OBESITY AND DISEASE

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ATTITUDES towards the 'ideal' weight vary both from society to society and also over time. In many societies, large size and a big appetite are equated with health. In Tunisia and other parts of Africa, young girls are fattened-up for marriage, and the chieftain's prestige may be judged as much by his girth as by the number of his wives or children. The late Aga Khan, leader of the Mohammedan Ismailo Sect, was weighed every year on his birthday and if he had gained in weight he received gifts in precious stones and metals to the same amount. The African explorer, Speke, in the nineteenth century came upon the harem of the King of Karagwe whose 'wives were so fat that they could not stand upright, and instead grovelled like seals on the floors of their huts. Their diet was an uninterrupted flow of milk that was sucked from a gourd through a straw. If the young girls resisted this treatment, they were force-fed like the pâte de fois gras geese of Strasbourg.'

Whilst Western society probably has few excesses to match these, nevertheless, for many centuries the fat person has been seen to personify the ideal and to portray a picture of happiness and contentment. It is only recently that both on aesthetic and health grounds the slim person has gained kudos. Now, not only is the sylph-like figure becoming admired by society, but obesity has become widely recognised by clinicians and nutritionists not only as perhaps the most common nutritional disorder in present day Great Britain but also as having serious consequences on health. Thus, insurance statistics from America show that men who are 20 per cent or more overweight have a 31 per cent greater mortality than do those of normal weight. (Society of Actuaries, 1959). It has even been suggested that to be 10 lb. overweight carries a greater health risk than smoking 25 cigarettes a day. (Sinclair, 1967).

However, whilst the indictment against obesity appears to grow in strength each year enormous gaps in our knowledge of the subject remain. There is great uncertainty regarding both an appropriate definition and possible methods of measuring obesity and consequent lack of information on its prevalence in the United Kingdom. This paucity of fundamental data makes it extremely difficult to assess the precise role of obesity in disease patterns.

The Incidence of Obesity

OBESITY has been defined as an excessive accumulation of fat in the storage areas of the body. (Davidson and Pasmore, 1966.) The problem is to decide in individual circumstances the point at which this accumulation may be considered to be excessive. The commonest method is to weigh an individual and check the weight against average weight tables. Almost all such tables are based on US data collected by 26 large life insurance companies over a period of 20 years, and involving the observation of nearly five million insured people. (Society of Actuaries, 1959.) This sample resembled the general population of North America closely, and included a sizeable proportion of wage-earners and a representative quota of recent immigrants.

In some ways, use of such tables of weight is unsatisfactory. Weight has to be related to the individual, his age and sex and the size of his physical frame. Moreover, if the number of obese people increases, the average figure may itself tend to be 'overweight'. Thus, in individual cases, it is important to establish that obesity is being measured not just deviation from a mean weight. This point was to some extent dealt with by the Metropolitan Life Insurance Company of America (1960) who listed 'desirable' heights and weights which were established on the basis of weights associated with lowest mortality, and related to frame size and age. (*Table A*).

However, it still remains true that whilst weight may indicate whether an individual is above average weight, it is not a clear indicator of whether he is too heavy, and consequently obese. Because of this, other methods of establishing obesity have been considered. Measurements of body fat can be made by under-water weighing, by determining total body water or indirectly calculated by estimating the lean body mass. These methods are clearly too complicated for normal clinical procedures. Another alternative method has been the measurement with calipers of skin fold thickness. In this instance, it is necessary to measure skin folds in several places such as, the upper arm, the abdomen and the upper thigh.

Many clinicians have argued that the definition of obesity must remain subjective. 'Obesity may be defined as a condition in which the body contours are distorted by a diffuse

Table A

'Desirable' Weights for Men and Women.
According to height and frame. Ages 25 and over. USA.
Source: Metropolitan Life Insurance Co. (1960)

MEN. Weight in pounds (in indoor clothing).

Height (in shoes)	*Small frame*	*Medium frame*	*Large frame*
5 ft. 2 in.	112 – 120	118 – 129	126 – 141
5 ft. 3 in.	115 – 123	121 – 133	129 – 144
5 ft. 4 in.	118 – 126	124 – 136	132 – 148
5 fr. 5 in.	121 – 129	127 – 139	135 – 152
5 ft. 6 in.	124 – 133	130 – 143	138 – 156
5 ft. 7 in.	128 – 137	134 – 147	142 – 161
5 ft. 8 in.	132 – 141	138 – 152	147 – 166
5 ft. 9 in.	136 – 145	142 – 156	151 – 170
5 ft. 10 in.	140 – 150	146 – 160	155 – 174
5 ft. 11 in.	144 – 154	150 – 165	159 – 179
6 ft. 0 in.	148 – 158	154 – 170	164 – 184
6 ft. 1 in.	152 – 162	158 – 175	168 – 189
6 ft. 2 in.	156 – 167	162 – 180	173 – 194
6 ft. 3 in.	160 – 171	167 – 185	178 – 199
6 ft. 4 in.	164 – 175	172 – 190	182 – 204

WOMEN. Weight in pounds (in indoor clothing).

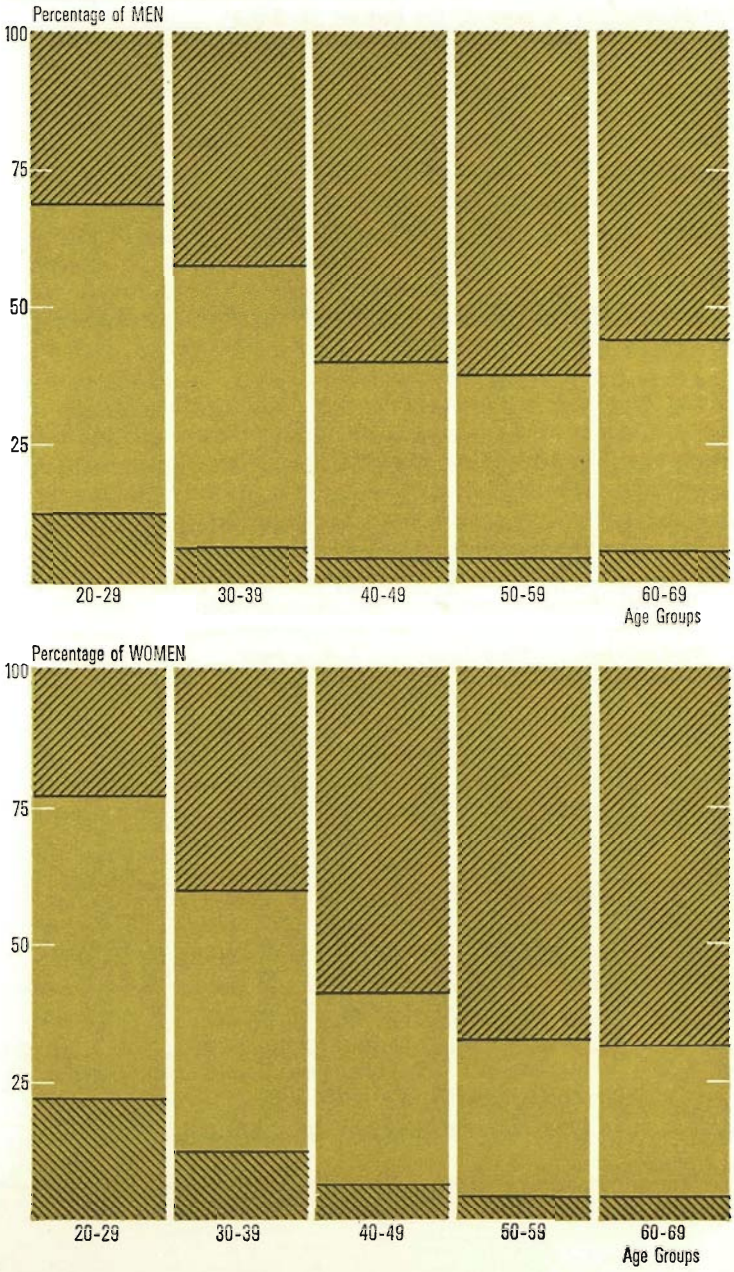
Height (in shoes)	*Small frame*	*Medium frame*	*Large frame*
4 ft. 10 in.	92 – 98	96 – 107	104 – 119
4 ft. 11 in.	94 – 101	98 – 110	106 – 122
5 ft. 0 in.	96 – 104	101 – 113	109 – 125
5 ft. 1 in.	99 – 107	104 – 116	112 – 128
5 ft. 2 in.	102 – 110	107 – 119	115 – 131
5 ft. 3 in.	105 – 113	110 – 122	118 – 134
5 ft. 4 in.	108 – 116	113 – 126	121 – 138
5 ft. 5 in.	111 – 119	116 – 130	125 – 142
5 ft. 6 in.	114 – 123	120 – 135	129 – 146
5 ft. 7 in.	118 – 127	124 – 139	133 – 150
5 ft. 8 in.	122 – 131	128 – 143	137 – 154
5 ft. 9 in.	126 – 135	132 – 147	141 – 158
5 ft. 10 in.	130 – 140	136 – 151	145 – 163
5 ft. 11 in.	134 – 144	141 – 155	149 – 168
6 ft. 0 in.	138 – 148	144 – 159	153 – 174

Figure 1

Deviation from 'best' weight.

Source: Metropolitan Life Insurance Co. (1960)

Percentage of men and women in categories (a) 10 per cent or more above 'best' weight, (b) within 10 per cent of 'best' weight and (c) 10 per cent or more under 'best' weight



accumulation of adipose tissue. This depends upon a concept which cannot be defined and which varies with taste and fashion. One observer can judge subjects consistently to indicate the incidence of obesity in a group. When such judgements are related to standard weight the inadequacy of weight alone as a criterion of obesity is clearly demonstrated.' (McMullan, 1959.)

These views are supported by other factors. Weight may be redistributed to form, for example, the 'pot belly' frequently found amongst ageing men. These individuals may not be obese or even overweight and what is required is exercise to deal with specific sagging muscles. Weight will also vary according to activity. The man who undertakes much physical work in his job or in a sport may be overweight not because of an accumulation of fat but because of the size of his muscles.

Such problems of definition have led eminent nutritionists to less clinical considerations. Yudkin (1959) has suggested that the individual himself can very easily determine whether or not he is overweight simply by looking at himself in a bathroom mirror or by checking whether or not his weight has increased over the last twenty years or so.

Thus, the great paucity of studies to establish the incidence of obesity probably almost as much reflect the problem of definition as the early lack of concern with the condition. The only national study carried out has been in America, where the insurance societies not only examined average weight but the extent of deviation from the mean. They found that one in every five men aged 20 or over, was at least 10 per cent above average weight, taking into account height and age, and more than one in every twenty weighed at least 20 per cent above the average. For women, the corresponding percentages are somewhat higher, being about one in four and one in nine respectively. The Metropolitan Life Co. (1960) went on to assess the percentages above 'best' weight, that is the weight at which mortality rates were lowest. (*Fig. 1*)

No comparable study has been undertaken in this country, and we are therefore left with less precise data on which to base an assessment of the prevalence of obesity. In 1966, *Retail Business* estimated the figure to be 28 million. (Economist Intelligence Unit, 1966.) However, it produced no data to back this estimate and in arithmetic terms the statement simply means that half the population is above and half below the average weight.

Clinical studies by McMullan (1959) and Hopkins (1965)

Table B

Percentage of subjects over 'desirable' weight according to age and sex.
Source: Montegriffo (1968)

	Percentages	
Age groups	*Males*	*Females*
25 – 29	33	21
30 – 39	47	33
40 – 49	60	53
50 – 59	52	64
60 – 69	51	59
All	48	46

found respectively that 18 per cent and 17·4 per cent of their patients visiting them in general practice were obese. However, in neither instances is a precise definition of obesity supplied; the authors relied on subjective clinical procedures. Pincherle and Wright (1967) found that amongst the first 2000 people visiting their clinic at the Institute of Directors for a check-up, there were 19 per cent between 10 and 20 per cent overweight, and 9 per cent more than 20 per cent overweight. However, their sample has a strong class and occupational bias.

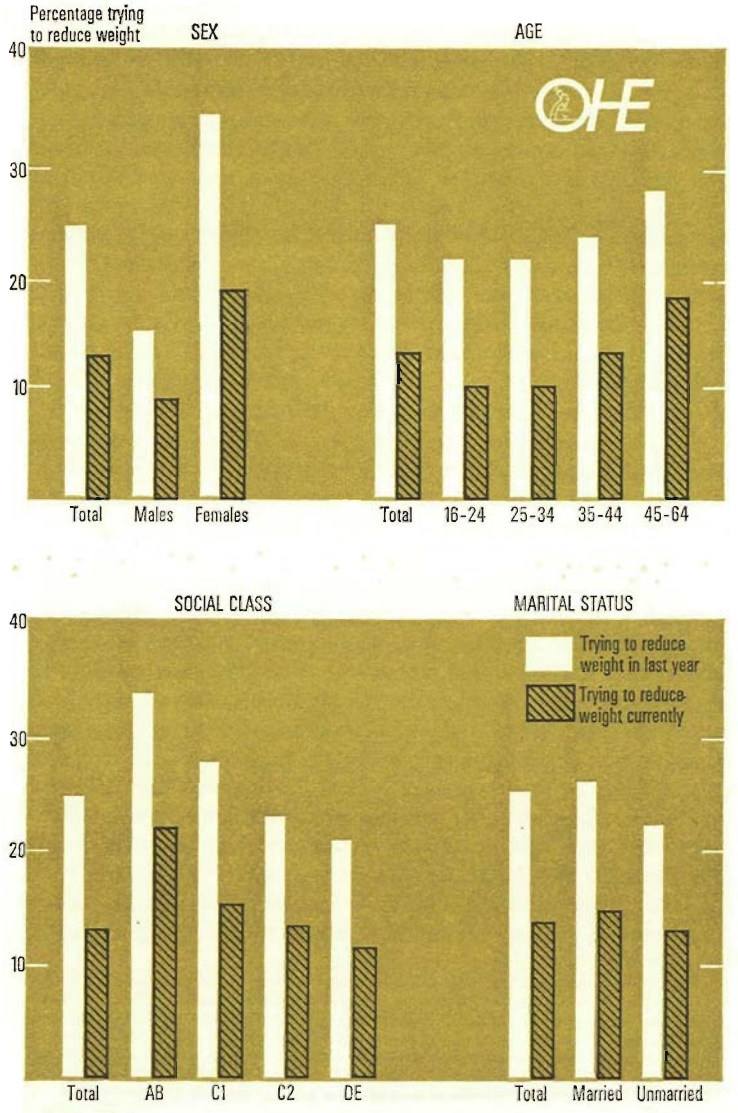
Montegriffo (1968) examined nearly 11 000 of the London employees of the British Petroleum Co. Limited between 1964 and 1966. Using the Metropolitan Life 'best' weight figures for assessment he found that almost 50 per cent of his sample were overweight. The percentage increased with age especially for women (*Table B*). Unfortunately, these data include relatively few results on the poorest social groups in the community.

Concern with, and treatment of, obesity is not however confined to medical studies. It is a subject of interest and concern to wide sections of the population, especially women. McKenzie (1967a) in a national study of 2000 adults, found that 13 per cent were currently trying to slim, and that within the last year 25 per cent admitted to having made some attempt to reduce weight. The majority of these attempts were by women, 35 per cent of whom had tried to lose weight in the last year. (*Fig. 2*). These figures reflect a wish to slim rather than a medical need to slim, but they can be related indirectly to the level of obesity in the United Kingdom. Just under one in ten of the total sample had been advised by their general practitioners during the past year to try to reduce weight. Since about 70 per cent of the population visits their general prac-

Figure 2

Population trying to reduce weight expressed as a percentage of total population and as percentages of selected groups of the population.

Source: McKenzie (1967a)



titioner in the course of a year, this figure may give some indication of the proportion of the population which the medical profession feels to be significantly obese.

The accumulation of data from these various studies would seem to indicate a picture similar to that found in America with about one in five adults considered to be clinically obese.

THE great majority of people who are obese have no specific predetermining conditions; in this instance, the condition is known as 'Simple Obesity'[1]. In such cases, obesity arises because the intake of food is in excess of physiological requirements and in consequence, fat tissues are built up. However, such a definition merely states the problem and does not indicate why intake exceeds need. A number of factors may be involved.

One of the major causes of 'Simple Obesity' is eating too much food or at least obtaining too many calories. It is known that the eating habits of obese people are variable. In some, continual nibbling seems to be an important cause of the excess food intake. These include many housewives who are fond of cooking and also others who work in kitchens. In other cases, food seems just too good to resist and enormous meals are eaten.

Not only is the quantity of food consumed important but also the type of food. Foods vary enormously in the number of calories they contain per ounce. For example, apples contain only 13 kcals per ounce and steamed lemon sole, 18 per ounce. But a chocolate cake contains 140 kcals per ounce and crisps, 160. Diets containing large quantities of fat and sugar containing foods are likely to provide excessive quantities of calories and in particular in the case of sugar containing foods the diet can be extremely palatable and tempting. High consumption of alcohol may also be a significant factor; a half pint of Bitter contains approximately 90 kcals and a single tot of whisky, 50 kcals.

Another factor influencing food intake is related to the very real psychological involvement which we all have with food. 'It is one of the very first means by which we demonstrate our mood and individuality. Thus, a baby demands food then perhaps rejects it; it comes to assert its personality by demand-

[1]There are some who have endocrine disease or syndrome, and in whom obesity emerges as one aspect of that disease. Some of the diseases producing the disorder are hypothyroidism, Cushings syndrome, Stein-Leventhal syndrome, eunuchoidism, hyperinsulinism and hypopituitarism. These diseases are relatively rare and must be regarded as making only a small contribution to the total incidence of obesity. Where obesity does exist as a result of one of these diseases the essential issue is the cure of the disease itself. This should lead to the disappearance of the obesity. It is not intended to consider this aspect of the problem in this booklet.

ing a particular food and rejecting others. As we grow older, simply because we eat three meals a day we come to regard ourselves as experts on the subject. In the same way food asserts itself as an integral part of our culture and many social events in our lives take place round the meal table. There are also deeper in-built psychological issues. Food helps to satisfy hidden needs for all of us. These include security; reassurance; adventure; pleasure; maternal satisfaction and paternal pride; individuality; group acceptance; and prestige.' (McKenzie, 1967b.) In consequence, food is often turned to in times of loneliness, unhappiness, grief, depression, anxiety, tension, frustration, and boredom. In a study of 500 patients it was found that 370 ate more when they were nervous or worried and that 95 ate more when idle or bored. (Freed, 1947.)

Silverstone and Solomon (1965) found that very few obese patients have marked psychiatric abnormalities but confirmed that many obese patients are of an anxious disposition and over-eat when they are upset and worried.

It has been frequently suggested that genetic issues may also be a factor involved in obesity. Certainly a large proportion of fat people have fat children. If one parent is obese about 40-50 per cent of the children become obese; the proportion rises to 70-80 per cent if both parents are obese. However, whilst a number of studies with animals have indicated that genetic factors are involved, it has not been possible to isolate such issues in humans. A key problem is to divorce genetic problems from family customs and eating habits. Children may very readily copy their parents example of over-eating or developing a taste for high calorie foods.

Two other physiological considerations have been put forward as causes of obesity. It has been suggested that a breakdown in the appetite control mechanism, the hypothalamus, may make some individuals consume enormous quantities of food. The hypothalamus is a small area of the brain, lying beneath the main bulk of the cerebrum, which controls the production of many hormones; it also regulates through the autonomic nervous system many of the vegetative functions of the body. By means of stereotaxic techniques and fine needles, it is possible to destroy microscopic areas of the hypothalamus in accurately localised positions. If in a rat the two medial nuclei of the hypothalamus are destroyed in this manner, the animal begins to eat voraciously as soon as it recovers from the anaesthetic; in a few weeks the animal becomes obese and this can be attributed to the loss of a 'satiety centre'. On the other hand, if two lateral nuclei in the hypo-

thalamus are destroyed, the animal, although otherwise normal, refuses to eat; unless fed forcibly it will die of starvation. Very occasionally in man, disturbances in feeding can be shown to be due to diseases affecting the hypothalamus. However, the great majority of obese patients examined at post-mortem have had no gross lesion of the hypothalamus. (Davidson and Pasmore, 1966.)

A 'caloric balance' may be achieved not only by a reduction in food intake but also by changes in caloric output regulated by metabolic methods. Dodds (1950) pointed out that general experience shows very clearly that people fall into two categories. There are persons who maintain a constant weight over the many years despite an excessive intake of food, and others who respond immediately to increases in caloric intake by putting on weight. A number of studies have demonstrated the validity of this hypothesis. One study examined the response of students to diets very high in calories. Some gained weight but others did not. In those who did not gain weight, there was an overall increase in metabolic rate in response to the increased food consumption. It was found that the excess food was not being stored but burnt off and converted into heat. Those who gained in weight showed no such increase in metabolic rate. (Miller and Mumford, 1966.)

Obesity may also be caused not by positively eating too much, but also negatively by not taking enough exercise. Investigations in the United States have shown that whereas obese women tend to walk on average two miles a day, controls walked five miles a day. Similar figures were found for men. Young fat girls have been shown to eat less and spend more time watching television than in active recreation compared with normal girls of their own age. In another study, a motion camera was used to follow the activities of obese and non-obese subjects playing volley-ball and tennis. The study showed that obese youngsters playing volley-ball are immobile 80-90 per cent of the time compared with 50 per cent of the time for the non-obese; playing tennis they were inactive for 60 per cent of the time as compared to less than 20 per cent for the controls. (Mayer, 1964.) The problem is to establish whether the low level of activity causes the individual to become obese or whether the obesity merely reduces the individual's manoeuvrability.

The problem of inadequate exercise is probably a growing one. The development of a prosperous industrial society means that many of the essential physical activities of life have been removed. Physical activity at work has been cur-

tailed by the development of machinery. Buses, cars and trains reduce the extent to which we walk. The coming of lifts, washing-machines and even dish-washers have cut down enormously on the quantity of physical activity which most of us have in day to day living. Such influences increase as one grows older, more prosperous and consequently, more and more prone to rely on mechanical aids.

The life styles of individuals may change in other ways. Peasants from poor communities may migrate to more prosperous societies but continue to place reliance upon large quantities of carbohydrate foods while in addition consuming other more sophisticated high calorie foods. People who stop smoking may for both physiological and psychological reasons find their appetite growing.

None of the factors outlined above can be regarded as the sole cause of obesity amongst all sufferers. As yet, it has not been possible to isolate the relative importance of each cause in the overall incidence of obesity. This is at least partly because there is frequent interaction between the various factors with no one factor having an apparent over-riding significance. It also reflects the limited nature of current researches in this field.

OBESITY is only rarely designated the specific cause of death.[1] However, obesity is frequently regarded as being a significant factor in other diseases. An issue of fundamental importance concerns whether any casual relationship exists.

United States life insurance studies have consistently indicated that overweight men have a significantly higher mortality than men of average or less than average weight, and that the greater the degree of overweight, the larger the excess mortality The Build and Blood Pressure Study (Society of Actuaries, 1959) shows that in the broad ranges of ages from 15 to 69 years the mortality among men 10 per cent or more overweight for age and height was one-fifth higher than that for all persons insured as standard risks; among men 20 per cent or more overweight, the excess mortality was about one-third. The figures for women are not quite so dramatic, but still disturbing. (*Fig. 3*) Moreover the figures would generally understate the excess mortality associated with extreme overweight in that insurance companies exercise considerable care in the selection of extreme overweight risks particularly for the older age groups.

It is frequently indicated that obesity predisposes to a variety of complications. There are firstly, mechanical complications. These are 'the effects on joints and ligaments of having too much weight to carry; backache, arthritis of the knees and hips, flat foot. An excess of fat round the trunk and in the abdomen is an obstruction to free breathing; chronic bronchitis in the winter is a common association. Abdominal surgery becomes more difficult when the operational field is obscured by fat. Ventral hernia is a further complication of abdominal obesity. Varicose veins occur more commonly in fat than in thin people. . . . Obese people are often slow in their movements and therefore prone to accidents, at home, at work, or in the street.'

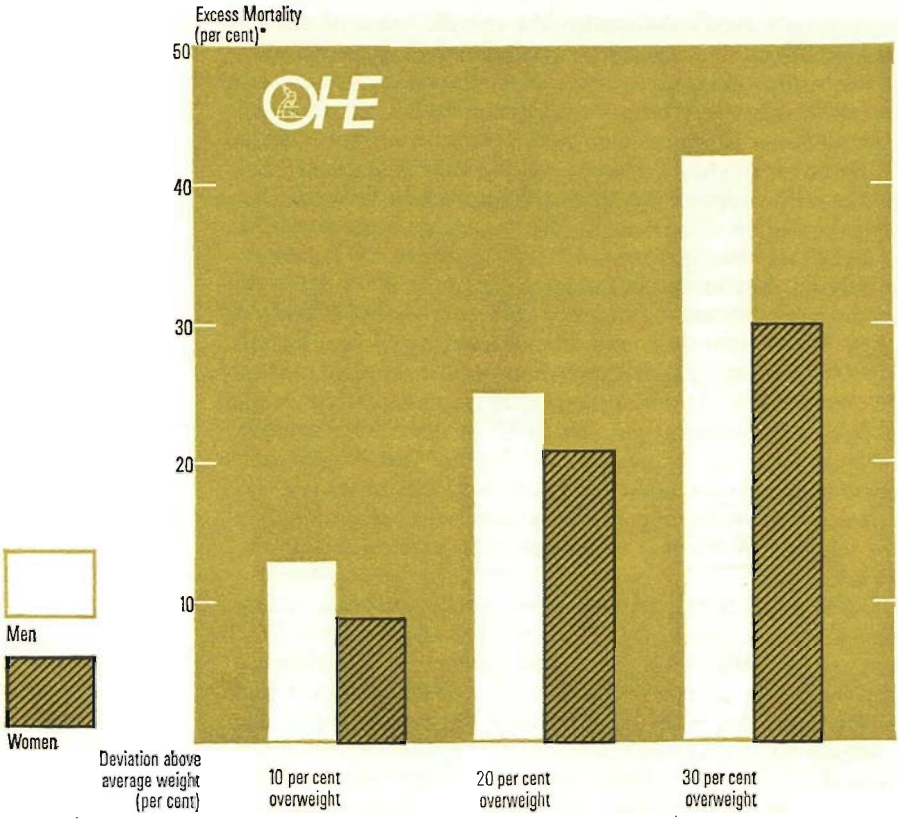
Secondly, there are metabolic complications. 'The majority of people who contract diabetes mellitus in middle-age are obese; yet they seldom develop ketosis and seem to have a remarkable facility for oxidising acetoacetic acid. Obesity is

[1] In 1967, the Registrar General's Statistical Review of England and Wales, listed only 171 people as dying from obesity.

Figure 3

Excess mortality among overweight men and women (aged 15-69).

Source: Society of Actuaries (1959)



*Compared with all persons insured as standard risks

often associated with chronic lipaemia and a raised level of cholesterol in the blood. Perhaps for this reason obese people have an unusually high incidence of cholesterol stones in the gall-bladder and may develop widespread deposits of cholesterol in the arteries (atheroma), sometimes leading to coronary thrombosis, renal failure or gangrene.' (Meiklejohn, 1959.)

Again the United States insurance studies have graphically indicated the increased risk level with overweight in certain diseases. (*Fig. 4*)

A major study over twelve years and involving more than 5000 men and women examined the inter-relationship between weight change and serum cholesterol level, blood pressure levels and the risk of developing coronary heart disease. Antecedent relative weight and weight gain after 25 years of age proved to be strongly related to risk of angina pectoris and sudden death. A number of suggestions as to how obesity could increase the incidence of coronary heart disease were made. Firstly, increased cardiac workload and blood pressure resulting from excess weight; secondly, an increase in the amount of coronary atherosclerosis resulting from high caloric intake and increased lipid levels and blood pressure accompanying a gain in weight. Thirdly, a decrease in physical activity associated with obesity, which may result in deficient development of collateral circulation in subjects of atherosclerotic involvement of coronary arteries. It was felt that a combination of all three of these factors might be at work. (Kannel et al, 1967.)

Other studies have shown that rates of atherosclerotic heart disease, hypertensive vascular disease, and all cardiovascular renal disease and diabetes are higher amongst those who were markedly overweight in childhood. (Huenemann, 1968.) It has also been demonstrated that women who start their pregnancy with a high initial weight are more likely to develop toxemia of pregnancy, hypertension and a number of other complications. (Emerson, 1962.)

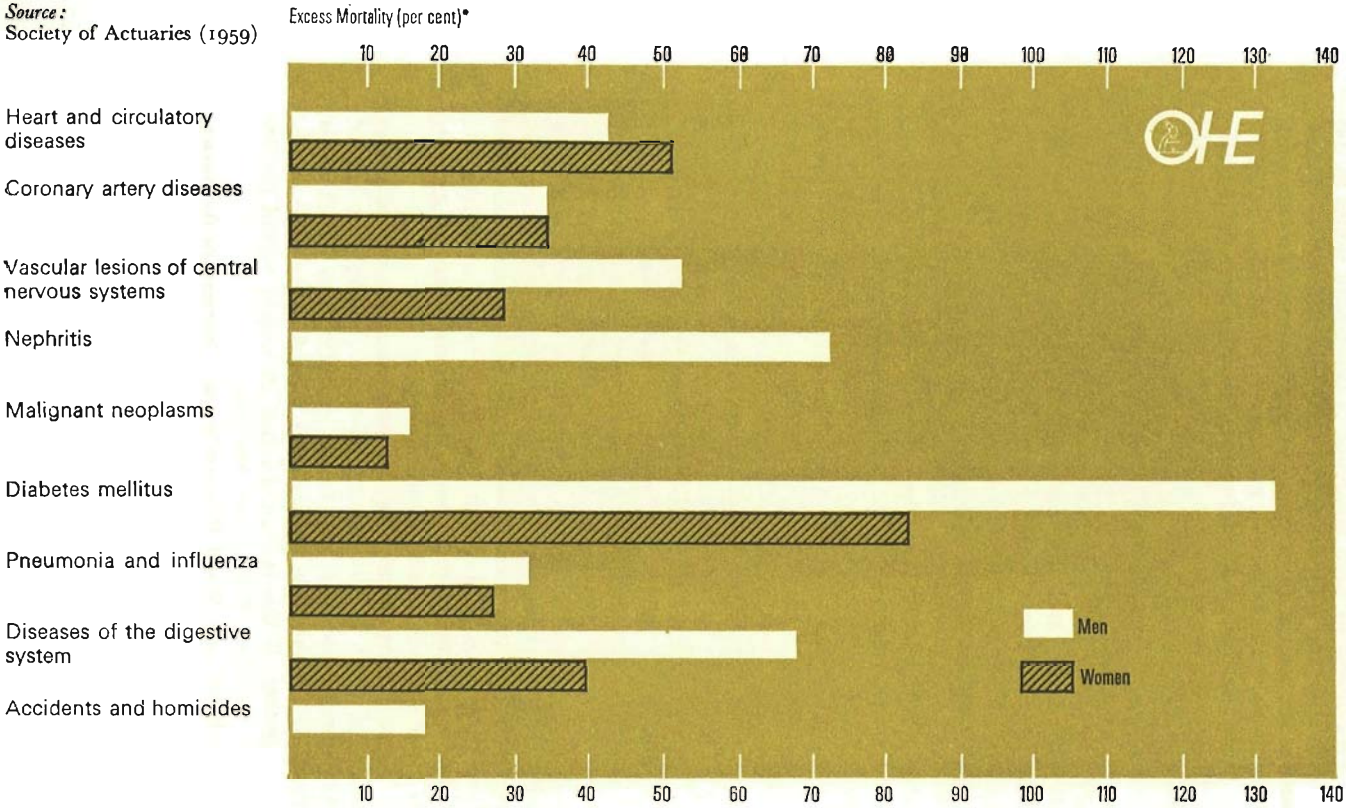
Thus, obesity figures significantly in most the of major causes of death in this country. However, it might be argued that obesity does not lead to the complications which cause death, but is simply a consequence following from the significant disease. If this is so, reduction in weight would not influence survival. This is not the case.

The Build and Blood Pressure Study (Society of Actuaries, 1959) examined the incidence of mortality amongst policy holders who were charged higher than standard premiums solely because they were overweight at the time they were

Figure 4

Excess mortality among overweight men and women (aged 15-69) by cause.

Source:
Society of Actuaries (1959)

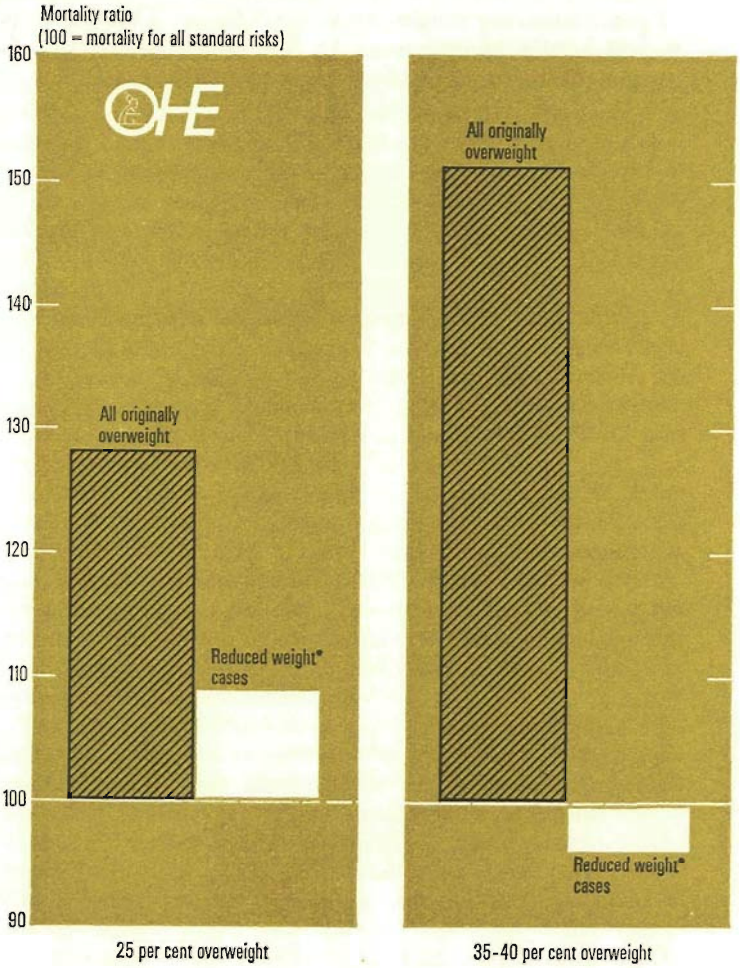


*Compared with all persons insured as standard risks

Figure 5

Mortality reduction through weight loss.

Source: Society of Actuaries (1959)



*Cases originally rated sub-standard through overweight but which subsequently became standard risks through weight reduction

insured but who later qualified for insurance at standard rates because they had reduced their weight sufficiently. Those male policy holders who reduced their weight experienced practically the same mortality as standard risks for a period of years following weight reduction. (*Fig. 5*) This study confirmed earlier investigations by the Metropolitan Life Insurance Company. (Dublin and Marks, 1951.)

THERE are two phases in the treatment of obesity. The first is to reduce weight to within normal limits, and the second to maintain body weight at this level. The first phase demands that the patient absorbs fewer calories than he expends, thereby forcing his body to utilise stored fat. The second phase demands that either by the maintenance of new eating habits, or some other procedure, caloric intake and expenditure are balanced.

In order to achieve these developments, it is essential that the patient accepts the argument that he or she should lose weight and is willing to modify his or her behaviour in the light of this decision. There must also exist a method by which a successful reduction in weight can be achieved and a lower weight maintained without too much hardship.

Given that obesity is caused by the ingestion of more calories than is required, then the obvious cure would seem to be to reduce the level of caloric intake. Most recommendations are that such a reducing diet should contain approxmately 1000 calories per day. This compares with the normal recommended allowance for adults undertaking light work of 2750 calories per day for men and 2250 calories per day for women[1]. (British Medical Association, 1950.)

Various theories have been put forward as to what food should be consumed to provide this caloric level. They have involved two criteria. Firstly, there has been some suggestion that diets low in particular nutrients or consumed in a particular manner are more effective. Thus, Kekwick and Pawan (1956) used over periods of seven days, 1000 calorie diets in which 90 per cent of the calories were provided in turn by carbohydrate, fat or protein. They found that loss of weight was most rapid with the high fat diet, less so with the high protein diet and there was little or no weight loss with the carbohydrate diet.

The way in which food is consumed may also be of significance. It has been found in rats that nibbling, that is eating frequent meals led to less weight gain than gorging, that is consuming the same number of calories per day in one or two

[1]The average in energy value of food obtained for household consumption in 1966 was calculated to be 2560 calories per day. (Ministry of Agriculture, Fisheries and Food 1968.)

meals. Fabry et al, (1964) found that people who have a number of meals a day or who nibble fairly frequently, tend to be less fat than those who only eat two meals a day. Munroe et al (1966), found that for some patients, frequent feeding of small quantities of food was more effective than infrequent feeding of larger amounts.

The second main criterion concerns the ability of the individual to keep to particular diets; this has favoured the high protein or low carbohydrate and low fat diet. Yudkin has for a long period claimed that the low carbohydrate diet is the most effective. 'The reduction of carbohydrate to 60 or 80 grams a day can readily save 1000 or more calories. Such a diet has many advantages. The most useful is that it allows unrestricted amounts of food containing only fat or protein, since these appear to be self-limiting when carbohydrate is low. It is also nutritionally satisfactory and with a little effort can become a permanent way of eating.' (Yudkin, 1967.)

There is no doubt that attempts to reduce weight by restriction of food intake is favoured both by most clinicians and the public. Yudkin (1968) found in a survey of 15 000 doctors that virtually all of them recommended a reducing diet to their patients. The diet most commonly suggested was based on a restriction of only, or mostly, carbohydrate. About half as many restricted fat as well as carbohydrate. Similarly, McKenzie (1967a) found that 78 per cent of the public who had tried to lose weight during the past year changed their food patterns. Most of these concentrated on restricting carbohydrate foods. Some 17 per cent also took more exercise. (*Table C*)

Taken to its logical extreme, attempts at weight loss by restriction of diet may be extremely dangerous. A number of studies have examined the treatment of gross obesity by a period of fasting in hospitals. In one instance, this resulted in the death of 2 of the 12 patients. (Spencer, 1963.) Moreover, not only has the method been shown to be no more effective than a low caloric diet but also the loss in weight has not been maintained in the long run. (MacCuish et al, 1968.)

There is an obvious relationship between reduction of caloric intake and an increase in caloric expenditure resulting from increased exercise. Unfortunately, whilst both activity and resultant heat loss owing to muscular inefficiency dissipate body energy, they also lead to an increase in both caloric requirements and appetite. However, it is possible that the value of the exercise is greater than often accepted. If in fact the increased metabolic rate continues for a long period after the task has been completed or if the efficiency of food utilisa-

Table C

Methods used to reduce weight.

(Expressed as a percentage of the total sample of slimmers)

Source: McKenzie (1967a)

BASE =	*Total* 500	*Men* 147	*Women* 353	*16-24* 90	*25-34* 87	*35-44* 102	*45-64* 221	*Married* 389	*Unmarried* 111
Changed foods eaten	78	67	82	73	80	80	77	79	71
Took more exercise	17	30	11	31	18	15	11	15	23
Took pills or medicine on doctor's or chemists's prescription	16	5	20	16	18	12	17	15	18
Took special food product for weight control	11	9	12	8	14	9	12	12	9
Bought special slimming garment	2	1	2	2	1	2	2	2	1
Went into hospital	2	3	2	—	2	—	4	2	3
Went into slimming clinic	—	—	1	—	—	1	—	—	1

tion depends upon the amount of exercise, then an increase in physical activity may be valuable. (Miller and Mumford, 1966.) Recent studies by Miller suggest that at least the latter finding may be true.

In practice, it is evident that most efforts to reduce weight, whether or not taken under the supervision of a doctor are unsuccessful. Thus, Kemp (1966) examined 684 hospital patients during the period 1956-65. The rate of default was in the region of 50 per cent and of the 308 patients who attended until treatment was completed, some 65 per cent were either unable to achieve the necessary reduced weight level or to maintain it once achieved.

Similar disappointing findings are found in studies on children. Lloyd et al (1961) demonstrated that during intensive treatment substantial reductions in weight were achieved. However even then only approximately one-quarter of the children studied managed to get back to normal levels and frequent relapses occurred during subsequent years when supervision was less strict or non-existent. Similar findings were reported by Alley et al (1968) who achieved successful weight reduction in only 54 per cent of obese children and noted that even amongst these only one-quarter lost as much weight as was really required.

In studies on the public, not necessarily related to slimming efforts recommended by the medical profession, McKenzie (1967a) found that 44 per cent of the public who tried to slim did not lose as much weight as they wanted. Twenty-seven per cent said they gave up too soon, 26 per cent, that they had insufficient willpower to stick to the diet, and 23 per cent, that they did not follow the method correctly. These views correspond with the reasons for failure suggested by doctors.

Yudkin's study of general practitioners, indicated that 50 per cent of doctors were prescribing medicines as well as recommending dietary changes to deal with obesity. As has already been indicated, 'it is much easier for a doctor to prescribe a low calorie diet, than it is for a patient to stick to it. Because it is so difficult to refrain from what are, after all, among the good things of life, many attempts have been made to reduce patients' desires to eat and thereby enabling them to keep more strictly to their diets.' (Silverstone, 1967.) In consequence, medicine may be used to help the patient to adhere to a particular diet. This may partly imply creating a state of mind in which an individual becomes more determined to adhere to the diet, and can therefore overcome the difficulties involved with it. It may also partly involve physic-

ally reducing appetite, or increasing metabolic rate.

The report of the British Medical Association Working Party on Amphetamine Preparations (1968) defines the ideal anoretic drug. 'It should be effective, and help patients to eat considerably less food than previously, should retain this effect for as long as it is taken, should have no undesirable side effects and should not lead to dependence.'

In 1963, the British Medical Journal stated that 'amphetamine is the medicine most widely used to deal with obesity. Treatment produces alertness and wakefulness, elevation of mood with increased confidence and euphoria, lessened fatigue, and an increased ability to concentrate. In humans and experimental animals, amphetamine also curbs appetite leading to weight loss. Weight loss is entirely due to reducing caloric intake and other suggested mechanism such as metabolic stimulation and impared digestion are of no importance. Recent experimental work supports the long held view that amphetamine has a direct effect on the hyperthalamus by which it inhibits food intake. Others, however, believe that the sole action is one of central stimulation, and the resultant elation enabling the patient to adhere more readily to a restricted diet.' (*British Medical Journal*, 1963.)

It is estimated that 2·3 million prescriptions were written in general practice in 1967 for preparations containing amphetamine. About 100 million tablets or capsules were prescribed without taking into account the 10 million or so used in hospitals. Sixty-four per cent of these general practice prescriptions were for the treatment of simple obesity. Other prescriptions were for different indications. (Medical Data Ltd, 1969.)

Whilst General Practitioners continue to use amphetamines in the treatment of obesity, official attitudes are becoming more cautious. Thus, the recent BMA Working Party recommends that 'these drugs should be avoided as far as possible in the treatment of obesity, but if in individual cases the doctor feels they must be used, they should be prescribed for a limited period only'.

Other recent research has argued that obesity is associated with a metabolic defect. It has been demonstrated that in obese patients, there is a block to muscle glucose uptake. The excess glucose consumed is available for conversion to lipid in the adipose tissue. A viscious cycle is established because the greater the degree of adiposity, the greater the block to muscle glucose up-take. (Butterfield et al, 1965, 1967.) When fenfluramine was perfused into one

forearm, the muscle glucose up-take on that side was increased. (Butterfield et al, 1968.) This preparation therefore appears to offer a logical treatment for obesity and has the additional advantage of no long term addictive problems. It was acknowledged by the BMA Working Party as having the least undesirable side effects although higher doses than originally recommended may be needed in refractory cases.

Obesity constitutes only a small proportion of patient's consultations with general practitioners. Calculations based on Medical Data Ltd. statistics data suggest only 1·5 per cent of all consultations in the United Kingdom. Nevertheless, this amounts to over 4 million consultations per year. Moreover, as pointed out by McMullan (1959) and Hopkins (1965) obesity is rarely the prime cause of a patient visiting a GP and the figure therefore probably substantially underestimates the amount of advice about obesity given by doctors. Nevertheless, the cost of therapeutic treatment remains low since, as has been indicated already, most treatment is limited to dietary advice. The total cost of prescription medicines used in the treatment of obesity is estimated to be about £3 million. In addition, in 1967, 52 000 hospital-bed days at a cost of £470 000 were taken up for the treatment of obesity.

These costs are very small when compared with the public's more general attempts to reduce their weight to what they regard as a reasonable level and maintain it at this level. Retail Business (Economist Intelligence Unit, 1966) estimated that in 1965 the market value for slimming foods was £20 million and that it was increasing at the rate of about 15 per cent per year. This would indicate a figure approaching £35 million in 1969.

Sales are spread over a wide variety of types of product including dietary preparations to replace food, low calorie biscuits and bread, artificial sweeteners and slimming drinks. Dietary preparations and slimming biscuits are sold mostly through pharmacists but most starch reduced products are now bought at the grocers' shops.

Conclusion

UNTIL recently, an individual's weight rather like the colour of his hair was felt to be primarily 'God ordained'. Moreover, whilst his weight might reflect both his character and his personality, it was thought to have little influence on his health. However, in the last few years obesity has come to be regarded as of clinical significance and to have an influence on length of life and the success with which diseases may be treated. These recent developments mirror lines of approach being established in wide areas of medicine as the result of our growing awareness of the 'iceberg' of disease. Slight variations from the norm have in many instances come to be regarded not as trivial idiosyncracies but as deviations which must be treated if more specific disease symptoms are to be avoided. The problem in the case of obesity as with many others is that our knowledge both of the natural history of the disease and the physiological mechanisms which cause it is very limited. Thus, the first essential is to extend our knowledge as widely as possible. This will involve much more extensive research not only into the reasons why people become obese but also why others apparently living in an exactly similar manner remain thin.

Even if current knowledge is sparse, it is nevertheless clear that the management of obesity is both complex and difficult. Unlike nutritional deficiencies obesity cannot be alleviated by the use of nutritional supplements added to existing popular foods. It implies a substantial modification by the individual of his existing food habits. Not only do most people find such changes difficult to adhere to but also in some cases involving, for example, a metabolic defect, the level of caloric intake would have to be so low as to be totally unrealistic for a large proportion of the population. It seems inevitable, therefore, that a totally successful cure for obesity will only be achieved when some method of 'burning off' excess calories has been isolated. It is to this area that we must look for future developments.

However, if slimming at the present time may be extremely difficult, nevertheless, it has at least one advantage over most other health orientated activities. Many health campaigns must of necessity have negative aspects in that the individual

must be encouraged to stop acting in a way he finds enjoyable, for example, he must give up smoking. Inevitably, there is an element of this in slimming for there must be some restriction in food intake. But weight reduction has one fundamental advantage. For once both clinicians and society support the same cause. The thin person is not only clinically more healthy but also today aesthetically more desirable and this may strengthen the individual's will to succeed.

The data on obese children are particularly distrubing. It is clear that the fat child is extremely likely to become a fat adult. It would seem essential, therefore, to concentrate on modifying behaviour at an early age when habits are more flexible and the problem is not so great. Such efforts would begin at ante-natal clinics and be carried on through biology and domestic science classes in schools. The support of the school medical officer would also be valuable in this work as would the constant vigilance of the family doctor.

A number of obesity clinics, mainly in hospitals, have been established within the last few years. Such developments would seem valuable since they provide both an opportunity to watch over in some detail the physiological and psychological responses of the obese patient as well as to provide a suitable background against which to extend research activities. In the long run, they might well also reduce the load of the General Practitioner in this area of disease. Nevertheless, at present, the General Practitioner still has a vital role in the management of obesity at all stages. Effective weight reduction is dependent upon long term supervision and encouragement. The provision of diet sheets and an exhortation to the use of willpower is of little help. General Practitioners must be aware not only of the present state of nutritional knowledge but also about current areas of uncertainty. They will then understand the very real obstacles which confront any seriously obese individual in his attempt to reduce his size to a clinically and aesthetically desirable level and be more likely to provide the social support and encouragement so essential to success at the present time.

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