

Obesity and weight control

Obesity is almost always brought about by the intake of more energy (food) than is necessary for day-to-day living. The excess energy consumed is stored as fat and this can be lost only by using up more energy than is eaten (excluding the surgical removal of fat). The fat may be laid down quite slowly or it may be accumulated rapidly. Once fat has been stored, eating just enough each day to balance energy output will leave accumulated fat unchanged. Obese people may therefore correctly state that they now eat only as much as many thin people yet they remain fat. As many obese people are inactive and because they are well heat-insulated by the fat under the skin, their food requirements may indeed be quite small but they must nevertheless eat less energy than they expend if they are to lose weight.

During the 1980s and 1990s the intake of energy in the United Kingdom fell but the fall in physical activity was even greater resulting in an increase in general body weight. Almost everybody in the United Kingdom is aware of obesity: it can be recognised easily by most people, there is repeated reference by the media and governmental offices of the need to control it, but there is only very little success in dealing with the problem.

Control of body weight

There is a general view that getting fatter on getting older is natural and it is certainly what happens with many people who can afford an ample supply of palatable food. But not everybody gains weight on ageing. In fact, some people maintain a remarkably stable weight over their entire adult life apart from fluctuations that occur during bouts of illness or during pregnancy and lactation. The way in which body weight is controlled is not understood in sufficient detail, but it is known that in the part of the brain called the hypothalamus there are two areas (centres), one of which causes eating to continue (the feeding centre) and the other causes eating to stop (the satiety centre). If the feeding centre is damaged, an animal will starve to death even though there is plenty of palatable food available. On the other hand, if the satiety centre is not working properly, an animal will continue to eat until it

becomes grossly obese. Similar centres in the brains of humans work in the same way but damage to them is very rare and unlikely to be the cause of obesity.

In addition to these nervous centres, there is at least one chemical in the blood which helps the centres to control energy balance. This substance is a protein called leptin, which is secreted into the blood by the cells which store fat (adipocytes). It is encoded by the *ob* (obesity) gene. Leptin passes via the blood to the centres in the hypothalamus and signals either how much fat there is in the body or the rate of fat formation or both of these. With a rise in blood leptin there is normally reduction in eating and a simultaneous fall in insulin and cortisol secretion into the blood, which causes a fall in fat formation by a direct action on the fat cells. There is, in addition, a rise in energy expenditure. In obese people, instead of there being a lack of leptin there is an increase of it in the blood, indicating that the hypothalamus has become less sensitive to its signal, possibly because it does not pass sufficiently well from the blood to the brain cells or because the cells have become resistant to it. On very rare occasions there may be a defective *ob* gene present, causing a fall in leptin in the blood and the expected gross obesity.

Obesity is often seen to occur in family groups and it is not always easy to decide whether the cause is chiefly genetic or chiefly cultural. The discovery of the rare abnormal *ob* gene and its effect on blood leptin is evidence for some genetic basis of obesity. Another is the observation that infants separated from their biological parents at birth develop body weights more like their biological parents than like the body weights of their adoptive parents. The greatest similarity is between mothers and daughters. It has also been found that identical twins generally keep remarkably similar body weights over the years.

All the known mechanisms for weight control cannot completely account for the remarkable control of body weight that exists over many years. None of them seems likely to adjust the energy intake so carefully as to prevent a daily excess of 50 kcal being eaten, yet such an excess would cause severe obesity over time unless an as yet unknown and very delicate controlling system were present.

It has been suggested that excess food can be burned off by special cells (called brown fat) in order to keep body weight constant and that obese people may be deficient in this regard. Although this mechanism, called diet-induced thermogenesis (DIT), may operate in some animals it seems not to be of importance in humans.

What constitutes obesity?

Obesity exists when the stores of body fat are excessive. It must not be confused with a high body weight because of bulky muscles or excess body water.

The true measurement of body fat is not feasible in day-to-day investigations but an assessment can be made by use of the body mass index (BMI). To derive the body mass index the subject's weight in kg (with light indoor clothing but without shoes and with the bladder emptied) is divided by the square of the height measured

Body mass index

Below 20: probably too thin
 20–25: good
 25–30: mildly overweight; usually no
 treatment necessary
 30–40: obese; should lose weight
 Over 40: gravely obese; needs
 urgent treatment

in metres. For example, an average adult who is not obese might weigh 70 kg and have a height of 1.8 m. The height squared in this example (1.8×1.8) is 3.24 and dividing the weight of 70 kg by 3.24 gives a body mass index of 21.6. This is also called Quetelet's index. People with values of 20–25 are considered to be in the desirable range because they have the lowest mortality rate (from all

causes). As the index rises above 25 the mortality rate also rises. For values of 25–30 the mortality rate rises only slowly and these people are considered to be only mildly overweight and probably do not need corrective treatment unless they have a wish to be thinner. If the index goes above 30, however, the mortality rate rises more steeply, so that somebody with an index of 30–35 is probably being damaged by their obesity. Those whose index is above 40 are gravely obese and need urgent medical attention.

Another assessment of body fat can be obtained by measuring the thickness of pinched-up skin over the upper arm, the hip and the shoulder-blade. This method requires a special device for measuring the thickness, some skill and is not always convenient. It is not useful when the skin is tense, as in marked obesity.

The above two methods are useful as quick convenient guides, but the results must be interpreted carefully for each subject. For example, when a non-obese but very muscular person of 80 kg with a body mass index of 27 becomes inactive much muscle may be replaced by fat. The body weight may still be 80 kg and the index remains at 27. Despite having the same body weight of 80 kg and an index of 27 throughout, this subject has passed from being not overweight to being mildly overweight as muscle is replaced by fat.

Losing weight

Many people attempt to lose weight and most are successful to some degree for a while, but after a year or so almost all are back to their original weight. Losing weight and staying thinner is clearly a difficult thing to do.

Before starting on a slimming regime the subject should be sure that there is a need to lose weight, that there is sufficient motivation to do so and that it is understood that eating habits will have to be changed permanently and that circumstances will allow for this. Further, although losing weight may bring better health, better appearance, more comfort and improved job prospects, it will not necessarily bring happiness or cure all problems.

At the start of a slimming regime a realistic target should be set and some degree of flexibility allowed for. Some people lose weight more easily than others. For most, there is no urgency to lose weight and a reduction of about 0.5 kg (1 lb) per

Losing weight

In mild overweight, losing about 250 g (about 0.5 lb) per week is a satisfactory rate: losing more than about 500 g (about 1 lb) per week is often too much.

week after the first four weeks can usually be achieved without causing much hunger or loss of muscle Power. During the first week or two there is a loss of stored carbohydrate (glycogen) and its accompanying water, amounting to about 4 kg, after which the fall in weight slows down. This has nothing to do with the amount of water taken. No

attempt should be made to lose weight by drinking less fluid, which can be harmful and has no effect on the rate of loss of body fat. Diuretics should never be taken to reduce body weight.

Losing weight at a slow rate has two advantages. First, the reduction in food intake is small and most people can soon accommodate to it. Second, it enables the subject to get used to a new style of eating over a substantial period and this new eating pattern can gradually and permanently replace the previous one.

Body weight should be measured about once a week, using the same scales in the morning before eating or drinking and after emptying the bladder. Change in body water and in the weight of the contents of the gastro-intestinal tract can together cause a 0.5–1.0 kg variation each day even on a constant food intake. It may take a few weeks to find the amount of food needed for the rate of weight loss desired.

The diet should be as varied as possible with only a little fried foods, fatty meat, full-fat cheese, biscuits, cakes, fat spreads, snack food and alcohol. Intake of fruit and vegetables should be increased.

Diets designed to achieve rapid loss of weight can be dangerous and do not teach a satisfactory eating habit. Unlike the very small effect that losing weight slowly has on general well-being, the debilitating effect of rapid weight loss can be very marked. People taking only about 1800 kcal/day, which is near the resting metabolic rate, have a fall in metabolic rate, a fall in the pulse rate, a decrease in general activity and a decrease in tolerance to cold. All these changes are attempts by the body to conserve energy and result in a diminution of the rate of weight loss. In addition, a much reduced energy intake may produce a constant anxiety about food, irritability, lack of interest in everyday things and some degree of depression. These mental changes may persist for months after normal eating is resumed.

If, during dieting, much exercise is taken, muscles may hypertrophy, so that although fat is being lost, body weight may not be declining very much. An inactive dieter may show greater weight loss but the very active person will probably be much fitter.

People only mildly overweight (body mass index 25–27) may find that the small advantages of their losing weight are not worth the effort of dieting and will very likely be better off doing nothing. This is especially so for the elderly.

A body mass index greater than 35 needs specialist advice immediately at an obesity clinic. In addition to being obese there are very likely medical problems requiring attention.

There are no such things as slimming foods: all foods will result in overweight if enough is eaten. No food can make you thinner. Pills and preparations to lose weight should never be taken except on medical advice.

Complications of obesity

Obesity can cause both physical and psychological damage and is associated with a decreased life expectancy. Of the numerous medical conditions found in obesity, diabetes mellitus is perhaps the most important. It is about five times more likely to be the cause of death in obese men than in thin men and it causes death nearly ten times more often in obese women than in thin ones. In addition, before these diabetics die they often have several years of poor quality life brought about by the diabetes. Losing weight, especially in the earlier stages of the disease, brings improvement and, even if this is not marked, further complications may be avoided for many years.

Also found in obese people, particularly younger ones, is ischaemic heart disease which may be accompanied by high blood pressure (hypertension), although this latter condition is not itself now thought to be due directly to obesity. Losing weight brings improvement in the ability to climb stairs, carry parcels, walk uphill and to occasionally run. Part of this improvement in exercise tolerance on losing weight is due to the respiratory system becoming healthier.

An important problem common in obesity, although not life-threatening, is damage to weight-bearing joints. Osteoarthritis of the hips, knees and ankles along with damage to the feet limits mobility and causes pain.

Gall-bladder disease is more prevalent in overweight people and its treatment less satisfactory.

Surgical operations are often more hazardous and the outcome likely to be poorer in the obese because operations may be more difficult for the surgeon, while the anaesthetist may have to cope with a failing heart and an inadequate respiratory system.

Other conditions commonly found in obese people are varicose veins, stretched skin causing permanent disfigurement, and irritation and infection of skin produced by chronic accumulation of sweat between folds of skin and under the breasts.

As so many of the problems associated with obesity limit mobility, sometimes severely, the exercise option for aiding weight loss is often not very useful, which means that reduction in food intake must be greater than it would be in more mobile subjects. Markedly obese people are usually very inactive, even fidgeting being almost absent. This physical inactivity plus their better heat insulation results in the obese needing relatively little food. However, if an obese person is able to be

active, the physical effort of carrying the excess fat uses up much energy and thereby greatly aids weight loss.

In addition to these ailments, obese people quite often have emotional problems because they find it more difficult than thin people to find a spouse, get a job, partake in sports and sometimes in travelling by public transport or even by private car. In western societies there is often considerable prejudice against the obese.

Natural tendency to overweight

It is not generally possible to foretell among the young who are going to become overweight. The fate of frank over-eaters is often clear, but over-eating need be only small for it to culminate in overweight. Inadequate energy expenditure for the amount of food eaten may also be small and not at all obvious before overweight becomes apparent. Many people are able to match their energy intake and output so as to remain almost the same weight over many years but some seem to lack this ability. Whether overweight is mainly an inherited trait is not known but it is possible. Becoming moderately overweight has survival value, enabling energy to be stored when food is plentiful as a precaution against starvation when food is scarce. It is only in affluent societies that moderate overweight becomes unnecessary.

Anorectic drugs



These are substances that help in weight loss by decreasing appetite. They are mainly amphetamine and its derivatives and all have undesirable side-effects. Experience with them is that, although they may help to control hunger and increase weight loss at first, they generally lose their efficacy after a time. So far, there is no drug which will produce effortless weight loss without side-effects. The current drugs may help some individuals in the

initial stages of dieting but the only satisfactory way to produce a permanent reduction in body weight is for the subject to learn to eat a good mixed diet in the quantity necessary to maintain a body mass index of 20–25. Anorectic drugs should never be taken except under the guidance of a medical specialist.

Metabolism-boosting drugs

The most efficient of these substances are the thyroid hormones. However, doses which increase metabolism sufficiently to produce a useful loss of weight usually cause undesirable side-effects, particularly damage to the heart. Furthermore, they often cause an unwanted loss of the non-fat tissues of the body rather than just a

loss of fat. The only time when thyroid hormones are needed by obese people is when they have a poorly functioning thyroid, but this is uncommon.

Slimming groups

These are of particular value to people who are only moderately obese (body mass index 25–30). Some groups are run for profit while others are on a non-profit basis. The techniques used by different groups vary a lot, so it is important to find a suitable one. The main advantage of joining a slimming group is the mutual support provided by its members. The exchange of ideas and advice helps members to think constructively about their problem and the feeling of not being alone helps some people. The need to eat less and exercise more still remains.

Childhood obesity

It can be difficult to determine minor degrees of obesity in childhood although grosser states can be defined. It is sometimes said that fat children become fat adults but it does not seem to be true. Of a group of obese 36 year-olds only about one-quarter were obese as children. This suggests that treating moderately obese children would not drastically reduce the number of obese adults. As many children change their degree of obesity several times over a few years, minor overweight should be ignored in otherwise healthy children.



Much childhood obesity seems to be familial or cultural and one of the ways to help limit overweight in children is to prevent sweets, cakes and biscuits being used as bribes or as a solace. If a child is taught that food can compensate for unhappiness, adult obesity may well be the result.

If it is thought necessary to limit the rate of weight gain in a child, expert medical advice should be sought. Unlike an adult, where simply keeping an unvarying weight is the goal, a child must be allowed to gain weight and designing a restricted but healthy diet for this is difficult. Encouraging a child to take plenty of exercise is better than merely limiting the energy intake and it may help the child to take a keen interest in its physical abilities and appearance. This is more likely to have long-term success than simply restricting the diet.