats (such as olive oil). Saturated fats (found in animal products) should be avoided.

Warning on Extreme Diets

Extreme diets of fewer than 1,100 calories carry health risks. They are also often followed by bingeing or overeating, and a return to obesity. Such diets often do not have enough vitamins and minerals, which must then be taken as supplements. Most of the initial weight loss is in fluids. Later, fat is lost, but so is muscle, which can account for more than 30% of the weight loss. No one should be on severe diets for longer than 16 weeks, or fast for more than 2 or 3 days. Severe dieting has unpleasant side effects, including fatigue, intolerance to cold, hair loss, gallstone formation, and menstrual irregularities. There have been rare reports of death from heart arrhythmias when liquid formulas did not have sufficient nutrients. Pregnant women who excessively diet during the first trimester put their unborn children at risk for birth defects. Of note, those whose diets include a high intake of fluids and much reduced protein and sodium are at risk for hyponatremia, which can cause fatigue, confusion, dizziness, and in extreme cases, coma and death.

Low-Fat and High-Fiber Diets

This dietary approach requires counting only grams of fat with the goal of achieving 30% or fewer calories from fat. One gram of fat contains nine calories, while one gram of carbohydrates or protein has only four calories. Fat in your diet converts more readily to fat in the body, compared with carbohydrates or proteins. Simply switching to low-fat or skimmed dairy products may be enough for some people.

There are possible drawbacks to this approach:

- Some people who reduce their fat intake may not get enough basic nutrients, including vitamins A and E, folic acid, calcium, iron, and zinc. People on low-fat diets should eat a wide variety of foods and take a multivitamin supplement, if appropriate. Calcium deficiencies may be particularly harmful in women at risk for osteoporosis.
- Many people start eating foods with too many carbohydrates, believing that they are not adding calories. No one should use a low-fat diet as an excuse for eating too many carbohydrates, particularly starchy foods and sugar. A high-calorie diet from any source will add pounds.
- Replacing fatty foods, such as cakes, cookies, and chips, with their commercial "low-fat" counterparts does not constitute a low-fat diet. These foods generally contain more sugar and hence calories, not to mention other ingredients, which have virtually no nutritional value.
- Very low-fat diets may increase the risk for stroke from hemorrhage in the brain.

Some fat in a diet is essential. It should come from plant oils and fish, however, and not from animal products or hardened oils, such as margarine. Trans fatty acids, found in hardened oils, are actually more of a risk factor for obesity than saturated fats from animal products, although both should be avoided.

Fiber and Complex Carbohydrates. In all cases, complex carbohydrates found in whole grains and vegetables are preferred

over those found in starch-heavy foods, such as pastas, white-flour products, and potatoes. Fiber is an important component of many complex carbohydrates. Fiber is almost always found only in plants, particularly vegetables, fruits, whole grains, nuts, and legumes (beans and peas). One exception is chitosan, a dietary fiber made from shellfish skeletons. Fiber cannot be digested but passes through the intestines, drawing water with it, and is eliminated as part of feces content. The following are specific advantages from high-fiber diets (up to 55 grams a day):

- Insoluble fiber (found in wheat bran, whole grains, seeds, nuts, and fruit and vegetable peels) has been associated with weight loss. Studies also suggest that diets rich in fiber from whole grains reduce the risk for type 2 diabetes.
- Soluble fiber (found in dried beans, oat bran, barley, apples, citrus fruits, and potatoes) has important benefits for the heart, particularly for achieving healthy cholesterol levels and possibly benefiting blood pressure as well. Simply adding breakfast cereal to a diet appears to reduce cholesterol levels. People who increase their levels of soluble fiber should also increase water and fluid intake.

Low-Carbohydrate Diets

Low carbohydrate diets generally restrict the amount of carbohydrates but do not restrict protein sources.

The Atkins diet restricts complex carbohydrates in vegetables and, particularly, fruits that are known to protect against heart disease. The Atkins diet can also cause excessive calcium excretion in the urine, which increases the risk for kidney stones and osteoporosis.

"Low-Carb" diets, such as South Beach, The Zone, and Sugar Busters, rely on a concept called the "glycemic index," or GI, which ranks foods by how fast and how high they cause blood sugar levels to rise. Foods on the lowest end of the index take longer to digest. Slow digestion wards off hunger pains. It also helps stabilize insulin levels. Foods high on the glycemic index include bread, white potatoes, and pasta, while low-glycemic foods include whole grains, fruit, lentils, and soybeans.

There has been debate about whether Atkins and other low-carbohydrate diets can increase the risk for heart disease, as people who follow these diets tend to eat more animal-saturated fat and protein and less fruits and vegetables. In general, these diets appear to lower triglyceride levels and raise HDL ("good") cholesterol levels. Total cholesterol and LDL ("bad") cholesterol levels tend to remain stable or possibly increase somewhat. However, large studies have not found an increased risk for heart disease, at least in the short term. In fact, some studies indicate that these diets may help lower blood pressure.

Low-carbohydrate diets help with weight loss in the short term, possibly better than diets that allow normal amounts of carbohydrates and restrict fats. However, overall, there is not good evidence showing long-term efficacy for these diets. Likewise, long-term safety and other possible health effects are still a concern, especially since these diets restrict healthy foods such as fruit, vegetables, and grains while not restricting saturated fats.

Fat and Sugar Substitutes

Replacing fats and sugars with substitutes may help many people who have trouble maintaining weight.

Fat Substitutes. Fat substitutes added to commercial foods or used in baking deliver some of the desirable qualities of fat, but they do not add as many calories. They cannot be

eaten in unlimited amounts, however, and are considered most useful for helping keep down total calorie count.

Plant substances known as sterols, and their derivatives called stanols, reduce cholesterol by blocking its absorption in the intestinal tract. Margarines containing sterols (such as Benecol and Take Control) are available. Benecol is derived from pine bark and Take Control from soybeans. These products do not appear to block absorption of fat-soluble nutrients or vitamins, as olestra does. They may be hydrogenated and include some trans fatty acids, however.

Olestra (Olean) passes through the body without leaving behind any calories from fat. Studies suggest that it helps improve cholesterol levels and may help overweight people lose weight. Early reports of cramps and diarrhea after eating food containing olestra have not proven to be significant. Of greater concern is the fact that even small amounts of olestra deplete the body of certain vitamins and nutrients that may help protect against serious diseases, including cancer. The FDA requires that the missing vitamins be added back to olestra products, but not other nutrients.

Beta-glucan is a soluble fiber found in oats and barley. Products using this substance (Nu-Trim) may reduce cholesterol and have additional health benefits.

A number of other fat-replacers are also available. Although studies to date have not shown any significant adverse health effects, their effect on weight control is uncertain, since many of the products containing them may be high in sugar. People who learn to cook using foods naturally lacking or low in fat eventually lose their taste for high-fat diets, something that may not be true for those using fat substitutes.

Artificial Sweeteners. Many artificial or low-calories sweeteners are available. A 2002 study confirmed that people who consumed artificial sweeteners and reduced their sugar intake weighed less over time than those who took in similar types and amounts of drinks and food containing sugar. It should be noted that using these artificial sweeteners should not give dieters a license to increase their fat intake. Studies indicate that consuming some sugar is not a significant contributor to weight gain, as long as the total amount of calories in the diet is under control. There is some public concern about chemicals used to produce many of these sweeteners, and the side effects seen in studies using rats. Natural low-calories sweeteners are available that may be more acceptable to many people.

- Saccharin (Sugar Twin, Sweet'N Low, Sucaryl, and Featherweight). Saccharin has been used for years. Some studies found that large amounts of saccharin cause bladder cancer in rats. However, the rats were fed huge amounts that do not apply to human diets. Currently there is no evidence that saccharin causes cancer in humans.
- Aspartame (Nutra-Sweet, Equal, and NutraTase). Aspartame has come under scrutiny because of rare reports of nervous system disorders, including headaches or dizziness, associated with its use. People with phenylketonuria (PKU), a genetic condition, should not use it. Studies have not reported any serious health dangers in otherwise healthy individuals, but some people may be sensitive to aspartame.
- Sucralose (Splenda). Sucralose has no bitter aftertaste and works well in baking, unlike other artificial sweeteners. It is made from real sugar by replacing part of the sugar with chlorine. Some people are concerned because chlorinated molecules used in major industrial chemicals have been associated with cancer and birth defects. Over 100 studies

have been conducted on sucralose over a 20-year period, with no reports of such risks.

- Acesulfame-potassium (Sweet One, SwissSweet, and Sunette). It has been used in the U.S. since 1988 with no reported side effects.
- Neotame (Neotame). Neotame is a synthetic variation of aspartame, developed to avoid its side effects. The association with aspartame has raised some concerns. Studies to date have reported no effects that would cause alarm, and it appears to be safe for general consumption.
- D-tagatose (Tagatose). This reduced-calorie sweetener is made from lactose, which is the sugar found in dairy products and other foods. It may be especially beneficial for people with type 2 diabetes. It may also have additional benefits that help the intestinal tract.
- Alitame (Aclame) is formed from amino acids, the building blocks of proteins. It has the potential to be used in all products that contain sugar, including baked goods.
- Stevioside (Stevia). This is a natural sweetener derived from a South American plant. It is available in health food stores. People with diabetes should avoid alcohol-based forms. It has not been carefully tested.

Other sugar substitutes being investigated include glycyrrhizin (derived from licorice) and dihydrochalcone (derived from citrus fruits).

Liquid Meal Replacements

Some studies have reported good success with meal replacement beverages (such as Slim-Fast and Sweet Success). They contain major nutrients needed for daily requirements. Each serving typically contains 200 - 250 calories and replaces one meal. (Note: Using them for all meals reduces calories to a severe extent and can be harmful.)

One study reported that most subjects who had undergone a 12-week weight loss program followed by using Ultra Slim Fast supplements as directed for maintenance kept off more than half their weight loss after more than 3 years. A quarter of the subjects were still losing weight.

Magnesium and Diet

Medical evidence suggests that a diet rich in magnesium could reduce a person's risk of metabolic syndrome, a cluster of problems that include obesity, high blood pressure, and high cholesterol. Metabolic syndrome can lead to diabetes and heart disease. Epidemiological studies have found that the risk for metabolic syndrome decreases in those who consume the highest amounts of magnesium from meals.

Medications

There are several different drugs used for weight loss. Unless specifically instructed by a doctor, people should use non-drug methods for losing weight. Except under rare circumstances, pregnant or nursing women should never take diet medications of any sort, including herbal and over-the-counter remedies. While weight loss drugs in general have shown some benefit, the overall weight loss achieved is generally limited. In addition, people will usually regain the weight when they discontinue the medication.

Over-the-Counter Weight Loss Products and Herbal Remedies

About 7% of American adults use nonprescription weight-loss products. People must be cautious when using any weight-loss medications, including over-the counter diet pills and herbal remedies. Buying unverified products over the Internet can be particularly dangerous.

Green Tea. Some studies have suggested that regular tea drinking is associated with lower weight, particularly in people who drink it for years. Green tea specifically has been associated with increased energy expenditure. One study reported that people who took a green tea extract (Exolise) lost weight and reduced their waist size. However, better evidence is needed to confirm the results on this supplement.

Thermogenic Approach to Weight Loss. An approach to weight loss called thermogenic (or hepatothermic) therapy is based on the claim that certain natural compounds have properties that enable the liver to increase energy in cells and stimulate metabolism. Theoretically, the result would be fat loss. Among the substances used in such products are EPA-rich fish oil, sesamin, hydroxycitrate, pantethine, L-carnitine, pyruvate, aloe vera, aspartate, chromium, coenzyme Q10, green tea polyphenols, aloe vera, DHEA derivatives, cilostazol, diazoxide, and fibrates drugs.

Nearly all the current over-the-counter dietary aids contain some combination of these ingredients. There is no evidence that any of these ingredients can produce weight loss, and some may even have harmful effects.

Chromium is a common ingredient in many diet supplements (such as Xenadrine, Dexatrim, Acutrim Natural, and Twinlab Diet Fuel). It is claimed to specifically promote fat loss, rather than lean muscle loss. Some evidence suggests that niacin-bound chromium may improve insulin sensitivity. On the negative side, animal studies have suggested that chromium may have damaging effects on genetic materials in cells. This could cause sterility.

Warnings on Some Ingredients in Over-the-Counter Diet Products

Ephedra, Ephedrine, and Ma Huang. The FDA does not allow the sale of drugs that contain ephedrine. In May 2004, the FDA banned the sale of dietary supplements that contain ephedra (also called Ma Huang). Ephedra can cause serious side effects, including strokes and heart attacks.

Brazilian Diet Pill. The FDA has warned consumers not to buy a product known as the "Brazilian diet pill." This product is labeled as a dietary supplement, but contains several chemicals found in powerful prescription drugs. The products are also known as Emagrece Sim and Herbathin dietary supplements.

Conjugated Linoleic Acid (CLA). Conjugated linoleic acid is found in many dietary products (such as Biosculpt Liquid, Body Success, and GNC Optibolic Body Answers Dietary Formula). There is no evidence that it produces weight loss. Furthermore, there is some concern that CLA might increase insulin resistance and a dangerous inflammatory response in people with obesity.

Tiratricol. Over-the-counter products containing tiratricol, a thyroid hormone, have been sold for weight loss. Such products may increase the risk for thyroid disorders, heart attack, and stroke. Tiratricol is also known as triiodothyroacetic acid or TRIAC.

Laxative Actions in Natural Substances. Many dietary herbal teas contain laxatives, which can cause gastrointestinal distress, and, if overused, may lead to chronic pain, constipation, and dependency. Rarely, dehydration and death have occurred. Some laxative substances found in teas include senna, aloe, buckthorn, rhubarb root, cascara, and castor oil.

Guar Gum. Some fiber supplements containing guar gum have also caused obstruction of the esophagus and gastrointestinal (digestive) tract.

Chitosan. Chitosan, a dietary fiber from shellfish, prevents a small amount of fat from being absorbed in the intestine. Well-conducted studies, however, have not found it to be effective. Products containing it include Natrol, Chroma Slim, and Enforma. People who are allergic to shellfish should not take these supplements.

Plantain. Dietary remedies that list the ingredient plantain may contain digitalis, a powerful chemical that affects the heart. NOTE: This substance should not be confused with the harmless banana-like plant also called plantain.

Orlistat (Xenical)

Orlistat (Xenical) can help about one-third of obese patients with modest weight loss and can help in long-term maintenance of weight loss. It works by slowing the absorption of fat in the intestine (by about 30%). The average weight-loss attained is around 6 lbs. with use of this drug. However, many people regain a significant portion of this weight within 2 years. While it does not work for all patients, orlistat may delay or even prevent the onset or progression of diabetes, and improve cholesterol levels, regardless of weight loss.

Orlistat can cause gastrointestinal problems and may interfere with absorption of the fat-soluble vitamins A, D, and E and other important nutrients. The most unpleasant side effect is leakage of oily feces from the anus. Restricting fats can reduce this effect. People with bowel disease should probably avoid it. In spite of these side effects, most patients are able to tolerate this agent.

In February 2007, the FDA approved an over-the-counter version of orlistat. Sold under the name alli, it is available at half the prescription strength of Xenical. Those eager to use the new pill should consider its cost (around \$100 per month) and modest benefits compared with its side effects, most commonly oily diarrhea.

Note: This pill, which prevents fat absorption from food, also increases the risk of not absorbing important nutrients from food while using it. The FDA recommends taking a daily multivitamin supplement when using alli.

Sibutramine (Meridia)

Sibutramine (Meridia) helps balance the brain chemicals serotonin and norepinephrine. This helps increase metabolism, causes a feeling of fullness, and increases energy levels. It may be particularly useful for binge-eaters. Studies indicate that sibutramine is effective in achieving weight loss, although the weight loss slows considerably after the first 3 months. The average one-year weight-loss using this drug is around 9 lbs. The drug also appears to improve cholesterol and lipid (fat) levels, and it may have other effects that benefit the heart.

Side effects of sibutramine are common. They include dry mouth, constipation, and insomnia. Many patients discontinue the drug as a result of these side effects. There have been reports of increases in heart rate and blood pressure while taking this medication.

At this time, people who have a history of high blood pressure, stroke, heart disease, or arrhythmias should not take this drug. People taking decongestants, bronchodilators (such as for asthma), monoamine oxidase inhibitors, or serotonin reuptake inhibitors should also avoid sibutramine.

Psychostimulants

Phentermine and Other Sympathomimetics. Sympathomimetics are drugs that act like the stress hormone (and chemical messenger) norepinephrine. These medications act as stimulants in the brain. Some are approved for treating obesity, but only for short-term use of 12 weeks or less.

Average weight-loss has been in the range of 7 lbs. over the short-term. These medicines include:

- Phentermine (Ionamin, Adipex-P, Fastin)
- Benzphetamine (Didrex)
- Phendimetrazine (such as Adipost, Bontril, Melfiat, Plegine, Prelu-2, and Statobex)

Phentermine is the most commonly prescribed appetite suppressant, and is less expensive than orlistat or sibutramine. Its effects are not long lasting, however. It can also raise blood pressure. In addition, phentermine is associated with depression, which is already a problem in many cases of obesity. A combination (Phen-Pro) containing phentermine and the antidepressant fluoxetine (Prozac) is being investigated to help reduce this problem. Note: Neither phentermine nor such combinations are associated with the heart problems linked to the previous phentermine combination known as Fen-Phen (phentermine and fenfluramine).

Amphetamines. The amphetamines dextroamphetamine (Dexedrine), methamphetamine (Desoxyn), and phenmetrazine (Pleudin) are powerful stimulants. They were used most often in the past but are no longer prescribed for weight loss. These drugs improve mood and produce some modest weight loss over the short term, but carry serious risks of addiction, agitation, and insomnia.

Investigative Drugs

Rimonabant. Rimonabant (Accompli) belongs to a new class of drugs called selective CB1 blockers. The drug is designed to block receptors in the brain associated with the regulation of eating. Rimonabant also targets receptors in fat tissue.

Studies involving the drug reported that obese patients treated with 20 mg of rimonabant lost significantly more weight and inches from their waist than patients who received placebo. The drug also appeared to have beneficial effects on raising HDL ("good") cholesterol levels. However, in April 2007 an FDA advisory panel rejected the drug, citing fears it may cause psychiatric problems and seizures in some patients.

Note: Fake rimonabant has been found for sale on several web sites. Patients should be aware that this drug is still experimental, and rimonabant is not available for sale. Buying and taking counterfeit drugs can have serious health consequences.

Topiramate. Topiramate (Topamax) is an anti-seizure medication being investigated for weight reduction. Several clinical trials have reported that obese patients with type 2 diabetes given topiramate lost more weight than those receiving placebo. Weight loss was sustained for up to 1 year. The drug is also being studied for binge-eating disorders associated with obesity. However, psychiatric and neurological side effects may prevent topiramate from being used regularly.

Cellulite Treatment

Cellulite-Removal Creams. Many women try to reduce fat in their thighs (cellulite) with creams that contain aminophylline (such as Skinny Dip, Thermojetics Body Toning Cream, and Smooth Contours). Studies provide no evidence that these creams are effective. Their apparent effect on fat may simply be from narrowing blood vessels and forcing water from the skin, which could be dangerous for people with blood flow problems.

Endermologie. Endermologie uses motorized rollers and regulated suction to smooth out cellulite.

Surgery

Surgical procedures for obesity may be appropriate for some dangerously obese people, and they may reduce heart problems and many of the risks associated with obesity. These risks include high blood pressure, sleep apnea, and diabetes. In fact, some evidence suggests that surgery may provide much greater control of weight and diabetes than nonsurgical weight-loss methods. Studies are reporting significant reductions in diabetes, and the need for diabetic medications, after surgery. Other medical conditions that often improve after surgery include heartburn, arthritis, and other joint and circulation problems.

The care of patients undergoing bariatric surgery, before and after surgery, requires specialized expertise and facilities. Studies have shown that the likelihood of complications is significantly associated with the experience of the surgeon and staff.

Bariatric surgeries produce weight loss through one of two approaches:

- **Restrictive Banding Procedures.** These procedures restrict the amount of food by closing off parts of the stomach with bands.
- **Malabsorptive Bypass Procedures.** This approach restricts the amount of food and also reduces absorption by using a bypass of parts of the intestine.

The malabsorptive procedures are more successful in achieving weight loss than the banding approach, but they carry a greater risk for nutritional deficiencies.

Benefits of Bariatric Surgery

Most people who have bariatric surgery lose about two-thirds of excess weight within 2 years. In addition, diseases associated with obesity (such as diabetes, high blood pressure, sleep apnea, joint pain, and incontinence) often improve.

Researchers at the Mayo Clinic looked at records from patients who had the surgery between 1990 and 2003. They found that those who had bariatric surgery reduced their risk of cardiovascular events such as a heart attack much more than those who lost weight without surgery. The findings were published in the September 2005 *Mayo Clinic Proceedings*.

Other studies have shown that even though most patients maintain significant weight loss, the majority regain about 10% of their weight. Patients must still develop a healthy lifestyle and be calorie conscious after the operation. Follow-up must be lifelong.

Candidates for Bariatric Surgery

Any surgical candidate must have failed consistently in losing weight through less invasive methods. Experts recommend bariatric surgery only for the following:

- Those whose BMI is above 40 (about 100 pounds overweight)
- Those with a BMI of over 35 who have type 2 diabetes or serious obesity-related medical problems
- Those with severe obesity that interferes with employment, normal physical activity (such as walking), and important relationships

Patients with binge eating disorder should be identified before surgery and treated. A full evaluation, including a psychological evaluation, should be performed on all candidates for surgery.

Depending on insurance coverage and which procedure is performed, the cost of bariatric surgery may be up to \$35,000

Patient considering bariatric surgery should be well-informed regarding the procedure, its efficacy, side effects, and complications. They should also understand the following:

- Lifestyle and behavioral changes will still be needed after surgery, including:
- The continued need to focus on weight
- The need to chew food well
- The need for dietary restrictions
- The need for vitamin and mineral supplementation
- Patients will be unable to eat large meals.
- Surgery may not be successful in achieving significant weight loss.

Restrictive Banding Procedures

About a third of people who undergo these procedures achieve normal weight, and 80% experience some weight loss. They are less successful than the bypass procedures, but carry a lower risk of nutritional deficiencies.

Laparoscopic Gastric Banding. Laparoscopic gastric banding (the Lap-Band) usually does not require a major incision and avoids some of the major complications of gastric bypass. Patients lose almost one half of their excess weight after this procedure. Some smaller trials have shown remission of type 2 diabetes in over 70% of patients having the surgery, compared to around 10% treated medically. Death during or after the surgery occurs in fewer than 1/1000 of these procedures.

The Lap-Band procedure restricts the amount of food a person can eat and gives the feeling of fullness. It employs an adjustable silicone band that is placed around the upper part of the stomach. A small balloon-like reservoir attached to the band under the abdominal skin contains saline, which can be added or removed to tighten or loosen the band.

The band is removable, if necessary. Studies to date indicate that the intestinal tract returns to normal afterward. Studies, including those done in the elderly, have reported significant weight loss and improved quality of life with the procedure.

Vertical Banded Gastroplasty. Vertical banded gastroplasty (VBG) was the most common restrictive procedure. It involves creating a hole through both stomach walls and sealing the edges with a staple. This narrows the stomach, similar to a funnel, and allows only small amounts of food to pass through. This procedure is rarely done today, as it has a higher failure rate than laparoscopic gastric banding.

Malabsorptive Bypass Procedures

Malabsorptive procedures produce greater weight loss than restrictive procedures. Patients generally achieve about two-thirds of their weight loss within 2 years. Furthermore, in a 2003 study, after standard bypass surgery, 83% of patients with type 2 diabetes had normal blood glucose levels, and the rest had significant weight reductions.

Roux-en-Y Gastric Bypass Procedure. This is the most common and successful malabsorptive surgery in the United States. It involves creating a small stomach pouch that serves as a reservoir and restricts food intake. The pouch eventually holds up to 3 ounces of food and has a small outlet that delays emptying and causes a feeling of fullness. Then the surgeon creates a Y-shaped section in the small intestine that

attaches to the pouch. This section allows food to bypass the lower stomach and upper part of the intestine.

Patients on average lose about 60% of their excess weight. Studies have shown improvements in control of type 2 diabetes and reduction in blood pressure. The procedure produces greater and more sustained weight loss than banding procedures, but it is also more complicated. Laparoscopy techniques, which are less invasive, are now preferred over open surgery. They achieve equally good results with fewer complications. Death during or after the surgery occurs in five out of 1000 patients having this procedure.

By definition, these procedures bypass the first part of the small intestine and carry poorly digested food to a part of the intestine that cannot absorb it as easily. Some patients develop what is called dumping syndrome. Symptoms include nausea, vomiting, bloating, cramping, diarrhea, sweateness, dizziness, and fatigue. These problems occur anywhere from immediately after eating to 3 hours afterwards. Patients with this problem carry a higher risk of nutritional deficiencies.

Biliopancreatic Diversion. This procedure is more complicated and removes portions of the stomach. The pouch that is created attaches directly to the lower part of the small intestine. It poses a higher risk for nutritional deficiencies than other procedures and is not used as often. This procedure is generally reserved for the "super-obese." Patients may lose around 70% of their excess weight. Death during or after the surgery occurs in around 1 out of 100 patients having this procedure.

Side Effects and Complications

General Side Effects and Complications. Side effects and complications of bariatric procedures are common, and up to 25% of patients need corrective or repeat procedures. After any of these procedures people must chew all their food carefully, and they cannot eat large amounts of food at one time. If patients do not follow these guidelines, they will experience nausea, abdominal distress, or both.

Complications from any bariatric procedure include:

- Vomiting: This is the most common complication, and it is most common with banding procedures. It is generally a result of eating more than the reduced stomach size can hold. With laparoscopic banding, adjustment of pouch size can be performed relatively easily.
- Heartburn, gastritis, and problems swallowing
- Nutritional deficiencies: There is a strong risk of nutritional deficiencies, particularly with malabsorptive operations. This complication can lead to anemia, due to either iron or vitamin B12 deficiencies. Nutritional deficiencies can also increase the risk of bone loss and osteoporosis, due to calcium deficiency. Taking enough mineral and vitamin supplements is important after bariatric surgery.
- Deep-vein thrombosis: There is a significant risk for deep-vein thrombosis (blood clots in the veins).
- Abdominal hernia: This is another common complication. Newer, laparoscopic techniques do not carry this risk, but not all individuals are candidates for this less-invasive approach.
- The stomach pouch can break down over time and need repair.
- Rapid weight loss after surgery: This complication puts people at high risk for gallstones.
- Women who wish to be pregnant should wait until their weight has stabilized. Rapid weight loss and nutritional deficiencies can harm the fetus.

People at highest risk for complications are those with heart or lung problems, severe obesity, and a history of abdominal surgeries. The mortality rate from bariatric surgeries is 0.2%, which is lower than the mortality rates from severe obesity itself.

Specific Complications of Restrictive Banding Procedures. Nausea, vomiting, or both occurs in half of patients, and severe heartburn occurs in a third. Device-related complications include band slippage, pouch dilation (widening), or both in nearly a quarter of patients, and obstruction in 12% of patients. Very serious complications are rare, but they can include blood clots, bleeding, infection, pneumonia, and perforation (tearing) of the stomach.

Specific Complications of Malabsorptive Bypass Procedures. Vomiting often occurs. Nutritional deficiencies occur more often in these procedures.

Care after Bariatric Procedures

Most people stay in the hospital for a few days after gastric bypass surgery. Patients are discharged when they can:

- Eat liquid or pureed food without vomiting
- Move without too much discomfort
- No longer need pain medication given by injection

Patients continue to eat a liquid or soft diet for several weeks after the surgery. In patients receiving a pouch procedure, the pouch eventually expands to about one cup of chewed food (a normal stomach can hold up to one quart).

Follow-up appointments are essential to determine if nutritional supplements, such as iron, calcium, vitamin B12, or other nutrients, are needed. Supplements, such as a multivitamin with minerals, may be prescribed.

Patients should eat small meals (usually six) throughout the day, rather than large meals that the stomach can no longer handle.

The new stomach probably won't be able to handle both solid food and fluids at the same time. Patients should separate fluid and food intake by at least 30 minutes and only sip what they are drinking.

After surgery, tolerance of fat, alcohol, or sugar decreases. Patients should reduce their fat intake, especially:

- Deep-fried foods
- Fast-food meals
- High-fat foods
- High-sugar foods, such as cakes, cookies, and candy

Exercise and the support of others (for example, joining a support group with people who have undergone weight-loss surgery) are extremely important in achieving and maintaining weight loss after bariatric surgery.

Exercising can usually resume 6 weeks after the operation. Even sooner than that, most patients will be able to take short walks at a comfortable pace, after consulting with their doctor.

Liposuction

Liposuction eliminates fat in specific areas, such as the abdomen, thighs, buttocks, or knees. Special instruments are inserted through the skin into the pockets, and suction is used to move the fat, break it up, and remove it. Small tubes may be used to drain blood and fluid during the first few days. The pain after the operation can be severe, and often the skin does not contract, resulting in a flabby look. Complications can include burns from the vibrators, bruising, blood clots, and bleeding. Weight gain generally tends to develop in other locations after the operation. Some doctors are using this procedure in overweight people with

diabetes to remove abdominal fat. Although there is no proof that it has an effect on diabetes, some experts believe the procedure deserves attention.

Resources

- www.healthierus.gov/dietaryguidelines -- Dietary Guidelines for Americans 2005
- www.naaso.org -- North American Association for the Study of Obesity
- www.eatright.org -- American Dietetic Association
- www.nutrition.gov -- Nutrition.gov
- www.asbs.org -- American Society for Bariatric Surgery
- www.cnpp.usda.gov -- Center for Nutrition Policy and Promotion
- <http://fnic.nal.usda.gov> -- Food and Nutrition Information Center
- www.americanheart.org -- American Heart Association
- www.nationaleatingdisorders.org -- National Eating Disorders Organization
- www.aabt.org -- Association for Advancement of Behavior Therapy
- www.fda.gov -- Food and Drug Administration
- <http://win.niddk.nih.gov> -- Weight-Control Information Network

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