



OBESITY

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Office of Health Economics

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INTRODUCTION

'We are unanimous in our belief that obesity is a hazard to health and a detriment to well-being. It is common enough to constitute one of the most important medical and public health problems of our time, whether we judge importance by a shorter expectation of life, increased morbidity, or cost to the community in terms of both money and anxiety' (James, 1976). So concluded a working party set up jointly by the UK Department of Health and the Medical Research Council. Sixteen years later little appeared to have changed with Kent and Bowyer (1992) arguing that 'obesity is one of the most important preventable causes of ill health in the UK today'.

Obesity is often accompanied by elevated levels of blood cholesterol and blood pressure giving rise to an increased risk of mortality from coronary heart disease, stroke, certain cancers and non-insulin dependent diabetes. Obesity is also associated with gall bladder disease, osteoarthritis, gout, and impaired respiratory and hepatic function (Table 1 includes some of the ailments associated with obesity). However, the relationship between a high body mass index (BMI) and disease may not necessarily be a causal one. For example, arthritis in the elderly may lead to reduced physical activity which could result in weight gain, thus a high BMI may not be the cause of the arthritis but is likely to exacerbate the problem.

In the UK over half the male adult population and just under half the female population are overweight to a clinically undesirable degree (The Health of the Nation: One Year On... Department of Health 1993). This represents a substantial increase in the prevalence of overweight and obesity over the past decade. Men tend to predominate in the overweight or grade 1 category (BMI 25-30 – for explanation of obesity classifications see Box 1) whereas women are more frequently found in the obese and severely obese, grades 2 and 3 (BMI 30-40 and BMI over 40), which have more serious implications for morbidity and mortality. Many people are aware of their excess weight and attempt to rectify this situation. This is demonstrated by the fact that a quarter of all adults in the UK are thought to be on diets at anyone time (Kent and Bowyer, 1992).

In the Government's consultative document 'The Health of the Nation' (1992), the obesity target is to reduce the proportion of obese people (BMI over 30 – see Box 1 for definition) to no more than six per cent among men and no more than eight per cent among women by the year 2005. These targets relate to men and women aged 16-64 years. However, the progress report, 'Health of the Nation: One

Year On...’ (Department of Health, 1993) based on 1991 data shows an increase in obesity (BMI over 30) from eight per cent in 1986/7 to 13 per cent among men in 1991 and from 12 per cent in to 15 per cent among women.

Overweight and obesity probably arise from most, or all, of the following factors: (1) an ample food supply; (2) a sedentary lifestyle; (3) psychological and behavioural factors; and (4) genetic or metabolic factors. Evidence will be examined concerning both the genetic/hereditary aspects of obesity and the environmental, psychological and behavioural factors which may also be significant in the aetiology of obesity. The recently identified binge-eating disorder, which appears to effect a substantial proportion of the obese and severely obese (BMI 30-40 and BMI over 40), may indicate important psychological elements in some cases of obesity but relatively little is clear about this disorder at the present time. It is discussed briefly in the epidemiology section.

This paper is set out as follows: chapter two provides an historical perspective to the development of awareness of the health dangers of obesity; chapter three looks at the incidence and prevalence of obesity and the morbidity and mortality associated with it. Chapter four explores understanding of the causes of obesity; chapter five considers treatment options and evidence of their effectiveness; chapter six examines the issue of prevention of obesity; chapter seven assesses social attitudes towards obesity; chapter eight sets out the cost to the NHS of treating obesity and chapter nine gives the conclusion.

Table 1 Some of the conditions where obesity is a risk factor

Coronary Heart Disease	Stroke
Cancer (endometrium, cervix, ovary, breast)	Non-insulin dependent diabetes mellitus
Hypertension	Hypercholesterolaemia
Gall bladder disease	Osteoarthritis
Gout	Ovulatory failure
Menstrual irregularities	Polycystic disease of the ovaries

BOX 1 Definitions of Obesity

Obesity is usually assessed by body mass index (BMI). This is calculated by weight in kilograms¹ divided by height in metres squared. The BMI is also known as Quetelet's index. The desirable BMI is between 20-25 for a young adult since this is associated with the lowest mortality ratio. Body mass index has been graded to indicate the degree of risk to health, with grade 3 posing the most serious health risks. The grading system is set out below:

Grades of obesity

Ungraded: BMI <20	Underweight
Grade 0: BMI 20-24.9	Desirable weight
Grade 1: BMI 25-29.9	Overweight
Grade 2: BMI 30-40	Obese
Grade 3: BMI >40	Severely obese

Examples of body mass index calculations are as follows:

BMI = Body mass in kg/(Height in metres)squared

Example 1 Height: 1.58m (5 feet 2 inches); weight: 100kg (15 stone 10 pounds)

BMI = 100/(1.58)squared = 40.06 (Grade 3: Severely obese)

Example 2 Height: 1.83m (6 foot); weight: 82.55kg (13 stone)

BMI = 82.55/(1.83)squared = 24.65 (Grade 0: Desirable weight)

In practice the grades of obesity should not be used as rigidly as the classifications may suggest since body frame and build should also be considered, thus, the categories in reality will have an element of overlap and flexibility. It has been suggested that a different BMI scale be used for women, with BMI 18-23 regarded as desirable, BMI 23-28 considered overweight and BMI over 28 judged to be obese (Bray, 1979).

A clear case can be made for the interpretation of obesity changing with increasing age. Among Finnish men over 80 years of age the highest five-year survival was among those with a BMI of over 30 (Mattila et al, 1986). Andres et al (1985) found that minimum mortality was associated with the following BMI at different ages²:

Age	BMI
20-29	21.4
30-39	21.6
40-49	22.9
50-59	25.8
60-69	26.6

It is thought that people's shape as well as their weight is an important factor with regard to potential hazards to health. A measure of 'central' fat distribution can be obtained by calculating the waist/hip ratio (WHR), by dividing the waist measurement by the hip measurement. Patients with a high WHR are the 'wrong' shape since they are 'apples' rather than 'pears'. A waist/hip ratio of above one in men and 0.85 in women has been identified as a meaningful cut-off point associated with increased health risks (Bray,

1 1kg = 2.2lbs; 1lb = 0.4536kg

2 However, a report of the Royal College of Physicians (1983) argued that no adjustment for age should be made since, they claimed, an increase in weight could be as dangerous as maintaining body weight constant at an excessive level.

1993). Many women are pear-shaped, with fat on the hips and legs, whilst an 'apple' shape, with fat around the middle, appears to be the harmful form of obesity, leading to increased risks of diabetes and heart disease (Kent, 1993). However, it is easier for apple-shaped people to alter their WHRs than for pear-shaped people because abdominal fat is more easily broken down than subcutaneous fat. 'Pear-shaped' individuals, however, may still be prone to 'mechanical' problems such as varicose veins and difficulties with weight-bearing joints. Those with excess abdominal fat and a BMI of 27 may be at greater health risks than those adults with a BMI of over 30 but who have their fat peripherally distributed.

Smoking suppresses the appetite and stimulates the body's metabolic rate, thus smokers tend to keep slim. However smoking should not be used to keep down weight. A report of the Royal College of Physicians (1983) states that 'smoking is the hazard which should be tackled first in an overweight smoking patient, the subsequent weight gain on stopping smoking being a smaller risk than continuing to smoke'.

HISTORY

The desirable or ideal body shape appears to be closely related to a country's stage of economic development. Western industrialised nations and Less Developed Countries often have very diverse notions concerning the most favourable body shapes. In some less developed countries fattening houses are provided for brides-to-be to build up their bulk over a period of weeks or months in preparation for their marriage. Western industrialised nations may have had similar beliefs with regard to body shape when they were at a comparable stage of economic development. Beller (1977) points out that until early this century Venus was always depicted as moon-faced, pear-shaped and well fleshed out. However, she argues that the insurance studies published in America early this century showing the adverse health implications of obesity 'ushered in a brave new world in body images'. Beller cites examples of primitive groups, nomadic or otherwise, where 'the petite has less aesthetic appeal than the massive'. Women with broad hips, powerful limbs and who are in general somewhat large appeared to be more favoured than smaller women in these traditional societies.

It has long been argued that being fat conferred a survival advantage upon our ancestors because fat people carried around their own energy reserves in the form of body fat and were better equipped to survive famines. During famines the metabolic rate decreased so as to minimize energy loss. When food became plentiful the metabolism and appetite were set so as to regain the weight loss quickly. This may explain why obesity appears to be esteemed in traditional societies but not in modern industrialised ones where food is plentiful. What was advantageous to our forebears has ended up as a great hindrance in modern societies where obesity has become associated with an increased mortality risk.

Although Hippocrates, the father of medicine, was reported (quoted in a 1927 translation of his work) to have pointed out that very stout persons are more liable to sudden death than are thin persons; Ayers (1958) tracing changing attitudes towards obesity suggests that in medieval times obesity was the happy prerogative of barons, lords and monks. In the renaissance period the paintings and sculptors of well-padded female forms by Botticelli, Da Vinci and Raphael or the curvaceous nudes of Rubens all demonstrate that pursuit of the slim form was less admired. Cobb (1951) wrote that 'the possession of a bulging paunch was not regarded as exceptional or as a matter of shame in the halcyon days of the eighteenth century'. William Banting (1864) in a letter addressed to

the public expresses a modern attitude towards obesity referring to it as a 'parasite' and an 'affliction'. Weight loss he suggests will lead to 'comfort and happiness'. However, he probably did not express the prevailing view towards obesity at this time.

Allchin (1906) suggested very conservative dietetic treatment for obesity, however he argued that those who are 'very stout, and yet very well;...should be left well alone'. In the early twentieth century life insurance companies began accumulating evidence linking obesity with early mortality. Obesity became related to a number of medical and surgical problems. For example, Terry (1923) discovered a high incidence of hypertension among obese women admitted to the Presbyterian Hospital Dispensary. Terry concluded that the majority of obese women who seek medical treatment have hypertension – a risk factor for stroke and heart disease in particular.

Slimming drugs are said to date back to the nineteenth century when ephedrine was extracted from a Chinese plant (Saul, 1993). Thus, there has been, at least a modicum of interest in slimming aids, but it was probably confined to the upper strata of nineteenth century society. A century ago Veblen (1889) raised the possibility that body weight might be related to socioeconomic status. He speculated that thinness had become an ideal of feminine beauty when it served as a status symbol of an emerging leisure class.

Experimentation with ephedrine-like compounds led to the development of amphetamines, the appetite suppressant effect of which was first reported in the late 1930s. However, amphetamines directly stimulated the central nervous system and had many adverse side-effects such as irritability, restlessness, insomnia and anxiety. Amphetamines could also lead to dependence and hence are no longer used to suppress appetite in the UK. Low calorie diets have also a long history. As early as 1924 Mason had employed diets of 500kcal per day (a very low calorie diet is defined as less than 800kcal per day) for as long as 100 consecutive days in Canada.

The change in attitudes towards obesity seen in Western nations is probably a result of the discovery of health risks associated with being obese, the growing popularity of sport and active leisure pursuits, and current trends in the shape of models and fashion garments. The social stigma attached to being obese, particularly with regard to obese women, may consequently have increased in recent times. Nevertheless, as noted in the introduction, the proportion of obese people (BMI over 30) has increased over the past decade.

EPIDEMIOLOGY

The absence of detailed information concerning the distribution of overweight and obese individuals in the United Kingdom led to the commissioning of a national survey of heights and weights in adults (Rosenbaum et al, 1985; OPCS, 1990). The results show a trend towards rising body weight, as shown in Table 2.

Most studies concentrate on the prevalence of obesity but one of the few to look into the incidence of obesity was the OPCS morbidity survey undertaken in 1981/82. It found an incidence rate of 12.3 per 1,000 per annum among females, based on visits to GPs.

Table 2 demonstrates a worrying upward trend in the proportion of the population who are overweight (BMI 25-30) and obese (BMI 30-40). Whilst males have experienced an increase primarily in the proportion who are overweight (BMI 25-30), females have chiefly seen a rise in obesity (BMI 30-40). Data included in 'The Health of the Nation: One Year On...' (Department of Health, 1993) show that in 1991 obesity (BMI over 30) had risen to 13 per cent among men and 15 per cent among women, overweight (BMI 25-30) had also increased to 40 per cent of men and 29 per cent of women. These 1991 statistics suggest that over 14 million adults in the UK are overweight (BMI 25-30) and a further six million are obese or severely obese (BMI 30-40 or BMI over 40) and face increased health risks from a number of diseases and disorders.

Support for an increasing prevalence of obesity in the population is provided by Knight (1984), Gregory et al (1990) and Gulliford et al (1992) who supply additional evidence of an increase in body

Table 2 Prevalence of overweight and obesity

Grade of obesity	1980 Male (%)	1980 Female (%)	1990 Male (%)	1990 Female (%)
BMI 25-30 (Grade 1)	34	24	37	24
BMI 30-40 (Grade 2)	6	8	8	12
BMI >40 (Grade 3)	0.1	0.3	0.1	0.3
Total	40.1	32.3	45.1	36.3

Sources: Rosenbaum et al, 1985; OPCS, 1990.

mass in the British population, particularly among women. Silverstone et al (1969) found, among London women from social classes four and five, twice the prevalence of obesity of that of women from social classes one and two. Garrow (1988) suggests

BOX 2 Binge-eating Disorder

Recently there has been considerable debate on the epidemiology of binge-eating disorder among the obese. Stunkard (1959) identified 'the eating binge' as one of three distinctive eating patterns among obese subjects (the other two being: night-eating syndrome and eating-without-satiation). However, only in the 1990s was it proposed that binge-eating disorder should be included as a new eating disorder classification. The diagnostic criteria for binge eating disorder has been set out as follows (Spitzer et al, 1993):

A. Recurrent episodes of binge eating, an episode being characterised by both of the following:

1. Eating in a discrete period of time (eg. within any 2-hour period), an amount of food that is definitely larger than most people would eat during a similar period of time in similar circumstances.
2. A sense of lack of control during the episodes, for example, a feeling that one can't stop eating or control what or how much one is eating.

B. During most binge episodes, at least three of the following:

1. Eating much more rapidly than usual.
2. Eating until feeling uncomfortably full.
3. Eating large amounts of food when not physically hungry.
4. Eating alone because of being embarrassed by how much one is eating.
5. Feeling disgusted with oneself, depressed, or feeling very guilty after overeating.

C. Marked distress regarding binge eating.

D. The binge eating occurs, on average, at least two days a week for a 6-month period.

E. Does not occur only during the course of bulimia nervosa or anorexia nervosa.

Telch et al (1988) found that 'binge eating becomes significantly more prevalent as the degree of obesity increases'. The sharpest increase was noted in those with a BMI over 34 where 40 per cent were found to be binge eaters. Among those with BMIs below 34 relatively few were bingers (less than 15 per cent). The bingers were aware that the bingeing episodes were abnormal, feared not being able to stop eating voluntarily and felt depressed after bingeing. The high calorie binges were usually carried out in secret. Yanovski et al (1992) studied 10 obese (BMI over 30) female bingers with an average age of 36 years. They found the women had binged on average for 17 years with an average of 3.33 binges per week.

that all surveys in Western industrialised nations indicate a higher prevalence of obesity in the lower socio-economic groups.

It is useful to place the UK figures in perspective by making an international comparison. Table 3 shows that the overall prevalence of overweight and obesity appears to be highest in Canada (for all ages). The UK appears to be fairly typical in its obesity rates. America has similar overall rates but a higher proportion of men in the more serious grades of obesity. Overweight (BMI 25-30) is more common amongst men, whilst more women than men are obese (BMI 30-40) or severely obese (BMI over 40), especially women in the 50 years and above age group.

Mortality

Since the first actuarial investigation of mortality in 1903, life insurance companies have been aware that overweight people tended to die younger than lighter people and hence could not be as profitably insured at the same premiums. Smokers tend to weigh less than non-smokers and to die younger, and so distort the relationship between obesity and mortality in studies of mixed populations. A non-smoker, for example with BMI 20-25 would have to increase his or her weight to BMI over 30 in order to experience the same mortality risk as a person with BMI 20-25 who smokes 20 or more cigarettes a day. The all-cause mortality data in a large US study of 750,000 men and women showed a gradual rise from a BMI of 25 to an almost 2.5-fold higher risk at a BMI of 40 (Lew and Garfinkel, 1987). However, the BMI influence on mortality in the elderly is less apparent. This may be explained by the fact that many very ill elderly people become underweight as death approaches.

Obesity reduces longevity mainly through its effect on related diseases which often run a chronic course and cause significant functional disability. Severe obesity (BMI over 40) is associated with a 12 fold increase in mortality in persons aged 25 to 35 years as compared to those with BMI 20-25 and BMI 30-40 with a two fold increased mortality risk (Drenick et al, 1980). In Australia the Institute of Health and Welfare estimated that 10 per cent of deaths in 1989 were due to obesity-related disease (Crowley et al, 1992). Obesity is a risk factor for many potentially fatal diseases which are likely to be recorded as the cause of death rather than obesity itself. Other diseases associated with obesity, such as diabetes and osteoarthritis of the weight bearing joints are crippling rather than fatal, thus mortality is not the only measure useful in gauging the significance of obesity as a health problem, since the effect on quality of life is also important.

Obesity is related to excess mortality from cancers of the colon, rectum and prostate in men, and the gallbladder, endometrium, cervix, ovary and breast in women (Garfinkel, 1985). Obesity also increases the risk of hypertension, stroke and heart disease which can lead to premature disability or to death. Fuller et al (1980) studied death from heart disease in a prospective seven year study of 18,403 civil servants aged 40-64 years. They discovered that obesity in men with normal glucose tolerance resulted in an increased mortality of 10 per cent, but in men with impaired glucose tolerance the increased mortality risk was 40 per cent. They concluded that at age 45 years BMI over 30 carries about three times the mortality risk of BMI 20-25.

Table 3 Prevalence rates of overweight and obesity (%) among adults in selected countries

Country	Age	BMI 25-30		BMI 30-40		BMI 30-40 >40		Total		Author
		M %	F %	M %	F %	M %	F %	M %	F %	
UK	16-64	37	24	8	12	0.1	0.3	45	36	OPCS, 1990
Netherlands	20-34	20	10	2	2	#	#	22	12	Van Sonsbeck 1985
	35-49	37	21	4	5	#	#	41	26	
	50-64	46	43	5	10	#	#	51	53	
Norway	20-24	17	11	1	2	~	0.1	18	13	Waler 1984
	40-44	41	30	5	5	~	0.5	46	35	
	60-64	44	43	8	24	0.1	1.1	52	67	
Australia	25-64	34	24	7	7	#	#	41	31	Bray, 1985
Canada	20-69	40	28*	9	12*	#	#	49	40	Millar, 1985
USA	20-74	31	24	12	12	#	#	43	36	Abraham, 1983

Sources: Garrow, 1988; OPCS, 1990.

Key to symbols: # BMI 30-40 and > 40 not separated; ~ prevalence < 0.05; * criterion for women: BMI 23.8-28.5; BMI > 28.6.

AETIOLOGY

People gain weight when they expend less energy than they consume in the form of food. In an average sedentary person about three-quarters of the total energy expenditure is accounted for by the body's basic activities e.g. breathing, heart beat, maintaining body temperature. This is called the body's resting metabolic rate and is partly determined by body composition (lean body mass). About one-tenth of energy expenditure is required for digesting food and the remainder for all other activities e.g. physical exercise. It has been argued that some people become obese adults because they continue to follow established eating patterns as children when they were allowing for growth. Bierman (1979) asserted two simple forms of obesity. One is lifelong with onset during childhood and with gains at puberty and, for women, during pregnancy, tending towards severe obesity (BMI over 40) in the long-run. The second form is adult-onset obesity associated with weight gain as a consequence of a more sedentary way of life and reduction of energy expenditure in middle-age. Bierman's suggestion may appear to be a logical possibility but is not, as yet, backed by scientific research. Knight (1984), for example, found no relationship in British women between weight gain and numbers of children.

Inactivity is seen by some as a cause of obesity and will be associated with a low metabolic rate. However, it is unclear whether people are inactive because they are obese or whether they are obese because they are inactive. Furthermore, many non-obese people will lead a sedentary lifestyle. Various factors have been argued to be associated with obesity including a genetically inherited predisposition, low socioeconomic status and psychological factors. In some cases hidden goals and motives behind excessive eating have been identified – such factors may be subconscious and only emerge during therapy. We consider in turn genetic, socioeconomic and psychological factors as explanations of obesity.

Genetic factors

Floch and McClearn (1980) looked at whether genetic factors were a cause of obesity. They reviewed several studies and found that two out of three obese patients had parents where one or both were also obese. However, this could be explained by families tending to share a similar environment. Children may follow their parents eating habits and diet. Withers (1964) found a closer correlation between weights of adopted children and their natural parents rather than their adoptive parents, clearly lending support to a

hereditary/genetic explanation. More recently Stunkard et al (1986a) found that for 540 Danish adult adoptees that 'there was a significant relationship between the weight class of the biological mother and the adoptee, but not between the adoptive mother and adoptee'. However, the relationship was strongest in determining thinness rather than fatness.

The genes which lead to a tendency to weight gain are thought to be insufficient on their own to cause obesity and can be overcome by manipulating lifestyle and diet. A high-fat/low-carbohydrate diet may be a specific factor in manifesting a metabolic (genetic) predisposition to obesity (Lean et al, 1989). Adhering to a high-carbohydrate/low-fat diet will make obesity less likely.

Socio-economic factors

Socio-economic factors appear to have a correlation with obesity. Garrow (1992) claims that 'in addition to metabolic considerations there are social factors that predispose to substantial weight gain, such as, a low educational level, chronic disease, little physical activity, high alcohol consumption, loss of employment, and (in women) child bearing'. Sobal and Stunkard (1989) say that a review of 144 published studies of the relationship between socioeconomic status and obesity reveals a strong inverse relationship among women in modern Western societies. The relationship is less clear for men and children. In less developed countries, however, there is a strong direct relationship between socioeconomic status and obesity among men, women and children.

There are three possibilities for the powerful inverse relationship between obesity and socioeconomic status in the developed world, especially among women. Obesity could influence socioeconomic status, socioeconomic status could influence obesity, or a common factor or factors could influence both obesity and socioeconomic status. Stunkard and Sorensen (1993) say that 'the relation of obesity and socioeconomic status is bidirectional: each influence is at work'. However, another factor or factors may also influence both obesity and socioeconomic status. One such factor could be heredity.

The first empirical study to focus on the relationship between socioeconomic status and obesity found a remarkably strong inverse relationship among women. Obesity was six times more prevalent among women of lower socioeconomic status than among those of upper socioeconomic status (Goldblatt, Moore and Stunkard, 1965; Moore, Stunkard and Srole, 1962). The study was taken further to include parental socioeconomic status or 'socio-economic status of origin'. Goldblatt et al (1965) found that the

relationship of obesity with parental socioeconomic status was almost as strong as that of the subject's own socioeconomic status. Goldblatt also found that the prevalence of thinness varied directly with socioeconomic status; the higher the socioeconomic status the greater the prevalence of thinness. It has been suggested that amongst children the relationship between socioeconomic status and obesity does not hold but by adulthood (mid-twenties upwards) it becomes firmly established.

Some studies in the UK have shown an association between socioeconomic status and obesity among men. The National Health Survey of 5,362 people revealed that both men and women who had been raised in social classes four or five were significantly more likely to be overweight at age 36 than their non-manual counterparts (Braddon et al, 1986). The National Child Development study of over 9,000 people indicated that the weight differences among men are established at a much earlier age. By the age of 23 they found men in the lower social classes had a threefold increased risk of obesity compared to those from higher social classes; for women the increased risk of obesity was twofold (Power and Moynihan, 1988). However, other studies of men, have shown a direct, not an inverse, relationship and some no discernible relationship at all.

Gillum (1987) showed that in the USA there is an inverse relationship between socio-economic status and obesity for both Black and White women. One of the reasons for the inverse relationship may be that upper status women have higher educational levels and an increased knowledge concerning nutrition and dieting. They may also have greater access to and be more familiar with the benefits of exercise. Many will also have professional jobs and may wish to appear healthy, attractive and self-disciplined to those with whom they work. The fact that lower socioeconomic status tends to be associated with a higher prevalence of obesity in developed societies, could be taken to give more credence to an environmental rather than inherited explanation for the cause of obesity although both factors may be important and the direction of causation may be reversed.

Psychological factors

Psychological factors have been identified as a significant component in obesity in some instances. 'Reactive obesity' is said to exist when over-eating takes place as a reaction to a distressing situation or event. It appears that over-eating may provide consolation when it seems to be impossible to resolve a problem. The simplest hypothesis would be to suggest that eating provides comfort in times of anxiety, depression and loneliness.

Conclusion

Garrow (1988) says 'the aetiology of obesity in man has genetic, social, cultural and psychological components in different proportions in different people'. Thus, for some people obesity will derive primarily from social and environmental factors, while for others the main factor may be a consequence of inherited or genetic characteristics and in other cases psychological problems will be the principal root. All will become obese as the result of the interplay of several, or all, of these factors.

TREATMENT OF OBESITY

The reasons mentioned by patients for wanting to lose weight include: a concern about their general appearance, a shortness of breath and poor exercise tolerance. For younger women, infertility is occasionally a motivating factor. For older people a pain in the back, hips and knees may prompt a desire to lose weight. Weight loss may also be required prior to an operation. A request for referral may be encouraged by a fear of heart disease, experience of angina, or refusal of life insurance at normal rates (Garrow, 1992). It is thought that men often diet for medical reasons while women are more likely to diet for social reasons such as appearance. The dieting population comprises of about four females for every male dieter (Prior Information – personal communication). For those who are overweight (BMI 25-30) medical treatment is unlikely to be necessary, but it is important to prevent further weight gain and a conventional diet may be used in an attempt to reduce the BMI to 20-25. Increased health risks are usually only apparent in those with BMI over 30, and especially for those with BMIs over 40.

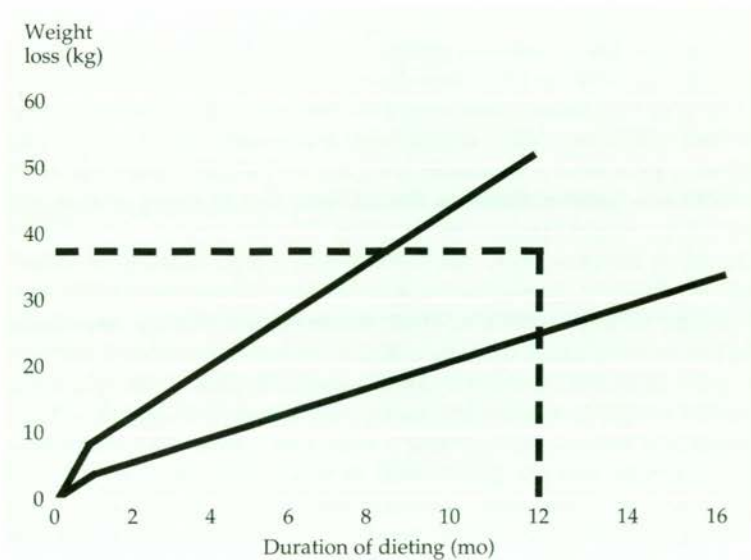
Quality of life as well as a recognition of the health risks of obesity will often contribute towards a desire to lose weight. For example, a woman of 1.58 metres tall (5 feet 2 inches) weighing 100kg (15 stone 10 lbs) – BMI over 40 – would have a mortality risk 250 per cent above a person at a desirable weight (BMI 20-25). This degree of obesity is a greater threat to health than that of being within the desirable weight range but smoking 20 cigarettes a day. Heart disease is the main risk, but there is also a significantly increased risk of diabetes, osteoarthritis, gall-bladder disease and some sex-hormone sensitive cancers. Thus, treatment for obesity, especially for the severely obese (BMI over 40), is necessary in order to prevent serious ill-health. Goldstein (1992) suggests that even relatively modest weight loss amongst the severely obese (BMI over 40) offers substantial benefit. He says that a man with a BMI of 40 who drops his weight by five per cent to BMI 38 will reduce his mortality risk by 12 per cent. Goldstein concluded that 'modest weight loss... has beneficial health effects in most obese patients with medical complications of obesity'. He does, however, suggest that a continuum exists with greater benefits for increased weight loss. Nevertheless, for those who are unable to attain a desirable weight target, an incentive for even minor weight loss exists since this will reduce the risk of obesity-related medical complications.

Aims of treatment

There are two main aims in the treatment of obesity. The first is to reduce weight to within a desirable weight-for-height range. The second is to maintain body weight at this level by educating the patient in order to alter their life style and eating habits. Obesity can be seen as a chronic condition and slimming is, thus, not simply a matter of eating less but is a life-long programme of behavioural change.

The weight goal may, nevertheless, differ from patient to patient. A 60 year old woman weighing 100kg and 1.58 metres tall (BMI of 40) with osteoarthritis of the knees will benefit greatly from a loss of 10-15kg but will experience increasing difficulty and diminishing returns from any further weight loss. However, a similar height and weight 20 year old with a family history of diabetes would be well

Figure 1 Rate of weight loss for obese patients



Note: Desirable rate is between 0.5 kg (bottom line) and 1.0 kg/week (top line), but during the first month of dieting double this rate is permissible, since some of the weight lost is glycogen and water. Broken line indicates that a patient might expect to take about a year to lose an excess of 37 kg.

advised to aim for the desirable weight range (BMI 20-25) (which would suggest a weight of no more than 63kg) since the difficulties in doing so, great as they may be, are likely to be less than the problems arising from diabetes in middle-age. Figure 1 demonstrates a desirable rate of weight loss, for a patient in this position, indicating that it will probably take at least 12 months to reduce weight from 100kg to 63kg.

Treatment options

Table 4 demonstrates Garrow's preference for the appropriate treatment selection for obesity depending on the severity of the condition. Dietary restriction remains the mainstay treatment for all grades of obesity. Restriction of fat intake is especially important for the treatment of obesity and also as a policy for preventing heart disease, stroke, cancers, etc. A low-fat diet (automatically a low energy diet) is thus the cornerstone of dietary treatment. However, caution should be exercised to ensure that fat does not provide less than 25 per cent of dietary energy. Diets with more severely reduced fat intakes could result in nutritional deficiencies. Conventional diets tend to have a daily energy intake of between 1000kcal and 1500kcal and should bring sustained weight loss of between 0.5kg and 1kg a week. Success depends upon adequate nutrition and patient compliance. Compliance cannot be achieved unless the programme is palatable, the dieter's appetite is satisfied and their motivation sustained over the necessary period. Correctly formulated meal replacement products can ensure that in reducing the energy content of a diet, nutritional adequacy is not compromised. Dietary advice is essential, including correcting mistaken beliefs concerning what types of foods are fattening or slimming and helping people judge their food intake correctly (Mitchell, 1988).

Patients must understand that, although the first two or three weeks of dieting are likely to bring about rapid weight loss since glycogen and associated water is lost as well as adipose tissue, the rate of weight loss will slow down after the initial period. The dieter may become despondent when this happens leading to decreased compliance and weight regain.

As will become clearer later in this chapter, some health professionals would take issue with Garrow's table arguing that very-low-calorie diets could be a first line therapy for the severely obese (BMI over 40) and may be used for the obese (BMI 30-40). Gastric stapling may be recommended, by some, for the severely obese, particularly those who seem unable to lose weight by conventional means.

Table 4 Treatment options for overweight and obesity

Treatment	BMI > 40	BMI 30-40	BMI 25-30
Starvation	No	No	No
Very-low-calorie diet	Possible	No	No
Conventional (Low-calorie diet)	Yes 1st line	Yes 1st line	Yes 1st line
Milk	Yes 2nd line	Yes 2nd line	Possible
Jaw wiring/waist cord	Yes 3rd line	Possible	No
Exclusion surgery (gastric stapling)	Possible	No	No
Anorectic drugs	Possible	Possible	No
Physical training	No	No	Possible

Source: Garrow (1988).

It is important to bear in mind that the largest group requiring or seeking medical advice or treatment will be in the range BMI 30-40 with relatively few people having a BMI over 40. The majority of the overweight, those with BMI 25-30, will probably try over-the-counter diet treatments rather than seek the help of health care professionals, since the degree of overweight is unlikely to lead to severe medical complications.

In this context, we consider minimal intervention strategies, very-low-calorie diets, pharmaceuticals, surgery, behavioural therapy, the social benefits of treatment and long-term maintenance of weight loss.

Minimal intervention strategies

Black et al (1984) looked into the possibility of minimal interventions for weight control. Simple, less intensive interventions for weight control were considered since, if successful, they would be more cost-effective and efficient than a comprehensive behavioural programme. Three simple verbal instructions about how to lose weight resulted in an average weight loss of 5kg by seven months follow-up. These results were compared with full-length behavioural programs and the results were found to be not significantly different. 'It was concluded that a minimal intervention program seems to produce weight loss and to be cost-effective and efficient method for some subjects' (Black et al, 1984). It was suggested that simple, less intensive interventions could be

offered alongside more complex ones in a 'stepped-care' approach with more comprehensive treatments available for those unable to achieve weight loss by simple, cheap methods.

Very Low Calorie Diets (VLCDs)

A very low calorie diet (VLCD) is defined as a diet supplying less than 800kcal per day. The Cambridge Diet is an example of a very low calorie diet (VLCD). Initially this diet, as the sole source of food, provided an intake of only 330kcal per day. The Committee on Medical Aspects of Food Policy (COMA, 1987) suggested that any diet should contain a minimum of 400kcal per day for women and 500kcal per day for men or tall women (173cm or over, 5ft 8in). The COMA report also recommended that VLCD are not used for more than four weeks at a time. Howard (1985) who pioneered the Cambridge diet claimed that it produced rapid weight loss consistent with good health and well-being and that it was complete in all essential nutrients; nevertheless the diet was altered to contain 405kcal per day in order to comply with the COMA report.

The Cambridge Diet comes in a number of guises: soups, milkshakes, and desserts each containing 135kcal. Plenty of water should be consumed and black coffee, tea or calorie-free drinks can also be taken. Howard recommends that subjects avoid weight regain after completion of the diet by continuing to take the formula meals three times a day while gradually reintroducing normal food in the form of healthy meals and snacks as recommended by the manufacturers. This transition period aims to help the dieter learn new, moderate eating habits while they determine the level of daily calorie intake that is likely to maintain their target weight.

The American National Task Force on the Prevention and Treatment of Obesity (1993) reported research into the efficacy and safety of VLCDs over the period 1966-1992. It was found that whilst VLCDs have been superior to conventional low calorie diets in achieving short-term weight loss, they have not been more successful in maintaining weight loss in the long-term. The Task Force concluded that 'a balanced LCD (low calorie diet) combined with a program of exercise and behaviour modification remains the treatment of choice' for the majority of mildly obese individuals. For the severely obese VLCD can achieve significant short-term weight loss and rapid improvement in weight-related medical conditions. To promote long-term weight loss the Task Force recommended VLCDs should be offered as part of a comprehensive program including nutritional education, an exercise program, and behavioural therapy. However, even programmes containing all

these elements have disappointing results in terms of sustained weight loss over a period of several years.

Pharmaceuticals as a method of weight loss

Pharmaceutical agents may be useful in treating obesity. These agents will be designed to do one or more of the following: inhibit absorption from the gut, increase energy expenditure, or reduce hunger and thus make dieting more acceptable. Drugs in the first two categories are under development. The most widely used pharmaceutical in the treatment of obesity is the anorectic drug dexfenfluramine which acts by increasing the satiating power of food. Guy-Grand et al (1989) carried out a one-year, randomized, multicentre, placebo-controlled, double-blind study of 822 obese patients. Four hundred and four patients received dexfenfluramine, 418 were given placebo. In addition both groups adhered to a calorie-restricted diet. The patients emanated from 24 centres in nine European countries. At 12 months 189 patients (45 per cent) in the placebo group had withdrawn – over half of these because they were dissatisfied with the weight loss – and 150 from the dexfenfluramine group (37 per cent). Thirty-five per cent of patients on dexfenfluramine achieved weight loss greater than 10 per cent compared with only 17 per cent of those on placebo. One-third of those treated with dexfenfluramine lost over 10kg compared with only 16 per cent of those receiving placebo. Virtually all weight loss was achieved by the sixth month; weight remained almost stable for the last six months, although some signs of weight regain had emerged in both groups by 12 months. The drug group achieved 30 per cent of the required weight loss compared with 20 per cent in the placebo group.

Enzi et al (1988) reported on a double-blind controlled multicentre study of dexfenfluramine. One hundred and thirty-three obese patients entered the study; 64 were receiving the active drug and 69 receiving a placebo. After 90 days treatment the average weight loss was 8.1kg in the active group against 3.5kg in the placebo group. Enzi et al concluded that in the 'short-term controlled trials dextrofenfluramine is an effective and safe weight lowering drug with minimal side effects'.

It is believed that selective serotonin re-uptake inhibitors (SSRIs) antidepressants have a similar effect to dexfenfluramine. The SSRI fluoxetine is awaiting approval in the US for the treatment of obesity. It will be marketed, if approved, at a dose of 60mg (the recommended antidepressant dose is 20mg daily). However, whilst short-term effectiveness has been shown for certain groups of

patients, results from long-term trials are not yet available (Scrip, 1992).

New anti-obesity drugs are currently under development. Second generation thermogenic drugs are about to undergo clinical trials and are being researched by several major pharmaceutical companies. However, even if the trials prove successful, it will be at least five years before any of these compounds reaches the market place.

Surgical treatment

When conventional dieting fails to lead to sufficient weight loss patients may require more drastic action in the form of some physical obstacle to food ingestion. The advent of surgical treatment for obesity some 30 years ago radically changed the outlook for the severely obese. Indeed long-term follow-up studies suggest that surgery is probably the most successful treatment for the severely obese, particularly if coupled with post-operative advice on diet maintenance. Nevertheless, surgery should only be offered if all other treatment options have failed since the risks attached to major surgery are heightened by excess weight. The patient must be severely obese (BMI over 40) to warrant surgical intervention and also must have no serious contraindications, either medical or psychiatric, to surgery.

Intestinal bypass was the earliest of the surgical procedures for the treatment of obesity. This operation drastically alters the way that the body works. The risks associated with intestinal bypass include liver damage, anaemia, vitamin deficiencies, kidney and gallstones and chronic diarrhoea. This therapy has now been superseded by gastric reduction procedures which produce similar benefits but with fewer complications.

The most common surgery for severe obesity is now some form of gastric restriction surgery which was first enacted in the late 1960s. Such operations decrease the amount of food entering the stomach at any time as the size of the stomach is reduced dramatically. If more food is eaten than the stomach can hold, patients will vomit. In gastroplasty (stomach stapling) procedures a small pouch with a capacity of about 25ml is created from the main body of the stomach by a double line of staples. Anderson et al (1987a) reported 5-year follow-up results for severely obese patients after either horizontal gastroplasty or treatment with a very-low-calorie diet (VLCD). Twenty-six gastroplasty patients were followed-up and 30 VLCD patients. The maximum weight loss was achieved at nine months in both groups although the average weight loss was slightly greater

in the gastroplasty group (26kg against 22kg). At five years 18 (70 per cent) of the gastroplasty patients had relapsed compared with 25 (83 per cent) of the VLCD group. Whilst neither of these results represent resounding successes the gastroplasty group did show a greater, although still disappointing, level of weight loss maintenance over the five year period. However, VLCDs are cheaper, less socially restricting, require no hospitalisation and a minimum of medical supervision, and are not associated with serious adverse side effects, pain or disfigurement that may result from surgery.

Anderson (1987b) reported on patients given gastroplasty after pretreatment with a very-low-calorie diet. Anderson et al concluded that vertical banded gastroplasty could add a significant weight loss to that obtained by VLCD. The authors also suggested that the pre-treatment principle may have some advantages over immediate gastric surgery. For example, patients can be selected with respect to their ability to comply with a diet.

Jaw wiring may also be employed as a physical barrier to food ingestion. Jaw wiring restricts the intake of solid food while permitting the ingestion of liquids. Jaw-wiring may be combined with a waist cord – a nylon cord sealed around the waist serves as a reminder if patients overeat. However, weight regain after the removal of the wires is a major drawback. Jaw wiring can nevertheless perform a useful function when weight loss in preparation for surgery is required and this is its most common use (Stunkard et al, 1986b). Patients should be made aware that jaw wiring and gastric stapling are not alternatives to dieting but a means of enforcing a diet. The practice regarding a desirable rate of weight loss still apply, as does the need for proper dietetic supervision. Jaw wiring can be painful and socially restricting and whilst good short-term results may be achieved in the long-term most patients will regain weight when the wires are removed (Fordyce et al, 1979). For this reason gastric stapling has been preferred. Garrow (1992) says, 'despite... reservations, jaw wiring or gastric stapling is the best option for a minority of severely obese patients'.

Intragastric balloons were introduced in the 1980s and attempt to achieve gastric restriction by noninvasive means. A plastic bubble limits the capacity of the stomach leaving patients feeling full after small meals. The procedure is still experimental and balloon breakage is a problem currently being encountered. Weight regain even with the balloon in place has been reported.

Lindor et al (1987) carried out a randomized double-blind trial

comparing intragastric balloons with standard therapy for obesity. At the end of the study (12 weeks) eight out of ten balloons were found to be deflated. One balloon had been passed in the stools. Five patients had gastric erosions and one had multiple gastric ulcers surrounding a deflated balloon. The authors concluded that, 'no clinically important differences in weight reduction were noted with use of the intragastric balloon, and the rate of spontaneous deflation of the balloon and damage to the gastric mucosa was unacceptably high'. Given the high cost of the balloon, and costs for insertion and removal of the balloon, the lack of efficacy and the damaging effects on the gastric mucosa, 'the routine use of this device for the treatment of obesity is difficult to justify' (Lindor et al, 1987).

There are always risks involved in undertaking major surgery, especially so in obese patients. Dietary advice, and finding out if that does not work, why not, is therefore always the first stage in treating obesity. The next step could be jaw-wiring with a waist cord, and only after these have failed should one consider gastroplasty.

Behavioural therapy³

Once sufficient weight loss has been achieved it is necessary to tackle the problem of preventing weight regain. Behavioural therapy may play an important role here in altering the eating behaviour of an obese individual. Since much eating behaviour is learned, not innate, it should be possible to modify eating behaviour to a form more favourable for weight control. Eating needs to become a conscious activity rather than something that happens whilst watching television or doing other things. Behavioural therapy may take several different forms such as Weightwatchers (a support group), individual therapy, partner involvement or workplace initiatives. Weightwatchers is probably the best known dieting organisation in Britain. It has approximately 150,000 members at any one time with about 3,400 meetings a week. Weightwatchers aims to permanently change peoples eating habits, by suggesting for example that members eat more slowly and take

³ Behavioural therapy is a type of psychotherapy which aims to replace poor ways of coping with situations. Patients may unlearn previous patterns of thinking or behaving and acquire better ways of reacting to situations. The therapy will often take the form of cognitive behavioural therapy (CBT). Interpersonal psychotherapy strives to alter circumstances, CBT endeavours to adjust the way a person perceives and reacts to existing situations.

smaller mouthfuls in the hope that such behavioural change will lead to weight loss which can be maintained.

Some evidence on the effectiveness of the behavioural approach is provided by Bjorvell and Rossner (1985) in Sweden who traced 104 out of 107 severely obese patients four years after beginning a behavioural modification programme. Thirty-three patients had left the programme, eight were above their initial weight, 17 were 0-5kg less, 35 were 5-20kg less and 14 were more than 20kg less than their initial weight.

Patients must have realistic expectations concerning weight loss since inappropriate targets can lead to disappointment and disillusionment. There are some patients who do not lose weight even when they claim to have been complying with their diet. Lightman et al (1992) suggest that some obese subjects do not lose weight while on a low-calorie diet because their energy intake is substantially higher than they report. Whilst many people underreport their caloric intake, the degree of underreporting appears to be greater amongst obese subjects. As well as misreporting their food intake, this subgroup of obese individuals may also overestimate the level of physical activity that they undertake. Lightman's study showed a group unable to lose weight on diets reporting an energy intake of around 1000kcal per day, but in fact their actual intake was over 2000kcal. The control group, not currently dieting and so seeking to maintain body weight, reported an energy intake of almost 1700kcal per day when their actual intake was nearer 2400kcal. However, whilst both groups underreported energy intake it was clear that the diet resistant group misreported to a greater extent. Similarly with physical activity the diet resistant group more heavily exaggerated their true level of activity.

Dieters often require social support as well as accurate dietary advice – well organised slimming groups provide an economical method of supplying both these requirements (Box 3 shows some of the dietary advice that obese patients may receive). The involvement and encouragement of the spouse or partner may be beneficial.

Some studies have been carried out which look into the effect of partner involvement in weight loss programs. Black and Threlfall (1989) studied 26 subjects and their partners. The subjects averaged 37 per cent overweight; among the partners 16 were 20 per cent or more overweight and the remaining 10 were of desirable weight. Subjects paid a \$75 program fee plus a \$100 deposit which was returnable in \$25 payments subject to attendance at each of four assessment meetings during the study. All subjects were enrolled in

BOX 3 Dietary advice for obese patients

Patients should aim for three meals a day which are low in fat and sugar and high in fibre.

Complex carbohydrates – bread, potatoes, rice, pasta and cereals are to be eaten regularly although not to excess.

Increase fibre intake – eat wholemeal/granary bread, high fibre breakfast cereals, brown rice, wholemeal pasta and all fruit and vegetables including potatoes.

Reduce fat – avoid fried foods, grill or bake instead. Cut the fat off meat before cooking. Limit the quantity of crisps, biscuits and pastry. Use low-fat milk, spreads and cheeses.

Reduce sugar – avoid added sugar, confectionery, sweet biscuits, cakes. Use 'diet' or sugar-free soft drinks.

step 1, the minimal intervention program. In this first meeting subjects were given a few verbal guidelines about how to lose weight safely and were asked to self-monitor calories consumed and expended daily. Some subjects continued step 1 for the entire treatment year. Others with a lack of progress moved onto the more intensive treatment step 2. Step 2 participants received weekly mailings containing behavioural weight loss and problem-solving materials. Partners were encouraged to assist subjects in losing weight and help solve weight-related problems.

A follow-up meeting took place three months after completing the one-year program. Subjects with normal weight partners were found to have lost significantly more weight than those with overweight partners. However, overweight partners lost an amount equivalent to the patients in the overweight partner group. The authors concluded that couple programs for weight loss may provide an as yet untapped cost and public health benefit.

Dahms et al (1978) concluded that in their cost-benefit assessment of behavioural therapy, placebo and two anorectic drugs all had similar effectiveness. Behavioural therapy had a cost advantage, however, because there were no medication costs, treatment was by a dietitian rather than a physician, and patients could meet the dietitian as a group rather than individually.

Social benefits of treatment

In addition to relief from greater risks of mortality and morbidity, there is clear evidence of quality of life improvements from weight loss. Stunkard et al (1986) say that the social and emotional

consequences of successful weight loss appears to improve psychosocial functioning. Many of the psychosocial benefits are derived directly from increased stamina and mobility which coupled with lessened self-consciousness encourage patients to explore social and vocational activities which they might have avoided in their pre-operative morbidly obese state. Mood, assertiveness and self-confidence are said to improve in most patients. Solow (1977) said that the majority of patients three years after surgery felt 'escape from a chronic sense of helplessness, hopelessness, and unrelieved failure'.

There have been some conflicting reports surrounding the effect of weight loss (as a result of surgery) on marital relations. Rand et al (1982) said that surgery had a positive effect on stable marriages. In other cases improved psychological functioning made it possible for patients to leave unhappy marriages and spouses who were exploiting them. Rand et al (1982) say that an increase in the frequency of sexual relations was reported by both the patient and the spouse and the spouses saw the patient as more sexually attractive. In a follow-up study Rand et al (1984) noted in particular many patients citing increased social activity with their spouse and heightened sexual satisfaction. Hall et al (1983) commenting on patient well-being after gastric bypass surgery said that 'for most patients, the increase in self-image was particularly manifest in family relationships. Some of the testimonials were: 'my husband now takes me on outings', 'children are now proud of me', and 'sister has stopped teasing me'. Other factors Hall et al cited included being able to walk to the local shops, fit inside cars, sit on normal chairs, clean themselves properly after defaecation, buy clothes 'off the rack', and not have people stare at them.

Hall et al (1983) concluded that 'patients who lose weight after gastric bypass surgery feel healthier, have greater self-esteem, are better able to relate to others, and as a consequence are more socially active'.

Long-term maintenance of weight loss

Any method that succeeds in achieving weight loss will be ineffective in the long-term unless accompanied by changes in eating habits. As weight is lost, energy requirements fall in direct proportion to the reduction in lean tissue or fat-free mass. Some lean tissue loss is an inevitable and natural consequence of weight loss (about 25 per cent of the weight lost will be accounted for by lean tissue). Thus, once a dieter has lost weight, it is necessary to maintain a lower calorie intake for life in order to keep the weight

off. Since previous diet and lifestyle habits are likely to have led to obesity, the obesity will recur if the same habits are followed after a period of successful weight loss.

Summary

With the publication of specific targets relating to the prevalence of obesity in 'The Health of the Nation' (1992) we expect to see a more concerted effort to reduce the prevalence of obesity in the population. The target is to reduce the proportion of obese adults to 7 per cent or less of the population by the year 2005 (from 8 per cent for men and 12 per cent for women in 1986/87). The precise strategies which will be used in an attempt to realise these aims are not entirely clear at the present time, although an emphasis on prevention seems to be evident.

The best course of action for patients is to lose weight at a sustainable rate and take care to maintain the weight loss. The method employed to achieve weight loss will depend on the severity of the obesity and whether certain approaches have failed previously in individual patients. Minimal intervention programs seem worthy of consideration and are, if successful, a cost-effective method for achieving weight loss, although it is unlikely that it would work for more than a sub-group of highly motivated obese patients. Conventional low-calorie diets are the first line treatment in most cases, although very low-calorie diets (VLCDs) can be effective. Howard (1985) reports many anecdotal case studies of severely obese people who, using the Cambridge diet (a VLCD), attained a desirable weight for height target and maintained the weight loss over prolonged periods.

Surgery in the form of gastric stapling may be effective in treating severely obese (BMI over 40) patients. However, the main drawback associated with treating obesity is the lack of long-term success in weight loss maintenance. Nevertheless, Garrow (1992) says whilst the results 'leave much room for improvement...Nonetheless, they indicate...a possible route of escape from the mortality and morbidity associated with severe obesity'.

Goldstein (1992) showed that modest weight loss, even in severely obese patients, can produce positive health benefits in patients with obesity-associated medical complications, even if the patient remains above a desirable weight-for-height target. Thus, a small sustained weight loss is preferable to large weight losses followed by weight regain.

PREVENTION

Helping people avoid becoming obese would reduce the incidence of stroke, heart disease, some cancers, osteoarthritis, gout and non-insulin dependent diabetes. For individuals there could be an increase in both quality and quantity of life. Patients and GPs could be relieved of the frustration of tackling symptoms resulting from the accumulation of weight gain over a number of years.

The potential savings to the NHS and to society are considerable, if the number of new patients presenting for treatment with heart disease, stroke, diabetes, hypertension, arthritis, gout, etc could be reduced, resulting from a reduction in the incidence of obesity. The risk of death from coronary heart disease increases three-fold, in women, with a BMI over 29 compared to those with BMI up to 21 (Manson, 1990).

Particular care is needed in diabetic families to prevent the development of obesity. Diabetes mellitus is three times more common among the obese (BMI over 30). A body weight of only 20 per cent above the desirable weight for height is associated with an eightfold increase in hypertension incidence in later years (Van Itallie, 1985; Kannel et al, 1967).

It is often difficult, however, to induce changes in behaviour that could lead to an avoidance of obesity. The promotion of a healthy diet and lifestyle combined with physical exercise may help. Many consumers are, however, well informed about nutrition but do not change their diet. Desire for a healthy diet may conflict with a wish to save time or money, or for a quiet life when children pressure parents for sweets and crisps, rather than fruit or vegetables. Lean (1988) says that 'there is some epidemiological data between countries to suggest that obesity is less likely to develop with very high carbohydrate (thus low fat) intakes'. Conversely a high-fat/low-carbohydrate diet is likely to increase the probability of obesity. Hence prevention may need to concentrate on promoting a high-carbohydrate/low-fat diet.

The role of exercise

Physical exercise can be used to increase the metabolic rate and decrease the proportion of fat to muscle. Exercise can contribute to the patients' sense of well being and exercising patients may maintain weight loss better in the long-term. Whilst exercise may be a 'remarkably ineffective means of achieving weight loss in obese people' (Garrow, 1992) – it may be effective in helping to prevent weight gain.

Nicholl et al (1994) say that 'there is good evidence that disease can be ameliorated by exercise (coronary heart disease, stroke, diabetes, hip fracture, and mental illness)'. They concluded, perhaps surprisingly that 'with regard to health and medical care costs, there are strong economic arguments in favour of exercise in adults aged over 45 but not in younger adults'. This was mainly due to the cost of medical care for injuries incurred playing the sport. However, it is unlikely that adults aged over 45 years would take-up an active lifestyle for the first time, thus a sporting or active lifestyle from an early age is probably clinically and economically more desirable than a sedentary one.

The role of diet and nutrition education

As part of the 'Health of the Nation', strategies are being adopted to address the problem of obesity. The Nutrition Task Force is developing a programme aimed at achieving the diet and nutrition targets within the Coronary Heart Disease Key Area of the Health of the Nation strategy, and this will have knock-on effects if successful for the obesity targets. The obesity target is also being addressed as a specific item. The Nutrition Task Force in collaboration with the Physical Activity Task Force, has started to consider the issue of prevention of obesity. A symposium⁴ was convened in early 1994 focusing on how to prevent obesity.

Work Place Health Promotion

Health promotion at the work site has the potential for improving public health. Work canteens should ensure that they offer healthy meal options and where possible keep-fit or gym facilities should also be available. An important aspect of prevention is preventing those already overweight (BMI 25-30) from becoming obese. Brownell et al (1984) looked into the issue of weight loss competitions at the work site in the USA. From three banks 176 employees, of whom 112 were more than 10 per cent overweight, participated in a 12 week program. Fifty-three employees from a manufacturing firm participated in a 13 week program. Forty-eight

⁴ The symposium adopted the concept of promoting 'fitness for life' as appropriate to all seasons of life and integral to daily life. It was proposed that a non-governmental national body be set up which could promote research and knowledge of effective interventions into obesity.

It was also suggested that the workplace could provide a bike pool or interest free loans for bikes and mileage allowances for bike use. Companies could try to get their employees discounts for using local sports and activity centres.

employees from another manufacturing firm participated in a 15 week program. Each volunteer was given a weight loss goal. Participants were divided into teams and the winning team (the team achieving the greatest percentage of its weight loss goal) received a pool of money created from the \$5 entry fee paid by each person. Only one person in the three competitions dropped out. The mean weight loss for the three competitions was 5.5kg, with men more successful than women in each competition. At six month follow-up the average person maintained 80 per cent of their weight lost during the program. A longer follow-up period would have been desirable. The program was reported by both employees and management to have had positive effects on morale and employee/management relations. The cost-effectiveness ratio of \$2.93 per one per cent reduction in percentage overweight was seen as justifying the program, although it would be wrong to assume that programmes tested in other countries, in this case the USA, would have the same outcome if introduced to the UK.

Summary

Prevention of obesity appears to be a sensible strategy to pursue since, if successful, an appropriate lifestyle will be in place to avoid weight gain.

However, the evidence for the effectiveness of prevention programmes is not greatly encouraging. The OXCHECK Study Group (1994) reported disappointing results one-year after nurses had delivered health advice to general practice attenders. There was no significant differences in body mass index between the intervention group and the controls at follow-up. The range of health promotion messages may have diluted their impact. Smokers, for example, may have quit at a higher rate if this was the only aspect of their lifestyle receiving advice.

Regular exercise and a healthy diet are important in maintaining a lifestyle likely to prevent the emergence of obesity. Employers, judging from experience in the USA, could contribute by organising work-based weight loss competitions and by ensuring that healthy meals are available to employees. Larger employers may be able to offer gyms and other fitness amenities.

Prevention appears to be becoming central to the government's strategy to tackle obesity. However, this may be of little comfort to the millions who are already overweight or obese. Preventive interventions are of unknown effectiveness and resistance to changes in lifestyle may make progress in this area very challenging.

SOCIAL ATTITUDES

It has been suggested that there is a stigma or shame associated with obesity in modern industrialised nations such as the UK. 'Obese people, like people with physical handicaps, wear their 'problem' for all to see at all times and yet, unlike those groups, are held responsible for their condition. They can scarcely avoid interactions with others in which weight and eating behaviour are an explicit topic of discussion, concern, and criticism, or a covert determinant of others' evaluations' (Wooley, Wooley, and Dyrenforth, 1979a, 1979b). Beller (1977) says that 'the fact that obesity is supposed to be reversible, while skin colour and national origins are not, may make the stigma all the harder to deal with'. She also argues that in societies which abhor overweight, the social repercussions of obesity are very significant.

Allon (1982) says 'unless the obese can provide an excuse for their weight, such as a thyroid condition, or can offer evidence of successful weight loss, their character will be impugned'. Obese people cannot help but notice that they are different, as society makes them aware of this fact in innumerable ways. Seats on buses, trains, aeroplanes, in theatres and cinemas are often too narrow, even turnstiles may pose a problem.

Beller (1977) says studies have shown that obese high school seniors in the US have less chance of getting to their college of choice than their thinner schoolmates with identical scores and grade-point averages. This can lead to direct economic consequences for the obese. Obesity, Beller concludes, 'directly affects the individual's labour market value'. Kalisch (1975) claims that obese women in the US find it more difficult to be upwardly socially mobile, obtain marriage partners and relate to others than do obese men. This is reinforced by others. For example, Wadden and Stunkard (1985) suggest that obese 'women, adolescent girls and the morbidly obese [male or female] suffer the most deleterious consequences of society's contempt for the obese'.

Gortmaker et al (1993) considered the social and economic consequences of overweight in adolescence and young adulthood in the USA based on a nationally representative sample of 10,039 people who were aged 16-24 when the survey began in 1981. In 1981, 370 of the subjects were overweight (three per cent of the females and 3.4 per cent of the males). Seven years later, women who had been overweight had completed fewer years of school, were less likely to be married, had lower household incomes and higher rates of household poverty. Men who had been overweight

were also less likely to be married. Seventy-seven per cent of the women and 66 per cent of the men who were overweight in 1981 were still overweight in 1988. Gortmaker et al (1993) concluded that, 'overweight during adolescence has important social and economic consequences, which are greater than those of many other chronic physical conditions. Discrimination against overweight persons may account for these results'.

Jean Mayer (1968) quoted some bizarre examples of social attitudes towards obesity. For example, Mayer cited the party platform of a Danish reform group which included a proviso that fat people be taxed one hours pay per month for every 1kg of overweight. Whilst such trivial examples may always have been the exception rather than the rule, the ramifications of obesity should not be understated. As Beller said (1977) 'the psychological and social costs of obesity are intolerable to many of the people who spend the better part of their lives paying them'.

Matthews and Westie (1966) found that 144 high school students preferred to be a greater 'social distance' from an obese child than a handicapped child. 'Social distance' was graded on statements ranging from 'would exclude this type of person from my school' to 'would be willing to marry this type of person'. In the US the National Association to Aid Fat Americans (NAAFA) has existed for over 20 years. NAAFA provides obese people with a social support network. A central goal of the organisation is to help obese people accept and respect themselves in order that they can live full and happy lives. NAAFA members often speak of their difficulties in buying fashionable clothes, in getting and keeping jobs, in buying health and life insurance and in social relationships where there is often contempt, ridicule and avoidance.

Tucker (1980) related some legal cases in the US where discrimination against obese people has been at issue. The courts have found in some cases – mainly based around refusal to hire – discrimination on the basis of overweight. In one case the New York City Civil Service Commission was adjudicated to have discriminated unlawfully on the grounds of obesity against a woman who was denied a permanent job with the civil service as the result of a doctor rating her as 'not qualified' because of obesity during her probationary period of employment. Back pay and reinstatement with full benefits was awarded.

The medical profession has not escaped criticism in its treatment of obese patients. Allon (1982) says that 'medical personnel contribute to making fatness a social handicap'. Maddox and Lieberman (1969) claimed that doctors dislike of people being obese

was derived from their middle-class values and informal experience rather than from formal training. Some doctors according to Maddox and Lieberman perceived severely overweight people as weak willed, ugly and awkward.

However, in avoiding stigmatising obese people we should not become complacent towards helping them to lose weight and thereby reduce the probability of serious ill-health or early death.

COSTS OF OBESITY

The most readily quantifiable component of the financial burden of overweight and obesity is the direct expenditure borne by the National Health Service. Data on the extent of treatment in the primary care setting can be obtained from the third National Survey of Morbidity in General Practice (OPCS, 1986). The study covered a 12 month period during 1981/2 and found that 18.9 per 1000 females and 5.4 per 1000 men consulted their GP regarding overweight or obesity. Application of these rates to the 1990 UK population suggest that a total of 706,914 individuals consult their GP each year concerning overweight or obesity.

The consultation rates for overweight and obesity for the female patients observed by the study were 38.8 per 1000. The respective figure for men was 9.2 per 1000. On average then each patient consulted their GP approximately twice a year. The average cost of a GP consultation was estimated at £9.85 in 1991 (OHE, estimate). This yields an estimated cost for GP consultations of about £13.8 million.

The morbidity survey also provides information on the extent to which general practitioners refer patients to outpatient departments. From the 1981/2 survey it is shown that one per cent of patients with obesity who consult their doctor each year are further investigated and treated as outpatients. For all causes the cost of the average case seen in this setting was £120 in 1990. A total expenditure of about £850,000 is accrued.

A large proportion of direct health care costs result from treatment on an inpatient basis. The Hospital Inpatient Enquiry estimates that in 1985 there were 1470 admissions for overweight or obesity among females and 450 for males in hospitals in England. The mean duration of inpatient stay for each case was 30.8 and 11.3 days respectively. Overweight and obesity thus accounted for 50,361 hospital bed days in 1985 in England. Adjusting these figures pro rata to include the rest of the United Kingdom suggests that a total of 60,312 bed days was attributable to overweight and obesity. Taking an average inpatient bed day of £137.73⁵, it may be estimated that hospital inpatient treatment for overweight and obesity gave rise to annual NHS expenditure of £8.3 million.

The pharmaceutical costs are relatively low, since medicaments have only a limited role in the treatment of overweight and obesity in the UK. In 1992 there were over 200,000 prescriptions written for appetite suppressants resulting in a cost of £2.9 million. However,

many anti-obesity prescriptions are private.

Dietitians time spent treating obese patients will also account for considerable resources, estimated at £3.5 million (Lean, 1990). In total overweight and obesity are estimated to cost the National Health Service (NHS) directly almost £30 million (see Table 5).

The additional costs to the National Health Service for treating conditions triggered by obesity will, however, be much larger and would include a proportion of the costs involved in post-operative care of surgical patients, treating heart disease, stroke, diabetes, some cancers, osteoarthritis and hypertension among others.

Colditz (1992) produced figures for the full costs of obesity in the United States. Obesity is associated with an increased risk of non-insulin dependent diabetes mellitus (NIDDM), hypertension, cardiovascular disease, gallbladder disease and cholecystectomy, and colon and postmenopausal breast cancer. Using a prevalence based approach to cost of illness, Colditz estimated that the economic costs attributable to obesity in 1986 for these medical conditions was \$39.3 billion. This figure was based on the fact that approximately 34 million adults were obese in the US in 1980.

Colditz includes both direct and indirect costs in his analysis. Direct costs are the value of resources (personal health care, hospital care, physician's services, nursing home care, other professional services, and drugs) that could be allocated to other uses in the absence of disease. Indirect costs are the value of the lost output as a result of cessation or reduction of productivity caused by morbidity and mortality. An imputed value may be used for people too sick to perform their usual housekeeping duties.

The figure of \$39.3 billion may be an underestimate since several cancers have been omitted as have musculoskeletal disorders such

Table 5 The direct cost of overweight and obesity to the National Health Service

Health Service Sector	Obesity £mn
General practice	13.8
In-patient	8.30
Out-patient	0.85
Pharmaceutical services	2.9
Dieticians	3.5
Total	29.35

Sources: IMS, OHE estimates.

as osteoarthritis. Colditz claims that if an estimate of the costs of obesity attributable to musculoskeletal disorders is included then the total costs of obesity amount to 7.8 per cent (or \$56.3 billion) of the total costs of illness in the US. Colditz concluded 'that obesity represents a major avoidable contribution to the costs of illness in the United States. One approach to containing the rapidly rising health care costs in the United States could be the implementation of programs aimed at avoiding weight gain in middle and later life'.

Colditz's figures for the costs of obesity of between \$39.3 billion (£26.6 billion) to \$56.3 billion (£38.0 billion) demonstrate the huge burden which this ailment places on society and the health service sector. It should be noted that the prevalence of obesity in the US is higher than that in the UK and thus the figures are not easily transferable to the UK, even if one could attempt to take account of differences in medical costs.

The Australian Institute of Health and Welfare (1992) estimated that, in 1989, the healthcare costs attributable to obesity in Australia were \$A395 million. (Crowley et al, 1992). Hypertension treatment accounted for almost one-third of this cost, coronary heart disease for about one-quarter and NIDDM for one-fifth. About 15 per cent of total health expenditure is not captured in the categories costed by the model; it does not include out-patient costs either. The costs refer strictly to obese patients and do not include overweight individuals.

The costs associated with conditions in which obesity is a risk factor are immense in the UK (see Table 6). OHE (1988) estimated that stroke cost the NHS £550 million in 1985 in England and Wales – this figure does not include community support services such as home nursing where overweight or obese patients are particularly demanding. The main cause of stroke is hypertension to which obesity contributes. Assuming a conservative figure of five per cent of strokes resulting from obesity produces a cost of £27.5 million per year for obesity related stroke at 1985 prices. Added to this would be the extra nursing burden and injuries incurred nursing very heavy stroke patients. Hypertension itself imposes costs on the NHS via GP consultations, specialist clinics and treatment with pharmaceuticals in order to prevent stroke or heart disease. The direct health care costs for diabetes were estimated at £484 million for 1986/7 by OHE (1989). Assuming 80 per cent of non-insulin-dependent diabetes mellitus costs are due to overweight or obesity (the figure quoted includes insulin-dependent as well as non-insulin dependent diabetes costs) gives a figure of about £100 million. In relation to musculoskeletal disorders a recent OHE publication (1992) put the cost to the NHS of arthritis at £495 million. It is difficult to calculate

Table 6 The cost of overweight and obesity as a risk factor for other diseases

Disease	Date	Total cost (£mn)	Per cent due to obesity	Obesity cost (£mn)
MI (Heart attacks)	1990	155	5%	7.75
Stroke	1985	550	5%	27.5
NIDDM	1986/7	484	Diabetes 80%	100
Osteoarthritis	1989	495	Arthritis 10%	30
Hypertension		N/A	20%	N/A
Total		1684		165.25

Source: OHE.

precisely but about 10 per cent of osteoarthritis costs are thought to be due to overweight and obesity which could cost the NHS £30 million per year. The OHE Compendium of Health Statistics (1992) has indicated that myocardial infarction (heart attacks) cost £155 million for hospital discharges only. Overweight and obesity are major factors leading to myocardial infarction in some patients; taking a figure of five per cent for the proportion of costs due to overweight and obesity would give rise to a cost of £7.75 million. Coronary heart disease accounts for 35 million lost working days in the UK per year (Health of the Nation, 1992) and is a major cause of premature death.

There are other conditions in which overweight and obesity will be a factor increasing an individual's risk of incurring the malady e.g. certain cancers. However, even confining cost implications to those conditions in the previous paragraph gives rise to a financial burden in excess of £165 million on the NHS which can be directly or indirectly attributed to obesity.

There are also private costs associated with overweight and obesity. Over-the-counter diet products are widely available and many people who perceive themselves as overweight try one or more of these products. About £80 million is spent on meal replacement slimming products per year in the UK. About £5.5 million was spent on slimming magazines (Willings Press Guide, 1987). When seeking life insurance, overweight and obese people may find themselves forced to pay higher premiums due to the increased risk of premature death. The costs of detriment to quality of life and employment prospects has also to be taken into account in assessing the overall impact of overweight and obesity.

CONCLUSION

This paper has highlighted the threat to health posed by overweight and obesity. Unfortunately we are currently witnessing a worrying upward trend in the prevalence of overweight and obesity (with nearly half of men and over a third of women being overweight or obese in the UK i.e. BMI over 25).

The aetiology of overweight and obesity is complex with genetic or metabolic factors probably interacting with psychological, behavioural and lifestyle factors as a cause of obesity. It is clear that many obese individuals do feel that societies antipathy towards them leads to an additional burden, both psychological and practical, further to any health risks that exist.

Overweight and obesity pose significant difficulties because of the vast numbers of people involved and has enormous ramifications across society. Overweight and obesity, particularly in young people, reduces longevity mainly via its effects on related diseases and this reduction in quantity of life years is considerable. The effect on quality of life may also be significant. Obesity is a risk factor for many conditions: BMI over 40 increases mortality 12 fold in those aged 25-35 years and BMI 30-40 carries a three-fold increased risk of mortality at age 45 over someone of a desirable weight (BMI 20-25).

The Government's consultative document, 'The Health of the Nation', has emphasised the importance of obesity as a major public health concern by placing targets for a reduction in the proportion of people with BMI over 30 by about a third over the next decade. The Government is right to concentrate on the more severe grades of obesity since these are far more detrimental to health than overweight (BMI 25-30). However, it is important to prevent those currently overweight (BMI 25-30) from becoming obese (BMI over 30). Data for 1991, recently published as an indicator of progress towards the health of the nation targets, reveals that the number of people with BMI over 30 has risen by over 50 per cent among men since 1986/7, and by 25 per cent among women. It appears that despite prevention programmes, such as, 'Look After Your Heart' (which is not strictly about weight), and health promotion resource packs for GPs (e.g. 'Better Living, Better Life') the targets for obesity are now 'more challenging than was realised' (Health of the Nation: One Year On... Department of Health). The 'Better Living, Better Life' initiative is probably too recent to be properly evaluated at this time. Connected with the obesity targets, there are also aims to reduce the proportion of food energy derived by the population

from saturated fatty acids by at least 35 per cent and total fat by at least 12 per cent by the year 2005.

The Health of the Nation Nutrition Task Force has an emphasis on prevention which whilst in theory attractive, may in practice fail to achieve its aims in reducing the incidence of obesity. Evidence of the effectiveness of prevention programmes is disappointing and the OXCHECK Study Group (1994) 'urge that policy should follow careful research rather than the other way round'. The Family Heart Study Group (1994) looking into the issue of prevention of coronary heart disease and stroke via targeting major risk factors ie. smoking, blood pressure and diet in relation to obesity, found a 16 per cent lower cardiovascular risk at one year in the intervention group compared with the comparison group. However, since most general practitioners would follow a less intensive programme the changes in risk factors would probably be much smaller and the group concluded that, 'the government's screening policy cannot be justified by these results'.

Treatment of obesity is often successful in the short-term but relapse rates are high. Nevertheless, the situation facing those who are obese is not without hope. Surgical intervention is often effective, but requires life long nutritional supervision, as is therapy designed to resolve the any underlying problems that may exist. Diets can be effective but only if the patient views the diet as the beginning of a life-long programme of behavioural and lifestyle change. There is no once-off 'quick cure'.

Whilst obesity poses a complex dilemma to the medical profession, with incomplete understanding of the fundamental physiology involved in the determination of body weight, and weak armoury of effective treatments despite a very simple solution in principle: a calorie deficit will always lead to weight loss. It is clear that all too often weight loss fails to be sustained in the long-term and there remains anxiety about the health risks of 'yo-yo' dieting. Nevertheless, Goldstein (1992) has shown that even small weight losses can yield significant health benefits. Raising the profile of obesity with doctors and other health care professionals is an important step forward. The difficulty of achieving the Health of the Nation targets should not lead to them being abandoned.

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