

36. Obesity

Author

Stephan Rössner, MD, PhD, Professor, Obesity Unit, Karolinska University Hospital, Stockholm, Sweden

Summary

Body weight is the outcome of an energy balance, i.e. energy intake minus energy expenditure. While it is relatively easy to limit the daily energy intake by a few hundred kilocalories (kcal), it is significantly more difficult to increase the level of energy expenditure. In addition, activity advice given to overweight or obese individuals must be realistic as their mechanical ability may be impaired as a consequence of being overweight and obese. A small step forward such as an increased daily expenditure of 50–100 kcal is in fact an achievement and improvement as long as it is maintained. The long-term energy balance is most significant, largely involving a change in lifestyle. Choosing activity (walking, cycling, taking the stairs) instead of inactivity (watching TV, driving, taking the escalator). “Everyday physical activity” (also referred to as NEAT – Non-Exercise Activity Thermogenesis) is evidently effective and should be encouraged. Also, the extra muscle mass gained through physical activity improves the basal metabolism, making weight control easier. Successful weight loss through physical activity is just as much about eliminating mental obstacles as about actually performing physical activities.

Definition

Obesity is today the leading nutritional disorder in the Western World. There are more people in the world today that eat themselves to death than starve to death and international comparisons have made it possible to follow this explosive growth in obesity problems (1). The change in lifestyle that has occurred in the Western World over the past three to four decades has, for example, only been evident in Southeast Asia in the last couple of years. In the Pacific Islands, the most obese part of the world, more than 50 per cent of the population is obese. This dramatic trend of increasing overweight and obesity is now evident all over the world with a variety of illnesses that follow in its wake, further highlighting the consequences of obesity.

In Sweden, the number of obese people has increased by around 50 per cent in the past 25 years. This development is illustrated in Figure 1. Today, approximately 10 per cent of

the male population and 12 per cent of the female population are considered obese, defined as a body mass index (BMI) above 30 kg/m^2 . BMI is calculated as the body weight in kg divided by the square of the height in meters (kg/m^2). Whereas there is plenty of data about the prevalence of obesity among the adult population, there is significantly less data about children and adolescents. However, with regard to Swedish military servicemen, i.e. young men enrolling for compulsory military service at the age of 18, the data available is particularly reliable and indicates a dramatic increase in obesity. The proportion of obese 18-year-old men increased from 0.9 to 3.8 per cent from 1970 to 1994 (2). No comprehensive representative data exists in Sweden concerning children, although around 20 per cent are estimated to be obese. This figure is rising and the problem with obesity in Sweden is growing throughout the country regardless of age or social group. Most affected at the moment are middle-aged individuals in the inland parts of Norrland.

Obesity develops gradually. Our metabolism peaks at the age of 20, whereupon the basal metabolism decreases by about 1 per cent per annum. This means that young individuals of a normal weight will gain an average of 3–4 kg every decade. However, the risk of gaining even more weight than this increases for individuals that are overweight in childhood. It is estimated that many young people with childhood obesity gain around 1 kg in weight every year.

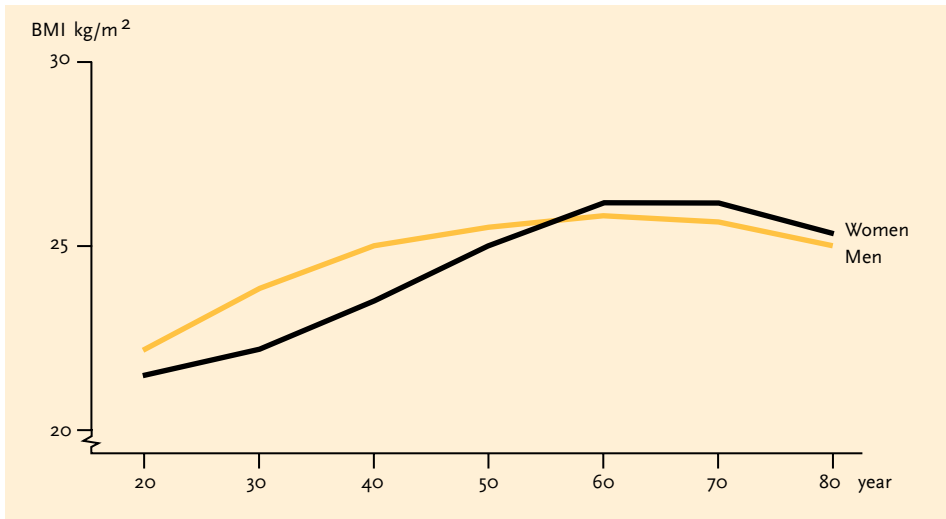


Figure 1. Weight development in Sweden over the past 25 years.

Most of the data available is cross-sectional, i.e. relating to individuals of different ages. No adequate longitudinal study has yet monitored the weight of individuals throughout their entire life. However, the cross-sectional data available indicates that the average weight of the population increases continuously until around 65 years of age when it starts to decrease (see Figure 2). There are many reasons for this break in the trend. It seems reasonable to assume that the older age group would include individuals that have passed away due to

complications caused by obesity and are thereby excluded from the statistics, which leaves behind less weighty and healthier individuals of a similar age. It is also possible that the muscle tissue deterioration or sarcopenia seen in older people leads to a weight loss except this is usually only a shift from less muscle tissue to more or an unchanged amount of fatty tissue. It is merely a shift of tissue proportions. In addition, the degree of tissue hydration decreases with age, affecting the body weight. Longitudinal data is still sparse. No study has monitored the weight of individuals throughout life. However, the preliminary data available shows that older people are also subject to a continuous weight increase.

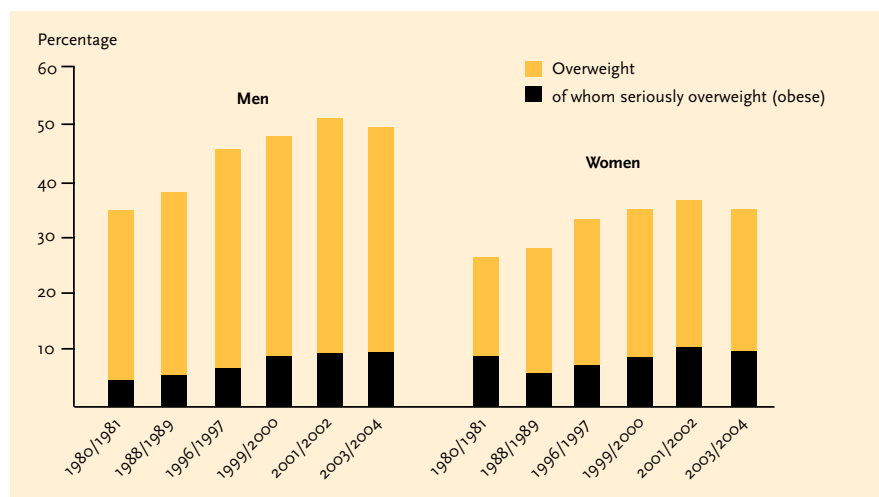


Figure 2. Cross-sectional data relating to weight developments in different age groups in Sweden.

As mentioned above, the obesity is defined using BMI kg/m^2 , a measurement that was first used in the middle of the 19th century to calculate relative body weight and compare individuals. The World Health Organization, WHO, uses BMI to define obesity as illustrated in Table 1. However, it is worth noting that the BMI value is neither age nor gender standardised and consequently provides an approximate estimate of the degree of obesity. A recurring objection to the use of BMI, particularly among athletes, is that BMI is an insufficient index of body fat as many well-trained individuals (with extra muscle mass) can have a BMI of over 30 without actually being fat. This is not untrue in itself, but irrelevant from a population perspective as only a negligible proportion of the population is classified in the incorrect BMI category.

In recent years, the significant risk factor of abdominal obesity has been recognised. The abdominal fat mass surrounds the organs in the gut and even a fairly modest volume has a major impact on metabolism. Abdominal fat mass can easily be determined by measuring the waist circumference, which is an increasingly common way to determine obesity (3). In a couple of years, BMI will probably only be used to classify individuals into categories of defined populations, while waist circumference will provide a more sensitive indication of fat deposits that may lead to health risks and the metabolic syndrome described

below. Table 1 shows the risk factor levels of men and women with a growing waistline. According to recent findings, measuring epicardial fat (the fat surrounding the heart) may also serve as an additional tool to assess the source of the risk, although the discovery of this potentially high-risk area of fat infiltration requires further verification.

Table 1. BMI and waist circumference used as risk classification according to WHO (1).

Classification	BMI	Health risk
Underweight	< 18.5	Low (but elevated risk of other clinical problems) < 18.5
Normal weight	18.5–24.99	Normal risk
Overweight	25–29.99	Slight increase in risk
Obesity Category I	30–34.99	Moderate increase in risk
Obesity Category II	35.00–39.99	High, serious increase in risk
Obesity Category III	≥ 40	Very high, extreme increase in risk

Gender specific waist circumference and risk of obesity related metabolic complications.

Risk of metabolic complications	Waist circumference (cm)	
	Men	Women
Increased risk	≥ 94	≥ 80
Severe increase in risk	≥ 102	≥ 88

Cause

The existence of obesity is very easily explained: Energy intake exceeds energy expenditure (or energy output). However, it is much more difficult to explain the acceleration of obesity recently seen around the world. The most plausible explanation is the fact that our genetic composition is not changing while the environment in which we live is undergoing a dramatic change (4). Our energy intake is influenced by the availability of large volumes of tasty high energy food with a high fat and sugar content. Our energy expenditure is reduced as a result of having created a society that requires minimal physical activity. Technical aids have limited the need for physical work which for many people means that their basal metabolism, i.e. the energy expenditure needed to keep a body ‘alive’, makes up more than 70 per cent of their total energy expenditure. High energy food combined with insignificant energy expenditure is therefore the likely cause of an impending obesity epidemic. Our genes tell us to eat when there is food as we are biologically programmed to cope with recurrent periods of starvation. However, the fact is that we have constant access to food and recurrent periods of starvation do not arise in our prosperity. As a result of learning how to refine sugar and purify fat – nutrients that did not exist in the Stone Age, the food we eat today is extremely high in energy. In addition, the flavours of sugar and fat complement each other very well, sending us irresistible signals that we should eat more.

There is a myth that overweight individuals constantly consume large amounts of fatty food. Binging does of course exist, but the majority of obese individuals have a small, but continuous positive energy balance. By adding as little as three lumps of sugar (approx. 42 kcal) every day to the food needed to maintain equilibrium, you will gain half a kilogramme of fatty tissue every year. The bad news is that even a small amount of excess energy will in the long run lead to a significant risk. However, the good news is that moderate, but regular exercise will keep the weight under control.

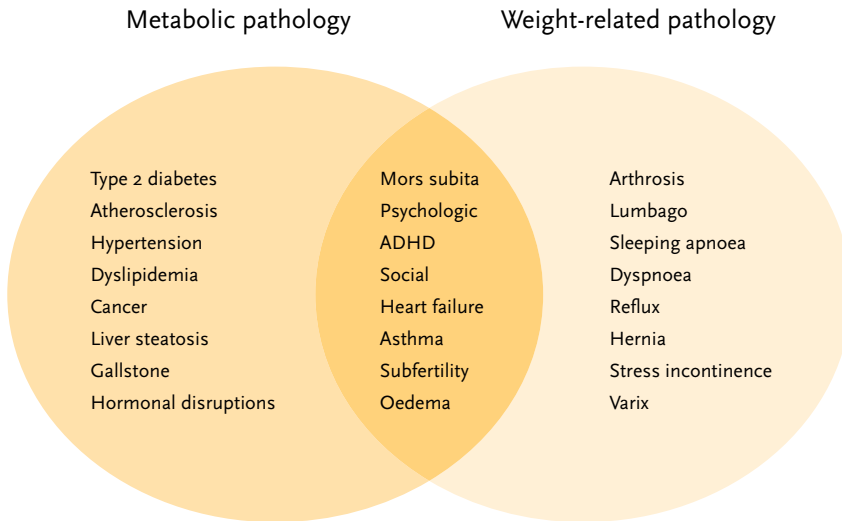


Figure 3. Complications of obesity.

Obesity gives rise to a number of risks (5, 6). Figure 3 shows metabolic and mechanical complications due to obesity as well as an area where these complications overlap. Most people know that high blood pressure (hypertension), lipid disorders (dyslipidemia) and diabetes are the most common companions of obesity, which together make up the so-called metabolic syndrome (7–10). It has been discussed whether metabolic syndrome in itself is an illness or merely coexisting complications of obesity.

It is not difficult to visualize the mechanical complications of obesity. The weight-bearing joints are clearly subject to added stress as a result of the increased weight load, but there are also other mechanical problems that are easily overlooked. Sleep apnoea is an underestimated public health problem that is particularly prevalent among overweight and obese individuals as the accumulation of fat around their air passages and abdomen leads to a feeling of pressure in the chest and difficulties breathing. Losing weight can have a dramatic effect on the health of these people. Incontinence is a problem that affects women in particular and intensifies with age. Obesity adds pressure on the urinary bladder and the short urethra, meaning weight loss would have a beneficial effect.

However, most sufferers find the psychological consequences of incontinence the hardest to deal with. Numerous studies have shown that obese people are subject to discrimination from an early age and that this discrimination continues into adult life (11). Consequently, obese and overweight people are more inclined to suffer from depression and despondency than people of a normal weight, and depression is even more manifest among those seeking help for their obesity.

Diagnosis

It is easy to diagnose someone as overweight or obese. However, in order to determine the type of obesity, it is important to measure the waist circumference as part of routine clinical practice. In case of serious obesity, it is often easier to measure the waist circumference with the patient reclined on a bed. The waist circumference is measured half-way between the twelfth rib and the iliac crest with the feet slightly parted and after normal exhalation.

Bioimpedance (tissue water conductivity converted to proportion of body fat) is a more detailed estimation of fatty tissue volume which becomes less precise as the severity of obesity increases. However, computed tomography and magnetic camera imaging can be used for research purposes, but is not suitable for routine clinical practice. All patients seeking medical care for one reason or another should have their height, weight and waist circumference measured. The baseline values obtained are used as a starting point for any future weight changes. Self-reported data is less useful as it is well-documented that obese individuals tend to give a lower weight than the actual weight as indicated by the scales.

Methodological problems

One of the greatest challenges of assessing the energy balance in overweight individuals is the reliability of the methods used. It is almost impossible to obtain an adequate dietary history of an obese person due to the large number of sources of error. Most people underestimate their true energy intake (12). The same applies to their energy expenditure. Even light exertion is a considerable effort for people with obesity who have a tendency to describe the same exertion as more of an effort than it actually was in terms of energy expenditure. This tendency to amplify the effort involved in physical exertion is also a major methodological problem. Expensive and advanced technology is required to make an objective assessment of an individual's energy intake and expenditure. Pedometers and pulse rate monitors only provide an approximation of the energy expenditure and double labelled water with stable isotopes or metabolic chambers are extremely expensive and resource-intensive technologies that can only be used in individual cases and not on a population level. Everyday movements or NEAT (see below) that are not detected by conventional measurement instruments may still have an effect the total daily metabolic rate.

Physical activity and obesity

The so-called non-exercise activity thermogenesis or NEAT refers to daily physical activities that are not perceived as exercise or fitness training. Standing instead of sitting, moving around and even laughing affects our basal metabolism. Such activities can amount to 150–250 kcal a day. This is a significant part of our energy expenditure that ultimately could improve our chances of maintaining a good energy balance.

There are two main objectives for physical activity in obesity (13). Physical activity obviously boosts the energy expenditure. However, the human body is extremely energy efficient. Losing weight by merely increasing physical activity is very difficult in practice. Many overweight and obese individuals also find it difficult to move around because of the mechanical load, risk of injury, etc. One important positive effect of physical activity is an increase in muscle mass and subsequent improvement in the basal metabolic rate. A large muscle mass improves the chances of maintaining a high level of energy expenditure. The muscle mass can only be increased through physical activity while the volume of fatty tissue can grow without limit through constant overconsumption. Table 2 is a summary of the effects of physical activity on metabolic functions.

Sarcopenia is defined as the age-related loss of muscle mass. This loss of muscle mass cannot be prevented, but can be mitigated with an active lifestyle. Strength training, for example, is an excellent form of exercise in this respect.

The assessment is further complicated by the fact that obesity is the result of a long-term positive energy balance. Not even the most advanced technology can measure disequilibriums of less than 100 kcal a day, but a comparable energy imbalance is equivalent to one kilogramme of adipose tissue per year.

Table 2. Effects of high intensity activity on metabolic factors related to weight loss.

Reduction in volume of subcutaneous adipose tissue.
 Increased mobilisation of adipose tissue.
 Increased muscle lipolysis.
 Less tendency to overeat following activity.
 Increased metabolic rate and fat oxidation.

Treatment principles

Prevention is obviously a fundamental principle. Because overweight children often become obese adults, focus is currently aimed at the identification of effective and preventative strategies. This falls far outside of the normal realms of national healthcare services: Good food in preschools and primary schools, possibility of physical activities, physical education and athletics not just for the most competent school children, but available to all school children and a lifestyle that promotes a healthy diet and physical activity. The Swedish National Institute of Public Health and the National Food Agency recently presented the results of a study including 79 proposals on how to improve public health (14).

Other treatment principles

Diet, exercise and behavioural change are the cornerstones of obesity treatment. Most people are familiar with these measures. Regular meals, compliance with the Balanced Diet Chart and Eatwell Plate Model based on breakfast, lunch and dinner at regular times with two snacks between meals. The basic advice is a low-fat, fibrous diet and moderation in alcohol consumption. Physical activity is another important ingredient, i.e. everything from general mobility to organised exercise activities as described below (15).

Discount prescription drugs are currently available to obese people with a BMI of over 35 or a BMI of over 28 with an added obesity-related complication like diabetes. There are currently three such drugs available.

Xenical is not absorbed by the body, but passes through the gastrointestinal tract while at the same time reducing lipase activity in the intestine whereupon around 30 per cent of fat is expelled in faeces. The drug is often said to have an “antabuse effect”. A continued diet of fatty food will give unpleasant diarrhoea as a result of which the patient soon learns to eat healthier food. This means low-fat food, which in itself leads to weight loss in addition to the fact that Xenical will also extract and expel fat from a healthier low fat diet. The medication is taken three times a day together with food and there are no real side-effects apart from the discomfort of diarrhoea as mentioned above. However, this is more a pharmacological consequence of the intrinsic properties of the drug rather than a genuine pharmacological side-effect.

Reductil works on the central nervous system as an appetite suppressant, actively lessening the desire for food and with an added thermogenic effect. Reductil is taken once a day and leads to weight loss, but it also has other desirable effects such as an increased level of the HDL cholesterol (“the good cholesterol”). Because Reductil is slightly adrenergic, i.e. it stimulates the sympathetic nervous system, the reduction of blood pressure is not quite as noticeable as with other medications. Consequently, caution should be observed and blood pressure taken before prescribing the drug. It has also been noted that obese people with high blood pressure (a common combination) actually see their blood pressure fall when they start to lose weight. Known side-effects of Reductil include constipation, a dry mouth and initial sleeping problems. However, these side-effects are generally transient.

Acomplia is a so-called cannabinoid receptor blocker that works both on the central nervous system and in the peripheral gastrointestinal tract, as well as other places such as the liver and muscular system. Acomplia produces weight loss by regulating food intake while also possibly affecting the metabolic system. The side-effects associated with this drug are generally psychological in nature and Acomplia should therefore not be prescribed to patients with a risk of depression. Other patients should be monitored to prevent the development of depression, which although unusual, must be considered a serious side-effect.

Many preparations claimed to reduce weight are available for purchase over the Internet or in shops. Some of the products available from health food shops are either hazardous to health or at best completely ineffective. Mechanical aids such as “slimming underwear”, “slimming sauna belts”, etc. have no effect whatsoever. Serious side-effects and even fatalities have been reported as a result of using these types of slimming methods.

Realistic expectations

A normal weight is seldom achieved with treatment. However, a permanent weight loss of 5–10 per cent will have a sufficient beneficial metabolic effect and it is very important for the patient to have a realistic expectation on what can be achieved with a treatment programme. Many patients give up on the programme when they do not achieve the unrealistic weight loss they had hoped for. The greatest weight loss usually takes place within the first six months. Most people are able to lose weight. However, the difficulty lies in maintaining the new lower weight for the foreseeable future as relapses are unfortunately not uncommon. Consequently, most weight-loss strategies focus on a permanent and long-term change in behaviour.

Surgery is the most effective treatment of obesity. A number of operations resulting in weight loss can be performed today. However, these operations always entail a lifelong change of circumstances. However, the Swedish Obese Subjects Study (SOS) showed that obesity surgery gave an average weight loss of around 16 kg after a period of 10 years and a 30 per cent reduction in mortality and morbidity. Also, surgery-induced weight loss eliminates diabetes almost completely. New onset diabetes is reduced by one thirtieth. A transient normalisation of changes in lipids and high blood pressure also takes place.

Effects of physical activity in obesity

The effect of physical activity in obesity is described in Figure 4. The dosage-time product is a health benefit. The more often, intensive and longer we exercise, the greater the amount of added physical activity. The individual ability to foster this new found legacy determines whether the change will result in a permanently improved state of health. Some people find it more difficult than others to change their behaviour and are more likely to relapse. Naturally, it is difficult to maintain a changed approach to physical activity in an environment that resists new and better behaviours. Work, family and financial pressures can put a stop to even the most ambitious individual exercise campaign. Those who manage to change their pattern of behaviour will of course reap the benefits over time. Weight loss not only entails a better reading on the scales, but also has effects that the individual cannot see with the naked eye, such as improved metabolic control, disease prevention and other psychological benefits. Surveys have shown that even a moderate weight loss through increased physical activity improves the quality of life.

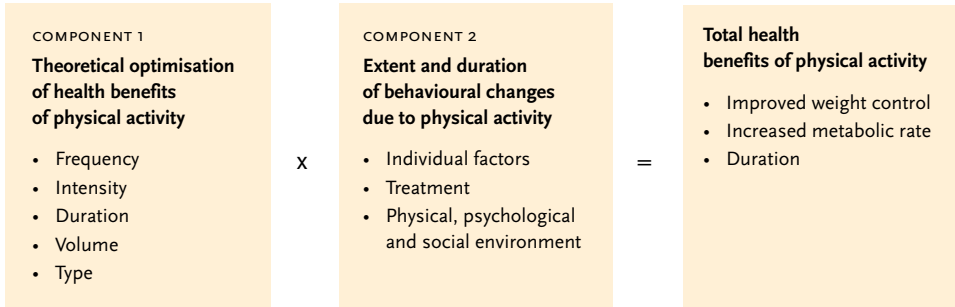


Figure 4. The effect of physical activity on health benefits according to Faskunger (15).

Everyday physical activity

Everyday physical activities are part of NEAT where every moment in life is used to improve the metabolic rate. For example, standing instead of sitting, not using machinery to make work easier and parking the car in the furthest corner of the car park are all examples of actions that promote everyday physical activities and can help shift the energy balance in the right direction.

A standard argument against the use of exercise in obesity is that it is too much of an effort. This incorrect reasoning is based on the old concept that the desired effect is only achieved through great intensity and endurance. This old data relate to an era when the demands and conditions of people in favour of everyday exercise were not taken into consideration. Today, we know that any activity, no matter how small, is better than sitting still and the good news is that accumulated daily physical activities count towards our overall energy expenditure.

Reasonable activity advice

It is easy to make demands on overweight and obese individuals in the belief that they will perform miracles despite their body mass and muscle composition. In fact, quite the opposite occurs. As part of a study conducted by Karolinska University Hospital, women of a normal weight were asked to walk at their own speed across a level floor for a few minutes. To do this, the women that were untrained required approximately 30 per cent of their maximum capacity. However, obese women required more than double this capacity to perform the same task. When asking obese people to ‘take a walk’, we are in fact asking them to perform a laborious task which is naturally met with resistance. Consequently, it is important to find realistic forms of treatment that are enjoyable and reasonable. Water gymnastics, cycling and swimming are exercises that have been shown to be especially effective against obesity as they put less strain on weight-bearing joints.

“Fat, but fit”

As almost 50 per cent of obesity is linked to genetic susceptibility, the best approach to advising obese people on physical activity has come under scrutiny. As a result, researchers in the United States have been able to show that it is possible to be “fat, but fit”. In other words, people with a strong susceptibility to obesity should continue exercising since, although they will never achieve a normal body weight, their fitness will improve and lead to health benefits.

Previous discussions have focused on the need for physical activity and *increased mobility* in obesity including proposals for various activity programmes. However, researchers have recently discovered the opposite, i.e. that the length of time *sitting still every day* is a risk factor. Watching TV, computer games, etc. can in fact be seen as missed opportunities of carrying out a physical activity. The results of many surveys show that the more time we spend idle every day, the higher the risk of being overweight. It is actually possible to lose weight by just cutting down on the time spent in front of the TV or games console, which is very much a focal point in the development of a healthy lifestyle programme for children and adolescents. Disallowing or minimising the time spent in front of the TV/computer will hopefully add appeal to other more energy demanding activities.

Objective registration

There is plenty of evidence to suggest that keeping a record of one’s activities leads to a positive change in behaviour when treating obesity. Physical activity is particularly suitable for this as nearly all daily movement can be monitored with a pedometer. Pedometers come in various qualities and with somewhat different measurement functions, but a simple pedometer counting the steps taken every day is usually sufficient without having to use complicated conversion tables according to age and gender. Recording the amount of steps taken every day is what leads to a change in attitude. Many experts fail to agree on the level of activity, but the general notion is that everyone should be as active as possible. However, people suffering from obesity may find it difficult to start an activity purely due to mechanical problems such as joint arthrosis, breathlessness, sweating and inner thigh abrasions (women in particular).

The American study National Weight Control Registry is a summary of the most important factors for successfully maintained weight loss subsequent to the completion of an initial programme (16–19). It is evident from the self-reported material of this obviously selected and successful group that its achievement is attributable to the following four simple factors:

1. Eating breakfast as a manifestation of a structured existence.
2. A fibrous low-fat diet.
3. Log books to record energy intake and expenditure.
4. More than 150 minutes of activity every week.

These patients had lost weight in quite different ways and hence, it was difficult to find common patterns for success. Yet, identifying the four factors listed above proved to be a lot easier, increasing the odds of maintaining the lower weight.

Physical activity and appetite

From a physiological viewpoint, long-term weight control should lead to a greater appetite and an increased energy intake because of the higher level of physical activity. However, the situation is somewhat more complicated in reality. It appears that obese individuals do not immediately compensate for exercise by eating more afterwards. In fact, it just goes to prove that having dinner after a training session is the rational thing to do. However, activity programmes do not seem to have a long-term effect on food intake or appetite, which is positive, as it allows for activities to be used as weight control instruments without the individual having an uphill struggle with a compensatory appetite increase. Nor do activity programmes seem to manoeuvre the food intake in a specific direction of preference for fat, carbohydrates or protein.

It is widely recognised that physical activity increases the feeling of well-being for obese individuals. Exercise alleviates depression, reduces anxiety, raises the mood and relieves stress. Exercise also appears to have a positive effect on the body perception of obese individuals who as a result of the increased activity adapt a more positive attitude to their personal appearance. Self-confidence and the ability to cope with challenges in life also improve as a result of weight loss due to physical exercise.

Table 2 is a summary of the metabolic effects of intensive physical activity.

Obstacles to change

The psychopathology of obesity is often characterised by procrastination, i.e. the deferment of actions or tasks to a later time. Obese patients often find a reason not to carry out a physical activity, some of which are listed in Table 3.

Table 3. Obstacles to behaviour change and counter-strategies.

1.	I do not have time.	A common reason for not wanting to perform a physical activity. However, not much extra time is needed if the physical activity is planned for and integrated with other everyday activities and, with a little planning, the majority of people can usually manage to squeeze in 30 minutes of physical activity into their daily schedules.
2.	I cannot afford it.	There is no need for expensive gym memberships or training equipment, many excellent forms of exercise are completely free of charge.
3.	I do not like exercising.	Bad experiences at school or during compulsory military service and tedious training can lead to a loss of motivation. Everyone can find an enjoyable form of activity such as ball games, gardening and other activities together with children, friends and colleagues.
4.	I am too old.	Researchers agree that physical activity is generally beneficial for people well into their 80's. One's personal performance can be improved well into the later years of life provided that the skeleton and joints are not put under too much strain.
5.	I might injure myself.	Outdated and tough exercise programmes often lead to injuries, sprains and pains. There is little risk of a problem if one starts carefully and gradually builds up mobility. People with a cardiovascular or serious chronic disease may need a medical assessment before starting a physical activity. However, there is an activity programme to suit everyone.
6.	I am too fat.	This is circular reasoning – if you never start any physical activity, then you will always be obese. The circle must be broken and the simplest way to do so is with moderate and modified activities that do not subject the body to undue strain.
7.	No one that I know exercises.	Someone has to be first and you often get an amazing response from everyone else when taking the initiative. The rewards are improved health, increased mobility and less risk of complications owing to obesity, which must after all be considered worth the effort.
8.	I do not like sweating.	It is not necessary to sweat copious amounts to get enjoyment out of a training session. However, a good rule to follow is that you should need to take a shower and change your clothes after exercise at least 2–3 times a week. The exercise in question may take the form of walking, cycling, picking mushrooms in the forest, a long stroll around a museum or whatever else takes your fancy. A dog provides the perfect motivation to exercise. “Take your dog for a walk even if you do not have one” is sometimes the advice given to obese people.

Social strategies

Primary prevention must permeate our entire society to stop the accelerating obesity epidemic. This is achievable in many ways: Providing the possibility of activity at preschools and primary schools with a school yard that encourages physical activity. So-called walking school buses through residential areas where children are walked to school by parents with the first and last parent in the line of walking children holding a flag. Walking school buses are part of a pilot scheme encouraging children to get to school

safely without having to use means of transport. An outdoor activity at the nursery school or a fun excursion instead of ice-cream and cake for a birthday celebration is a new way of thinking. Physical education at school not just for the elite, but structured so the heavier children also feel a sense of accomplishment, such as activities like swimming, giving the children who need exercise the most a chance. Stairs that encourage activity instead of being cold, dirty and frightening, and alternatives to escalators and lifts make it possible to choose more physical activity. Well-lighted walkways and jogging paths make it safer for older people to exercise outdoors. Side-walks, rather than just roads for cars, make it possible to go for a walk. Cycling paths make cycling safer. Good bicycle stands for locking one's bicycle and preventing theft increases the likelihood of people cycling as a means of transport. A good public transport system makes walking in conjunction with travel possible. TV free evenings involving doing something together rather than sitting still increase the level of activity. Discounts provided through work on health-promoting measures, lunchtime Nordic walking clubs, and competitions between departments at work to see which one is the most active usually raise employee interest in physical activities. Only a lack of imagination limits the list of possible activities.

Functional tests

Individuals with an uncomplicated obesity do not have to undergo complex examinations before commencing a general activity programme that involves, for example, walking and swimming. However, for individuals with a history of cardiovascular disease who need to start a systematic training programme, it is recommended that a medical examination and fitness assessment test are carried out. However, the patients themselves usually have a clear picture of the factors limiting their mobility.

Certain conditions make it difficult to put together a training programme that for example includes swimming. Some people have a fear of water and have never learnt how to swim or they are allergic to chlorine. Unfortunately, this eliminates that specific form of physical activity.

Type 2 diabetes and obesity are closely linked. There is enough of evidence to show that people with diabetes are able to lose weight although not generally as much as people without diabetes (20). However, it is well documented that obese diabetics gain just as much from losing weight as anyone else. There are specific reasons why diabetics cannot lose as much weight as other people. When diagnosed with obesity, diabetics are often slightly older than other sections of the population, and their higher age entails a lower basal metabolic rate and reduced potential for further weight loss. In addition, many diabetics are prescribed beta blockers, making it even more difficult to carry out a physical activity. Vascular spasm (angina pectoris) or diabetic foot conditions also make certain forms of exercise difficult or impossible to perform. In addition, diabetic patients are more inclined to suffer from depression and as a result, more likely to resist the thought of exercise.

Drug interaction

Patients with obesity and metabolic syndrome are often treated with a number of drugs such as beta blockers which make it difficult and burdensome to carry out physical activity. A medication-induced blood pressure reduction may give rise to nausea, making it more difficult to exercise, and diabetes treated with medication may lead to the blood sugar level falling, particularly during physical activity. However, situations like these do not give rise to any diagnostic problems and are usually recognised by both patients and healthcare professionals.

Contraindications

Obese patients often suffer from pain in their weight-bearing joints, back, hips, knees and ankle joints. Consequently, the physical activity must be modified accordingly. Water gymnastics are an excellent form of exercise for patients with joint pain. However, it may prove impossible for the patient to participate in water gymnastics if he or she is allergic to chlorine, a non-swimmer or afraid of water. Another recommended form of low-impact exercise is Nordic walking.

Risks

The paradox of patients losing weight while taking part in an activity programme is that they sometimes experience a higher degree of pain in, for example, the back despite having lost 15 kg. This is usually due to a load displacement from one section of the spine to another and other joints having to carry the load redistribution. The problem is usually transient, but it is important to inform the patient that he or she may still continue with physical activity. The risks involved are generally regarded as insignificant and a little extra care at the gym, in the swimming pool or when walking in the forest or along a foot-path is usually all that is needed.

References

1. WHO. Obesity. Preventing and managing the global epidemic. Report of a WHO consultation. WHO Technical Report Series, No. 894. Geneva: World Health Organization; 2000.
2. Rasmussen F, Johansson M, Hansen HO. Trends in overweight and obesity among 18-year-old males in Sweden between 1971 and 1995. *Acta Paediatr* 1999;88:431-7.
3. Janssen I, Katzmarzyk PT, Ross R. Waist circumference and not body mass index explains obesity-related health risk. *Am J Clin Nutr* 2004;79:379-84.
4. Perusse L, Bouchard C. Genotype-environment interaction in human obesity. *Nutr Rev* 1999;57:31-7.
5. Björntorp P. Overweight is risking fate. *Ballière's Clin Endocr Metab* 1999;13:47-69.
6. Francischetti EA, Genelhu VA. Obesity-hypertension. An ongoing pandemic. *Int J Clin Pract* 2007;61:269-80.
7. Despres JP, Lemieux I. Abdominal obesity and metabolic syndrome. *Nature* 2006;444:881-7.
8. Carey VJ, Walters EE, Colditz GA, et al. Body fat distribution and risk of non-insulin-dependent diabetes mellitus in women. The Nurses' Health Study. *Am J Epidemiol* 1997;145:614-9.
9. Defay R, Delcourt C, Ranvier M, Lacroux A, Papoz L. Relationships between physical activity, obesity and diabetes mellitus in a French elderly population. The POLA study. Pathologies Oculaires liées à l'Age. [Population-based study on age-related eye diseases] *Int J Obes Relat Metab Disord* 2001;25:512-8.
10. Hu G, Lindstrom J, Valle TT, et al. Physical activity, body mass index and risk of Type 2 diabetes in patients with normal or impaired glucose regulation. *Arch Intern Med* 2004;164:892-6.
11. Puhl R, Brownell KD. Bias, discrimination and obesity. *Obes Res* 2001;9:788-805.
12. Lichtman SW, Pisarska K, Berman ER, et al. Discrepancy between self-reported and actual caloric intake and exercise in obese subjects. *N Engl J Med* 1992;327:1893-8.
13. Ainsworth BE. Compendium of physical activities. Classification of energy costs of human physical activities. *Med Sci Sports Exerc* 1993;25:71-80.
14. Swedish National Institute of Public Health Handlingsplan för goda matvanor och ökad fysisk aktivitet i befolkningen. [Action plan on healthy dietary habits and increased physical activity] S2005/1274/FH. Stockholm: Swedish National Institute of Public Health.
15. Hemmingsson E. Behandling av vuxenfetma och dess följdssjukdomar. [Treatment of adult obesity and secondary diseases] I: Faskunger J. Motivation för motion [Motivation for exercise] Farsta: SISU Idrottsböcker [Sports books]; 2001.
16. Shick SM, Wing RR, Klem ML, McGuire MT, Hill JO, Seagle H. Persons successful at long-term weight loss and maintenance continue to consume a low calorie, low fat diet. *Journal of the American Dietetic Association* 1998;98:408-13.

17. Klem ML, Wing RR, McGuire MT, Seagle HM, Hill JO. A descriptive study of individuals successful at long-term maintenance of substantial weight loss. *American Journal of Clinical Nutrition* 1997;66:239-46.
18. McGuire MT, Wing RR, Klem ML, Seagle HM, Hill JO. Long-term maintenance of weight loss. Do people who lose weight through various weight loss methods use different behaviors to maintain their weight? *International Journal of Obesity* 1998;22:572-7.
19. Wyatt HR, Grunwald OK, Mosca CL, Klem ML, Wing RR, Hill JO. Long-term weight loss and breakfast in subjects in the National Weight Control Registry. *Obesity Research* 2002;10:78-82.
20. Campbell L, Rössner S. Management of obesity in patients with Type 2 diabetes. *Diabet Med* 2001;18:345-54.