

Obesity: a review

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Introduction

OBESITY is the most common nutritional disorder in Western society. There is good evidence to show that it is associated with a shortened life span, disability, distress and disappointment. It can result in ill health and medical consultations but it should be preventable and treatable. Unfortunately experience shows that this is often far from the truth.

Measurement of obesity

Obesity is a well-known term but is not easily defined satisfactorily. The definition 'excess body fat' does not define what is 'excess' or explain how body fat can be measured. Various methods are used to provide measures of body fat:

1. Simple measurements of body weight corrected for height, sex and sometimes frame size are often used, but these will not differentiate between those who are muscular and those who are obese (Figure 1).
2. Relative weights which are a percentage of the normal or ideal weight of a person of the same height, sex and possibly

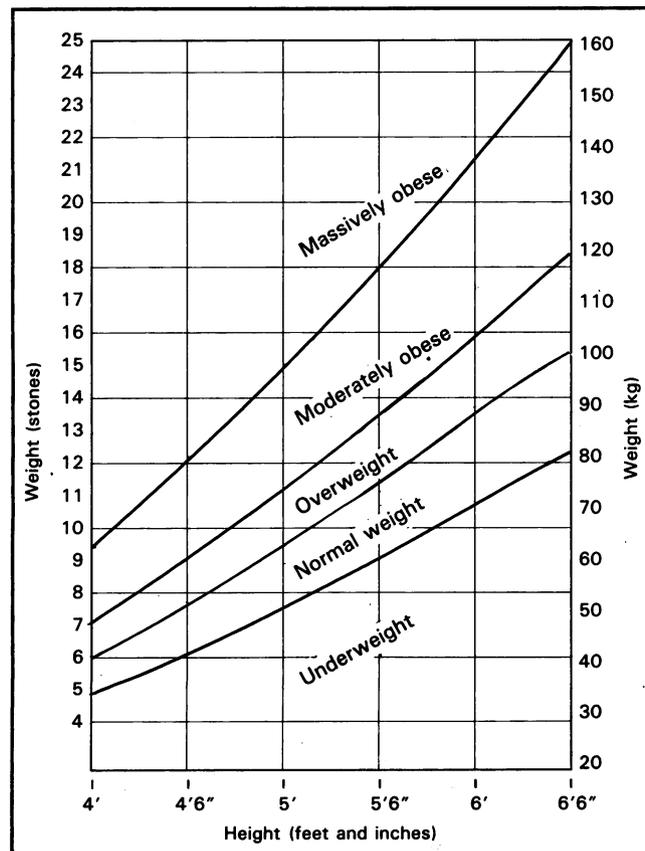


Figure 1. Height versus weight showing body weight categories.

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frame size are widely used by insurance companies. Relative weights are based on data collected by the Metropolitan Life Insurance Company of New York in 1960.¹ The problem with the measurement of relative weights is that the definition of the reference standard is arbitrary and is based on average populations who take out life insurance.

3. The results of some surveys show that height divided by the weight squared is closely related to skinfold thickness and body density in adults and this quotient may be used as a measure for body fat.²

4. Measurements of skinfold thickness are used although errors can be caused by variability between observers and also measuring instruments.

There are several well-established laboratory methods for establishing total body fat, but they are all time-consuming, expensive and require specialized laboratories; they cannot easily be applied in general practice.

Problems caused by obesity

Mechanical problems

Of the mechanical problems caused by obesity damage to weight-bearing joints — for example, osteoarthritis of the hips and knees — is common and so too are backache and flat feet.³ Excess abdominal weight may obstruct respiration and there is a definite association between chronic bronchitis and obesity.⁴

Obesity often reduces physical fitness,⁵ respiratory function and the capacity for work.⁶ Many obese people find it difficult to be physically active and their lives are therefore more restricted than the lives of the non-obese. It has been suggested that a low level of physical activity may cause obesity.⁷

Childbirth may be more difficult for obese women and the risks of pre-eclamptic toxæmia, fetal loss, postpartum haemorrhage, hypertension and other complications are increased.^{8,9}

Abdominal surgery is more difficult if the area of the operation is obscured by fat. There is an increased risk from the anaesthetic, and postoperative complications are more common, particularly deep-vein thrombosis, pulmonary embolus, chest infections, and cardiac problems. These problems double the surgical risk for the obese.

Varicose veins and varicose ulcers are common in the obese and may be troublesome and difficult to treat.¹⁰ Other surgical conditions are also more common in the obese, for example, gallstones, haemorrhoids, diverticulitis, and ventral hernia.^{11,12} Cirrhosis of the liver caused by a high alcohol intake is also found to be more common in the obese.

Metabolic problems

Diabetes mellitus. The association between obesity and maturity-onset diabetes is well known and is found in many different countries and for different racial groups and cultures. The weight/height index has been shown to be closely related to the onset of diabetes.¹³ Diabetes results in high levels of glucose in the blood and abnormal fat levels and therefore is an important precursor of atheroma. Diabetes can lead to myocardial ischaemia, renal failure, peripheral arterial disease, as well as to premature blindness, neurological problems, poor wound healing and frequent bacterial and fungal infections.

Ischaemic heart disease. There has been an increase in the mortality rate from ischaemic heart disease over the past few decades

especially in men between 35 and 45 years old. There is also evidence that since the 1940s men have been more obese earlier in life.

It is not easy to assess accurately the contribution of obesity to the increase in the number of deaths from ischaemic heart disease because of the many associated risk factors. A number of official bodies in the United Kingdom, including a working party of the Royal College of Physicians and the British Cardiac Society,¹⁴ have looked carefully at the evidence and have concluded that obesity does increase the risk of ischaemic heart disease. There have been a number of theories put forward to explain this:

1. Increased cardiac workload and blood pressure may result from excess weight.
2. An increase in coronary atheroma may result from high calorie intake, raised lipid levels and raised blood pressure.
3. A decrease in physical activity may result in deficient cholesterol circulation in those with atheroma.

Hypertension. Insurance statistics show a definite relationship between excess weight and mortality associated with hypertension. An American study was carried out on nearly 2000 schoolboys. Of these 94% were located 30 to 40 years later and a representative sample was examined.¹⁵ Those who had become obese since childhood had a higher incidence of hypertension and ischaemic heart disease than the remainder. Studies from Germany, India, Norway, the USA and the Institute of Directors' Medical Centre in the United Kingdom¹⁶ show a higher incidence of raised diastolic pressure in overweight men than in men of average weight. Studies on patients selected because they had hypertension showed no increase in the rate of mortality for those who were obese.¹⁷

The relationship between obesity and hypertension is not clear. *Research on obesity* states 'The evidence for a relationship between obesity and the development of hypertension is indecisive and the nature of the relationship, if it exists, is not clear. In hypertension, as with ischaemic heart disease, obesity is one among many risk factors and its relative importance is probably not very great.'¹⁸

Obesity is rarely stated as the cause of death on a death certificate, but the available statistics suggest that it is associated with increased rates of mortality at all ages, particularly under 50 years. The increase in mortality rate varies with the degree of obesity. Among the obese with no other impairment it was found that the number of deaths from cardiovascular and renal disease was 50% higher than the number for the non-obese; ischaemic heart disease showed a 40% increase in mortality and diabetes a four-fold increase.¹⁹

Causes of obesity

The causes of obesity are as uncertain as its effects and the simplistic approach of excess intake and reduced output of energy leaves many questions unanswered.

Psychological factors

A psychoanalyst may regard obesity as the result of an emotional conflict in early childhood, especially during psychosexual development. Food may symbolize a mother's love or may be a substitute for aggressive behaviour or sexual activity. However, this concept has not proved very successful in practice.

An alternative has been to look at the situations that lead to overeating and in particular at internal and external cues to eating. Studies by Stankard²⁰ have shown that obese people do

not respond to the same internal hunger cues as people of normal weight. Other studies have shown that obese people may eat as much on a full stomach as on an empty one and that fear does not decrease their food consumption — their food consumption may actually increase.²¹ Therefore internal cues do not govern the food intake of the obese but external cues, for example, time, taste, smell, and appearance of food, do have a strong influence.

Some investigators have suggested that the obese person is unable to distinguish between hunger and other states of psychological arousal such as fear, anxiety or anger.²² Such a person cannot correctly identify hunger cues and therefore relies on emotional cues. This inability to identify the hunger state may stem from the way the person's needs were satisfied as an infant.

Neurological factors

Some reports suggest that the obese person is more sensitive to external stimuli for the selection of food than an individual of normal weight but it is also suggested that this is an effect of obesity not its cause.²³ According to this view obesity is a disturbance of the long-term weight control mechanisms in the hypothalamic nucleus in the brain. There is some support for this view from animal studies and studies of brain-damaged humans.²⁴

Dietary factors

Evidence from studies on animals and humans suggests that refined carbohydrates may be a major cause of obesity.²⁵ Cleave and Campbell describe the changes which occur on transferring from a rural to an urban diet and they contend that reverting to a diet which is high in unrefined carbohydrate will reverse the condition if combined with a little exercise.

Brown fat cells

Recent work in Cambridge and London has drawn attention to brown fat cells.^{26,27} This is a term used to describe fat containing cells which are found throughout the bodies of various animals including man, but which differ from ordinary fat cells by their brown colour. Brown fat cells contain a great deal of intracellular material and they appear to cause fat to metabolize. Hibernating animals and babies have large numbers of brown fat cells and so too do adults. Brown fat cells are involved in generating heat and the number and distribution of brown fat cells are probably genetically determined. This may go some way to explaining why fat mothers often produce fat babies and possibly why some people are lucky enough to eat 'whatever they like and never get fat' while others 'only have to look at food to put on weight'.

Social factors

Considerable changes in diet have taken place over the last 50 years. As the twentieth century has advanced so the amount of refined carbohydrate, protein and fat in the diet has increased and the amount of bread, potatoes and cereals has reduced. There has been an increase in transport facilities and this has resulted in the population as a whole taking less exercise, particularly men and women in middle age. Labour-saving devices at work and at home also contribute to the decrease in the overall amount of exercise taken.

Surveys of height/weight carried out in London have shown differences in obesity between social classes but the study populations were not completely representative.^{28,29} Obesity was found to be more common in social classes 4 and 5, especially for women and this was not confined to the post-menopausal group.

Another important social factor which affects obesity is smoking but this has only been evaluated for men.³⁰ Middle-aged men who smoke often weigh less than non-smokers of the same age and although giving up smoking usually leads to an increase in weight undoubtedly smoking is the greater risk factor.

Sex differences

The difference between the sexes in the prevalence of obesity is of interest and is the subject of the book *Fat is a feminist issue* by the late Susie Orbach.³¹ She argues that women at home are often bored and constantly preparing food for their families which results in nibbling between meals as well as eating at mealtimes. Unhappiness and sexual and social frustrations affect women more than men, and can result in compensatory eating. Only when women have freedom outside the home and share roles within the home will these problems be resolved. Orbach also points out that although the biological changes of menstruation, pregnancy and lactation sometimes have a transitory effect on the function and shape of a woman this effect can be long lasting.

The greater weight of men and women in the lower social classes does not appear to be a result of their lack of awareness of their obesity.³² However, overweight women were more aware of their size and claimed to make more attempt to lose weight than overweight men. In the upper social classes both men and women were usually more active than those in the lower social classes and were better informed to deal with their diet.

Childhood obesity

Studies of children in the 1950s showed that a higher proportion of children from social class 1 were obese compared with children from social classes 4 and 5.³³ However, since then the position has reversed, perhaps in response to a change in social attitudes among the upper social classes. Obesity is more common in only children than in children from large families.^{34,35}

Estimates in the 1970s suggested that 25–30% of infants under one year of age are overweight and many of these are obese.³⁶ This is believed to be related to a decline in breast feeding between 10 and 15 years ago, together with an increase in the use of high-density human milk substitutes and the early introduction of cereals into the diet. Again this was particularly a problem in the lower social classes but the trend is now reversed with more mothers breastfeeding for longer periods than a decade ago.

The concept that fat babies grow into fat children and that fat children grow into fat adults has been widely accepted but the evidence for the former is not as well established as the latter. However, most of the studies on obese infants and children were based on hospital and clinic populations.^{37–40}

Primary obesity which arises in childhood by increased numbers of fat cells being laid down is very much more difficult to manage than secondary obesity which arises in adult life by enlargement of those fat cells already present.

Management of obesity

The fundamental principle of all effective treatment for obesity is to create a negative balance so that excess stores of fat are used up. This sounds easy but is difficult to achieve and even more difficult to keep to for any length of time. Obesity is a condition which varies from individual to individual and management must take into account the history, personality and bodily configuration of the individual. Each person will require

dietary advice which stresses the importance of a reduction in refined carbohydrates and an increase in exercise. Regular follow-up, initially at least, is valuable and food diaries of all food consumed may be helpful. The management of obesity is not an easy task for general practitioners. Professor C.H. Hollander of McGill University has stated 'The successful management of obesity when it does occur, is the result of a knowledgeable, sympathetic physician having the time and interest to meet repeatedly with a patient who has at least a modicum of insight into the condition and a considerable motivation to reverse it.'⁴¹

Diet

For at least 150 years attempts have been made to find the ideal reducing diet which should be easy to keep to, satisfying and relatively inexpensive and produce a slow, steady and consistent weight loss. Despite many attempts no ideal diet has been found.

A low-carbohydrate, high-fibre diet is the most common and is available in various forms, many of which are based on Marriott's diet which states at the beginning 'You may eat as much as you like of...' which is at least an encouraging start.⁴² There have been many variations on this original idea, the most well-known being proposed by Yudkin who recommended strict carbohydrate restriction but free protein and fat intake.⁴³ His argument was that in the long term people are more likely to conform to a pleasant and palatable diet than to one which requires strict self-control.

Various other dietary measures have been tried with some success. Bulk agents such as methylcellulose and agar have been used but often produce unpleasant abdominal sensations. Low-carbohydrate forms of bread (starch reduced) offer some benefits but are often expensive. High-fibre diets have been shown to increase satiation thus limiting energy intake. Liquid diets and meal substitutes have also been tried but are unsuitable for long-term use.

Reduction in the amount of sugar in the diet is a major part of a reduced carbohydrate diet and the use of saccharine as an artificial sweetener is of considerable value. Saccharine is reasonably priced but recently there has been some concern over the safety of its use.

There is a vast amount of dietary advice in newspapers, popular journals, women's magazines, special slimming guides and books and on the radio and television but it is difficult to determine which advice is of value. Studies have shown that doctors, medical students and nurses generally have a poor knowledge of nutrition and thus it may be difficult for them to give constructive advice.⁴⁴

Dieting may be considered to be an unsatisfactory concept. A low-carbohydrate, high-fibre diet may be acceptable for a few weeks or months but not for a lifetime.

Exercise

A number of studies have shown that obese children and adults exercise less than people of normal size even when participating in sports.⁴⁵ The energy output from a three-mile walk is small, approximately 300 calories for a person of average weight, but this can be significant in the long term if the walk is a daily occurrence. Alternatives to a three-mile walk might be cycling for three-quarters of an hour or badminton, tennis, squash or swimming for half an hour.

Exercise has a stimulating effect on the metabolic rate and leads to the loss of appreciably more fat than would be predicted from the amount of exercise undertaken. Surprisingly, this increase in energy expenditure is not accompanied by a compensatory increase in appetite and energy intake.⁴⁶ The obese diabetic can also benefit from regular exercise.⁴⁷

Drugs

For many years drugs have been used and abused in the management of obesity and there have been various fashions including the widespread use of amphetamines up to the 1960s and the use of thyroid hormone. These drugs are rarely prescribed now because of their side effects and in the case of amphetamines, the risk of addiction.

Diethylpropion and fenfluramine are two of the drugs currently in use and there is little to choose between them. The former may have fewer side effects and is cheaper but the latter may have advantages for nervous individuals with a degree of hypertension or raised serum cholesterol levels.

Perhaps work on brown fat cells will produce a drug which can alter the thermogenic regulating mechanisms of the body and enable excess fat to be burned off; however this is still some years away.

Psychological techniques

Whereas the previous methods have poor to moderate long-term success various psychological techniques have been applied with good results.

Behaviour conditioning. Behaviour conditioning is based on the idea that established patterns of behaviour can be replaced by better patterns of behaviour using a process of education with reward and punishment. Time is spent with patients in order to ascertain their eating behaviour and then restrictions of time, place and situation are made on this behaviour. Stuart has published good results achieved by this method but for most of us the time involved — 90 minutes per week per patient — would make this method impractical.⁴⁸ It is of interest that the weight loss achieved by this method was longer lasting than that achieved by other methods.

Group therapy. Group therapy uses the support of other obese people to help those who find it difficult to keep to a restricted diet on their own. Regular support by a doctor, nutritionist, dietician or other health worker increases the group's desire to comply with the diet. James and Christakis surveyed 2593 patients who attended one of New York's three obesity clinics from 1953 to 1957 and they found that group treatment with supervision was more successful than individually supervised weight reduction.⁴⁹

These findings have led to the formation of various groups to promote this idea and the magazines *Weight Watchers*, *Silhouette* and *Slimming* promote groups of this type which have a regular weekly attendance of between 50 000 and 70 000 in Great Britain. In these organizations, and in TOPS (Take Off Pounds Sensibly) which has a large following in the USA and Canada, there is a strong element of competition with prizes for attaining and maintaining ideal weights and fines and punishments if goals are not achieved. Members may be placed in pairs in order to provide individual support and the group leaders are all people who have attained their goal weight and thus know and understand the problems of dieting. Claims of success vary from 10–60% of participants, the average being 30%.

Some enthusiastic general practitioners have successfully run groups of this type with the help of a health visitor, nurse, psychologist or dietician with varying but encouraging results.⁵⁰

Patients with sufficient resources may attend health farms, beauty clinics or nursing homes for short-term therapy and some may return frequently to maintain the weight loss they have achieved.

Psychoanalytical approach. A psychoanalytical approach may also be advocated as obesity is thought to stem from disturbances during the early stages of development. The act of eating is thought to have a number of unconscious associations — food may symbolize a mother's love or eating may be a substitute for aggressive behaviour or sexual activity. This approach has been used to explain and manage obesity but is necessarily time consuming and the results have not been good. However it has emerged that, possibly because of the indiscriminate use of food for support in early infancy, obese individuals may not respond to the same hunger cues as the non-obese⁵¹ and may be unable to differentiate between sensations of hunger and other sensations such as fear or anxiety.⁵²

Hypnotherapy. Hypnotherapy has also been used, chiefly in the USA,⁵³ with other methods of treatment and after thorough psychological assessment it has been found to be a useful adjunct to other methods.⁵⁴

Other methods

Short-term fasting has been recommended by some members of the medical profession but is rarely popular with patients and in some studies has been shown to be harmful.⁵⁵ Long-term fasting in hospital with regular monitoring has produced more dramatic results but has also resulted in several deaths.⁵⁶ Other procedures including surgery may be considered if patients are massively obese, that is more than 100 pounds overweight, have been obese for several years, if other methods of control have failed, if patients have no endocrine problems, no associated diseases that would considerably increase the risk, a suitable home environment, minimal alcohol intake and if patients give informed consent.⁵⁷ How many patients fulfil these criteria?

The factors which appear to increase the success of weight reduction are:

1. Becoming obese as an adult.
2. Weighing more than 127 kilogrammes (20 stones).
3. Being a married male with children and in a high economic/social status group.
4. Medical reasons for losing weight.
5. Willingness and ability to take exercise.⁵⁸

Studies of obesity

Much time and effort is spent in trying to treat obesity because of its risks to life and health, and its damaging effect on self-esteem. However the outcome of all this activity is not very satisfactory.

McCann and Trulson carried out a follow-up study of obese patients at the end of three years.⁵⁹ They found that 35 of the 149 patients had lost at least 30% of their excess weight and that five patients were within the normal range. Other workers suggest long-term success rates of 1–12%.^{60–62} The Anti-Coronary Club of New York recruited 187 obese men aged between 40 and 59 years.⁶³ After four years on a 1600 calorie low-fat diet 134 of the men (72%) had become non-obese (less than 15% above optimum weight), however there are several additional factors which should be taken into account when considering this study.

In general practice, Lord followed up 40 cases for two years.⁶⁴ Eight patients were successful in losing half or more of their surplus weight and 11 were partially successful initially. In the series of 79 patients studied by Craddock, 70 patients were women and nine men.⁴¹ After five years 14 were judged as successful and 14 as partially successful with an average weight

loss of 8.1 kilogrammes (18 pounds), 13 were judged as successful but relapsed, 11 as partially successful but relapsed and 27 (over a third) as failures. In the study carried out by Binnie 63% were regarded as failures at 10 years, 12% as successful and 11% as partially successful.⁶⁵

There are few studies of the prevalence of obesity in general practice.^{28,29} For 1000 patients seen in my own surgery between October 1980 and March 1981 the incidence of significant obesity — considered to be a value greater than 28 for the height divided by weight-squared index — was 11% and among a group of executives attending a short course at the London Business School it was 8%. During the intensive 10 week business course there were several lectures on health education. Despite this the average weight gain was approximately five per cent. The excellent eating and drinking facilities available and the stress of the course presumably overcame considerations of health.

If, as is widely believed, the penalties of being overweight are severe then this is an important area for review and a study similar to the oral contraceptive and attitudes to pregnancy studies carried out by the Royal College of General Practitioners would be useful. It is clearly important to establish the incidence and prevalence of obesity, its natural history over five to 10 years and the results of treatment.

Comparison of the studies which have been carried out is complicated by differing definitions of obesity, ideal and optimum weight and criteria of success or partial success.

Ways of overcoming the problem of obesity

Obesity is a major problem in the Western world and several possibilities exist for altering this state of affairs.

Altering the balance between urban and rural society

A politico-economic solution would be to alter the basic outlook on which society is based — returning to a sane balance between town and country, making the United Kingdom self-sufficient in basic food and encouraging the consumption of fresh home-grown food as opposed to convenience foods.⁶⁶ This concept would obviously be very difficult to achieve and is almost certainly unrealistic. Current progress suggests that food will be increasingly grown in factories without the involvement of farming processes as we know them. Milk may well be produced more cheaply by direct manufacture from grass, and protein can be easily and economically obtained from plants or from the sea. It is unlikely that a sane balance between town and country can be achieved without a radical change in the structure of our society which is becoming increasingly dependent on service industries. The trend is towards urbanization; allotments are diminishing and home-grown food has become the privilege of the few.

General health education

The basics of nutrition should be taught at schools and colleges of higher education as part of an organized health education programme. People should be taught to regard good health as a prized possession. A healthy balanced diet is as important for staying in peak condition as clothing, warmth and shelter — it is incorrect diet which has resulted in 44% of people aged 16 years and over in Scotland having no teeth of their own.⁶⁷ Health education should include details of suitable exercise for all ages and suggest productive uses of leisure time.

Although great efforts have been made to bring health education into schools this is a comparatively new concept and is not common. Health education is often taught in primary schools but rarely in comprehensive schools or institutes of higher educa-

tion. Companies and commercial organizations should practise health-care management through their medical, personnel and catering departments.

Nutrition and dietetics for medical professionals

Few medical students and very few medical practitioners have a detailed knowledge of nutritional and dietetic principles⁴⁴ — I certainly do not remember learning anything of these principles at medical school. Enquiries at a number of teaching hospitals revealed a great variety of tuition in this field. If the medical profession lacks fundamental knowledge it cannot pass this knowledge on to others. More emphasis should be placed on nutritional education for both undergraduates and postgraduates and more use should be made of nutritionists and dieticians.

Prevention

General practitioners are guilty of concentrating on treatment rather than prevention. The training received by doctors almost ensures that this is the case.

More of the vast resources used to diagnose and treat disease could be channelled into prevention. This would involve no extra cost to the taxpayer but they would receive far greater benefit. This increase in preventive work could be carried out by organizations like the Health Education Council or it could be a part of general practice activity. Prevention could be emphasized in the home, at school and at work using all the manipulative resources available both locally and nationally.

Exercise

Increased facilities for exercise should be made available to all and paid for by taxes on refined foods, tobacco and alcohol. Employers could make sports facilities available during working hours and lifts and escalators should be reserved for the chronically sick and disabled — others should be encouraged to walk.

Financial

A financial policy could be introduced which would reduce the consumption of refined and processed foods in favour of naturally-grown foods by means of indirect taxation.

The immediate future

The various methods of solving the problem of obesity already mentioned are essentially moderate to long-term solutions (five to 10 years). Details are given below of what could be done in the next five years.

Selection and treatment of the young and newly obese

Young, newly obese patients in surgeries, school clinics, contraceptive clinics and hospital out-patient clinics could be selected and helped to achieve a realistic body weight. Various members of the practice team would need to be involved and cooperation with dieticians and nutritionists would be necessary.⁶⁸

Encouragement and support for the remainder

The remainder of obese patients should be placed in therapeutic situations as individuals and groups, and educated and followed as long as possible, however it must be recognized that success is likely to depend as much on personality, appeal and attitude as on the technique used.

Research and development

Expenditure should be increased on research in this area. The research should cover sociological and psychological aspects as well as the development of new drugs which may influence thermogenesis; the development of these drugs is likely to be slow and the side-effects are unknown. Dietary and nutritional education should be improved and psychological methods for encouraging patients to follow this education should be pursued.

Advances in the management of obesity are likely to be community-based and may follow attempts to control smoking and alcohol intake by a variety of direct and indirect means.

While few of us will grow as fat as Robert Earl Hughes who weighed 74 stone 5 pounds at the time of his death in 1858 at the age of 32 years, perhaps the medical profession should begin the control of obesity as they have begun the control of smoking.

I understand the views of Bolden who has argued against the treatment of obesity, particularly in view of the poor results obtained.⁶⁹ He has suggested that resources could be better used in other directions. Groups like Fatties Anonymous and Spare Tyre Theatre Company prevent some people who are obese becoming depressed; they provide mutual support and encouragement, but do not assist in weight reduction. Nevertheless I do believe that as the penalties of obesity are severe, prevention and treatment are important.⁷⁰

Conclusion

Obesity is not a simple, single disease and further research is necessary. Although it is known that there is a relationship between obesity and disease we can only achieve quantitative information about this relationship through long-term studies. In the meantime we should concentrate our energies on the younger age group because in this group there exists association between obesity, ischaemic heart disease and other causes of death.

As many as 20% of our patients are overweight — can we significantly influence the quality of their lives? Perhaps in our dealings with them we could well mark the words:

'Make less thy body hence, and more thy grace;
Leave gormandising; know thy grave doth gape
For thee thrice wider than for other men'

(Shakespeare, Henry IV, Part 2, Act V, Scene V.)

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