Tackling the Weight of the Nation

Without effective action...

...3 out of 10 adults in the UK will be obese by 2010

MRC Human Nutrition Research

A report by Dr Susan Jebb PhD, SRD and
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Tackling the Weight of the Nation

Obesity in the UK

A report commissioned by the Flour Advisory Bureau and Grain Information Service

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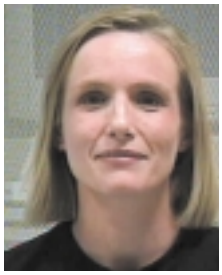

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Executive Summary

- The prevalence of obesity in Britain has trebled in the last 20 years. In 2001 21% of men and 23.5% of women were clinically obese (BMI >30 kg/m2) and a further 47% of men and 33% of women were overweight (BMI 25-30 kg/m2). If these trends continue, 30% of the adult population will be obese by 2010.

- Obesity is associated with a reduction in life expectancy of between 3 and 14 years primarily due to increases in the risk of cardiovascular disease and certain cancers. It also contributes to a substantial burden of ill-health, especially Type 2 diabetes. Irrespective of initial weight, further weight gain increases the risk of these metabolic diseases.

- There are three critical elements to reduce the burden of obesity-related disease. The first is to prevent the development of obesity, emphasising the importance of a healthy weight in young people. Secondly, overweight and obese people need to take steps to reduce their excess weight. Thirdly, it is imperative for the population at large to adopt a diet and lifestyle consistent with the prevention of chronic diseases, irrespective of their body weight.

- Results of carefully controlled experimental studies have identified a number of strategies to aid weight control:

(i) *Become more active, by reducing sedentary activities and increasing programmed exercise*
(ii) *Eat less fat and proportionally more wholegrain and high-fibre carbohydrate foods*
(iv) *Reduce added sugars, especially soft drinks*
(v) *Reduce portions of energy-dense foods*
(vi) *Plan regular meals, including breakfast*

- There is now good evidence from lifestyle intervention studies in Europe and North America that overweight individuals who adopt these strategies can significantly reduce their weight over several years.

- These trials have also shown modest weight losses of 5-10% of initial weight over a 4 year period can more than halve the new cases of diabetes and significantly decrease the risk of cardiovascular disease in overweight people.

- Data from people who have successfully lost weight and kept it off for more than a year provide evidence of effective long-term weight control strategies. These people tend to report an active lifestyle, a low fat diet with proportionally more carbohydrate (to reduce the risk of passive over-consumption). Smaller portions of energy dense foods, and more fruit and vegetables, also appear to aid weight control.

- The results of research studies on low fat diets, proportionally higher in carbohydrate, together with increased levels of physical activity, provide hard evidence of long-term health benefits.

- Many health professionals and consumers are confused by the plethora of alternative and faddy dietary approaches that are promoted by individuals and the media.

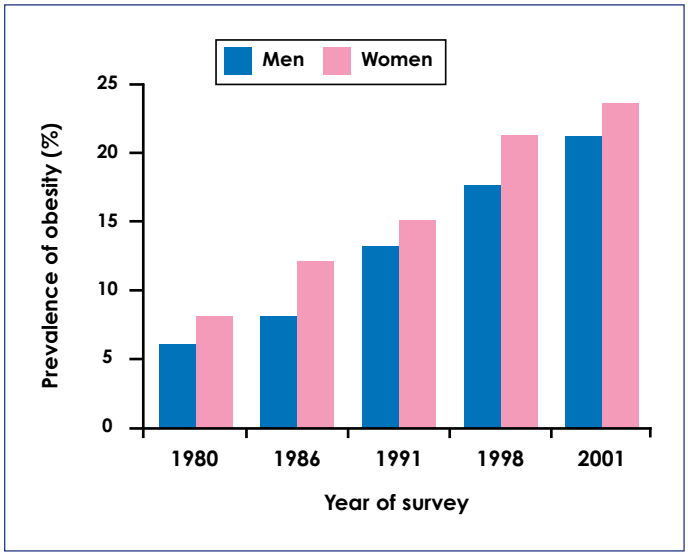
- Unsubstantiated claims about the dietary treatment of obesity contribute to a climate of confusion and public distrust that undermines credible treatments for obesity with proven health benefits.

1 Introduction

In 1999 the *'Weight of the Nation'* report highlighted some of the important diet and lifestyle factors underpinning the epidemic of obesity in Britain. It exposed the effect of sedentary lifestyles on body weight and the risk of weight gain associated with the consumption of high fat/low carbohydrate diets. It emphasised that the time was already overdue to begin to tackle the epidemic of obesity, but acknowledged some of the difficulties to developing effective interventions.

Since this time the average body weight in Britain and the proportion of obese people has increased. *'Tackling the Weight of the Nation'* sets out to identify some of the key factors for effective weight control. It considers the results of randomised controlled trials across Europe and North America that have used diet and lifestyle strategies to treat obesity. Finally, it considers the barriers to implementing the findings of successful research programmes in everyday life.

Figure 1
Secular trend in obesity in England and Wales
(Source: Department of Health)



2 The Weight of the Nation

The prevalence of obesity among adults in Britain has trebled in the last 20 years *(Figure 1)*. In 2001, 21% of men and 23.5% of women were clinically obese (BMI >30 kg/m2) and a further 47% of men and 33% of women were overweight (BMI 25-30 kg/m2).

Despite these stark statistics there is a tendency to compare the situation favourably with the United States of America. In the USA in 1999/2000 the age-adjusted prevalence of obesity was 30.5% compared to 22.9% in 1988-94[1]. But the rate of increase in obesity in the two countries is very similar. Britain is following in the footsteps of the United States of America – in just 10 years we can expect to see the same level of obesity that exists in the USA today.

Britain is not alone – the prevalence of obesity has increased throughout the world[2]. Policy makers and public health practitioners have been forced to rethink their approach. Obesity is now apparent in even some of the poorest countries of the world *(Figure 2)*. In economically developed countries

...the prevalence of obesity has increased throughout the world to such an extent that it has now been described by the World Health Organisation as an epidemic...

Figure 2
Prevalence of obesity from selected countries around the world c 1990[2].

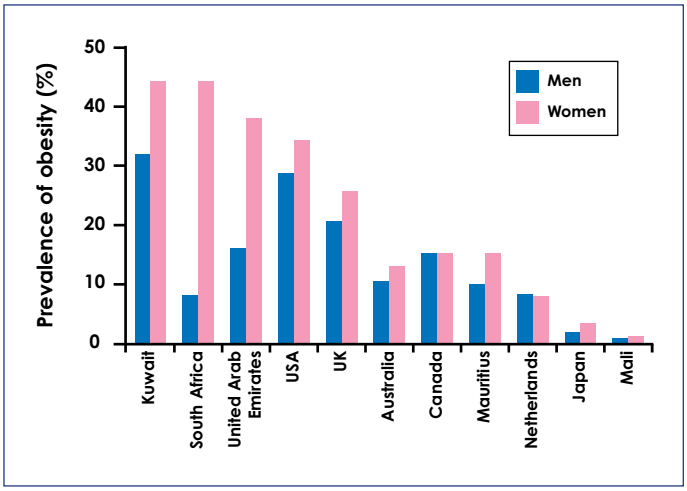
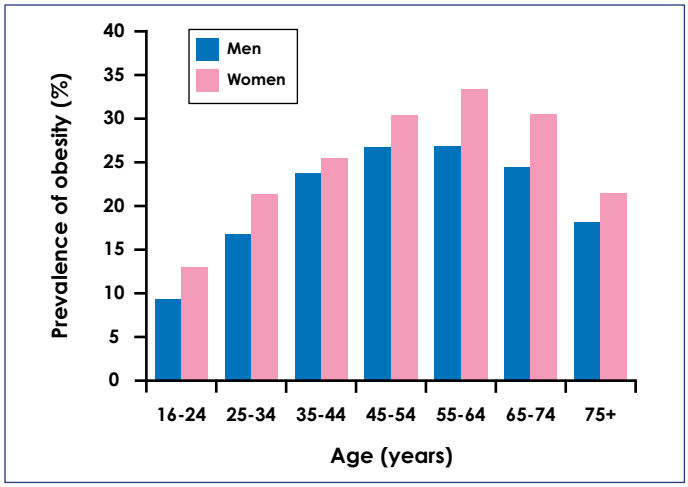


Figure 3
Age-related changes in the prevalence of obesity (Source: Department of Health)



obesity is characteristically higher among groups with low levels of education, low income or low social class.

...attention is increasingly focussed on young people where the problem of overweight and obesity has also become more pronounced...

Obesity was once a feature of middle age, but today the pattern has changed. The proportion of obese people increases with age until around retirement but beyond this, the impact of obesity-related premature death and disease-related weight loss, leads to a modest decline in the proportion of obese adults *(Figure 3)*. There is also a generational effect. People who today are in their 60s or older, were born at a time of austerity and limited food supplies. Younger people have largely grown up in a world where a greater variety of food than ever before has become available and at relatively low cost.

Attention is increasingly focussed on young people where the problem of overweight and obesity has also become more pronounced. Data from the National Study of Growth and Health shows that among primary schoolchildren there was little change in the prevalence of obesity between 1974 and 1984, but in the subsequent years there has been a marked rise[3] *(Figure 4)*. This trend has continued, and in the 1997 National Diet and Nutrition Survey (NDNS) of young people, 4-18 years, 4% were classified as obese and a further 15.4% as overweight[4]. Interestingly the NDNS analysis reveals some important variations in obesity across the country, with a significantly higher risk of obesity among young people in Scotland and Wales, relative to England *(Figure 5)*.

There is a higher than expected level of obesity among certain ethnic groups living in Britain. Data from the Health Survey for England shows that

Figure 4
Increases in obesity among primary school-aged children (7-11 years) [3]

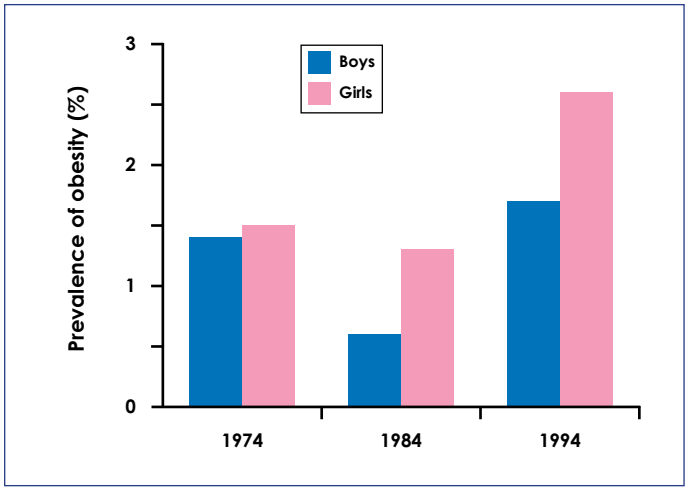
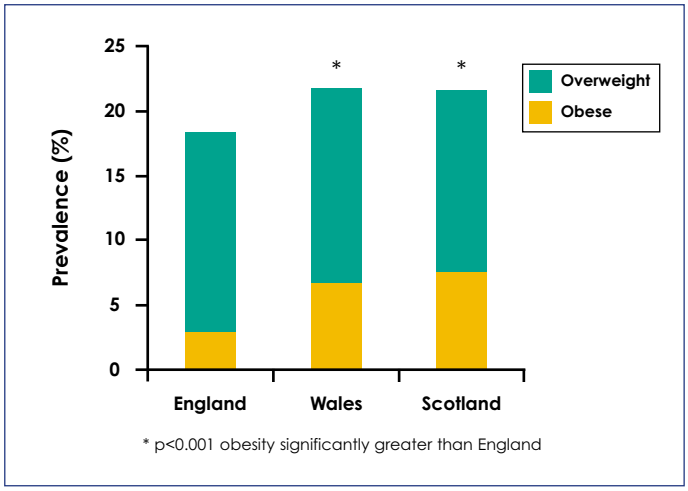


Figure 5
Prevalence of overweight and obesity in young people in Great Britain (4-18 years) [4]

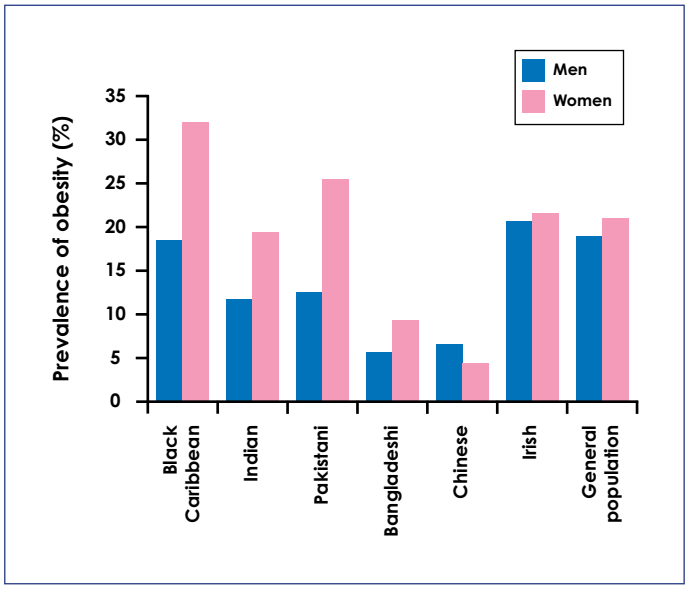


obesity is highest among people of Pakistani and black Caribbean origin *(Figure 6)*[5]. Similar trends are seen in young people, where the prevalence of obesity in young people of Asian origin is almost four times higher than among whites[4]. The reasons for these differences are not fully understood. However it is generally acknowledged that there may be a particular genetic susceptibility to obesity which is then unmasked by certain environmental factors, especially lifestyles with low levels of physical activity, together with an abundant supply of food. In addition, it has been suggested that the 'cut-off' for obesity in Asians should be lower than whites to reflect the increased health risks incurred by these populations at a similar BMI to their white peers. This would imply that the real increase in health risks among Asians may be even higher than suggested by these figures.

...variations in the prevalence of obesity need to be considered when developing effective intervention strategies...

These variations in the prevalence of obesity need to be considered when developing effective intervention strategies.

Figure 6
Differences in obesity in people of different ethnic origin [5]



3 The Burden of Obesity-Related Disease

Obesity – or more usually the pursuit of thinness – is a staple part of our culture. What changed over the latter part of the 20th century was that obesity emerged as a serious health risk. Today we recognise that obesity is underpinning a catalogue of ill-health including metabolic diseases (e.g. diabetes, heart disease and cancer) and mechanical problems (e.g. respiratory problems, osteoarthritis, back pain). Obese people are also more likely to suffer from low self-esteem, usually thought to occur as a consequence of the profound prejudice and discrimination associated with obesity, especially severe obesity. Together, these adverse effects on physical and mental well-being may lead to a reduced quality of life[2].

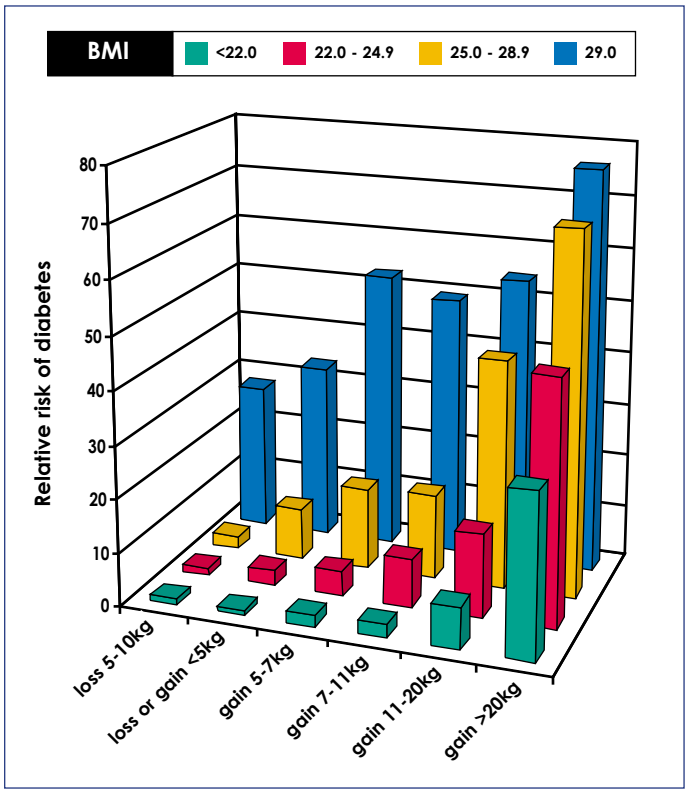
It is clear that obesity imposes a substantial burden of ill-health *(Table 1)*. The link between obesity and Type 2 diabetes is particularly striking and is significant even with modest degrees of overweight[6]. For example, women with a BMI of just 25 kg/m2 have a more than five-fold increased risk, while those with severe clinical obesity (BMI>35kg/m2) have more than fifty-fold increased risk[7]. Moreover, additional increases in weight during adult life further increase the risk of diabetes *(Figure 7)*.

Table 1
Health risks of obesity

*Greatly increased (relative risk greater than 3)**	*Moderately increased (relative risk 2-3)**	*Slightly increased (relative risk 1-2)**
❍ *Type 2 diabetes*	❍ *Cardiovascular diseases*	❍ *Certain cancers; including colon, kidney, prostate (men), post-menopausal breast and endometrial (women)*
❍ *Gallbladder disease*	❍ *Hypertension*	❍ *Reproductive hormone abnormalities*
❍ *Dyslipidaemia*	❍ *Osteoarthritis (knees)*	❍ *Polycystic ovary syndrome*
❍ *Insulin resistance*	❍ *Hyperuricaemia and gout*	❍ *Impaired fertility*
❍ *Breathlessness*		❍ *Low back pain due to obesity*
❍ *Sleep apnoea*		❍ *Increased anaesthetic risk*
		❍ *Foetal defects associated with maternal obesity*

**All relative-risk estimates are approximate (adapted from WHO, 1998)*

Figure 7
Obesity, weight gain and the risk of diabetes in women[7]

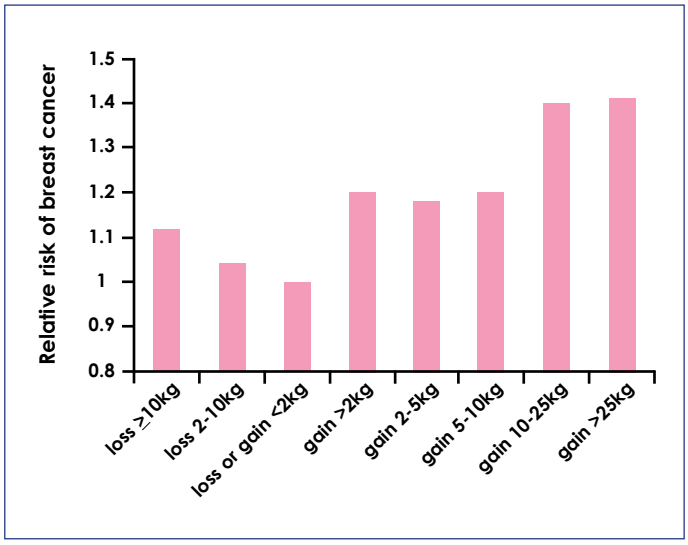


Recently the links between obesity and some kinds of cancer have come to the fore. In an analysis of the weight and health of almost one million Americans it was shown that 14% of cancer deaths in men and 20% in women could be attributed to obesity[8]. Most striking was the link between obesity and post-menopausal breast cancer, colon and kidney cancer. Like diabetes, additional weight gain during adult life increases the risk further *(Figure 8)*. For example, a 20 kg weight gain increases the risk of post-menopausal breast cancer by 40%[9].

...overweight and obese people lose between 3 and 14 years of life...

As a consequence of its morbidity, obesity is associated with an approximately two-fold increased risk of premature death, especially due to cardiovascular disease[10]. Overweight and obese people lose between 3 and 14 years of life. The impact of obesity on life expectancy is greater in the most severely obese, among those in whom obesity developed early in life and smokers[11]. Cancer, cardiovascular disease and diabetes constitute the principal causes of ill-health and premature death in Britain. An estimated 140,000 deaths each year in England are attributable to cancer and a further 100,000 to cardiovascular disease. Around 1.2 million people in Britain suffer from diabetes and it is estimated that almost the same number may have diabetes that is, as yet, undiagnosed. Most of these people are overweight. The evidence is clear – the risks of obesity to health are substantial. Thus there are three critical elements to reduce the burden of obesity-related disease: (i) avoiding becoming obese, (ii) taking steps to lose excess weight, and (iii) adopting a diet and lifestyle consistent with the prevention of metabolic diseases.

Figure 8
Weight change and the risk of post-menopausal breast cancer[9]



4 Critical Issues for Weight Control

Health statistics on the increasing weight of the nation paint a depressing picture. Indeed it has been argued that obesity is simply a predictable response to a changed environment[12]. Man has evolved in a world in which food was scarce and the physical demands of growing or seeking food were high. Yet today, with such ready access to an abundant supply of palatable and affordable food, combined with the low energy needs of a sedentary lifestyle, it is hardly surprising that the body's innate weight control system is overwhelmed. However a modest, but striking, number of people maintain a healthy weight.

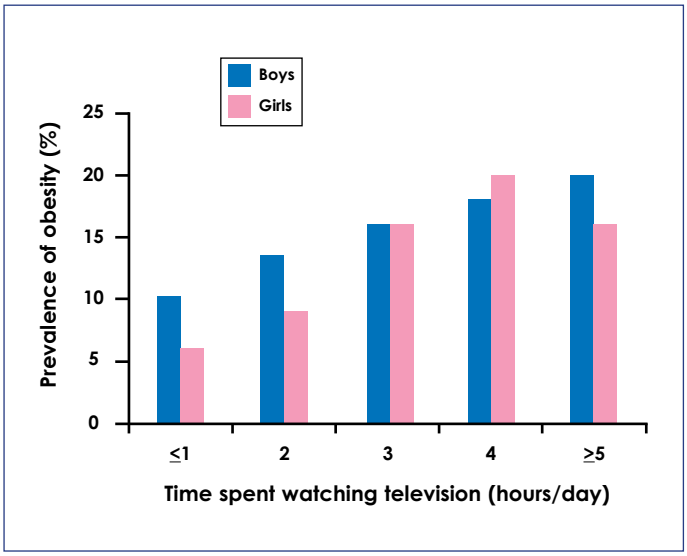
To understand the scientific basis of weight control it is useful to understand a little of the body's responses to specific challenges on its metabolism. Body weight is the end result of a lifetime of eating, offset by the energy expended in everyday activities and exercise[13]. Weight control is about achieving a balance between the energy consumed in food and that expended in activity. The average weight gain in Britain is less than 0.5kg a year. Reversing this trend to maintain a stable weight requires only a minor increase in physical activity, or a small cut in the energy we consume. Losing weight is more challenging, but only a 100 kcal deficit each day for a year will lead to a weight loss of over 5kg.

4.1 The importance of physical activity

Most people recognise that their parents and grandparents were much more physically active in their everyday lives than younger generations. The technological revolution of the modern age means that physical activity is no longer an obligatory part of everyday life. Cars are the major form of transport, there are few manual occupations and leisure time is dominated by television, videos and computers. In Britain in 1952 the nation cycled 23 billion kilometres a year compared to less than 4 billion today. This decline in physical activity has paralleled the rise in obesity.

Cross-sectional analyses repeatedly show that those people who exercise the most are the least likely to be obese[14]. *Figure* 9 analyses the problem from the opposite perspective. Young people who spend the greatest amount of time watching television, or other sedentary activities, are the most likely to be obese[15]. More importantly, people who are the most physically active gain less weight as they get older than those who are inactive[16].

Figure 9
Association between television viewing and the risk of obesity in young people[15]



It is difficult to find consistent evidence that interventions to increase physical activity help prevent weight gain. However in classical randomised controlled trials to prevent obesity, compliance to exercise instructions is often poor, reducing the likelihood of showing any improvement[17].

However, the benefits of physical activity are clearly seen in studies of weight-loss maintenance. People who have successfully lost weight are at high risk of weight regain and provide a useful group in which to examine potential interventions to aid weight control. In a review of the results of clinical trials in the USA it was reported that groups who exercised more had significantly enhanced weight-loss maintenance than non-exercisers[18]. After about 3 years of follow-up exercisers had maintained a weight loss equivalent to about half of the weight they lost, whereas non-exercisers regained three-quarters of the weight lost. Again the effects are likely to be greater in those who comply fully with the exercise prescription.

It is perhaps stating the obvious to suggest that becoming more active will help weight control by increasing energy needs. The challenge is that physical activity today is discretionary and to tackle the weight of the nation more people need to find ways to become more active on a regular basis.

4.2 Dietary fat and energy density

There is now a consensus across international agencies such as the World Health Organisation and national governments in Britain, the USA and elsewhere that most people in developed countries eat too much fat for good health[19]. Fat, especially saturated fat, increases the risk of heart disease, diabetes and some cancers. High fat diets also increase the chances of eating too much.

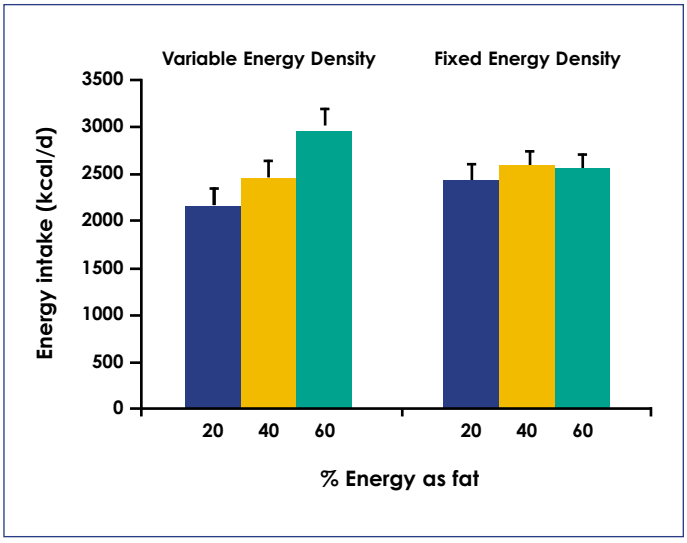
Carefully controlled research studies in the 1990s revealed that when people are offered foods that have been covertly manipulated to alter the fat content, they eat far more energy when the meal is high in fat than when offered an apparently similar low fat meal[20]. Moreover, if this experiment is continued, the overeating continues for at least two weeks[21]. The body appears not to recognise that it is eating more energy and weight gradually increases. Conversely on a low fat diet, despite eating as much as they wished and never feeling hungry, subjects found they lost weight. The first panel of *Figure 10* shows the average daily energy intake over a week on diets containing 20% fat (a low fat diet), 40% fat (close to typical UK fat intake) and 60% fat (a high fat diet). In this experiment the amount of protein in each diet was kept constant at 15% of the total energy. Carbohydrate varied reciprocally with fat so that the low fat diet was high in carbohydrate and vice versa.

This phenomenon is known as 'high-fat hyperphagia', meaning the tendency to overeat on high fat diets. The explanation for this effect lies in the energy density of fat. Fat is very 'energy-dense' – it contains more than twice as many calories gram-for-gram (9 kcal/g) as protein or carbohydrate (4 kcal/g). In a follow-up study, shown in the second panel of *Figure 10*, the energy density of each of the diets was carefully manipulated to be exactly the same and the high fat hyperphagia was abolished[22].

In the first study, volunteers thought they were eating the same amount of food on each occasion because they served themselves the same sized portion. However as the fat content increased, so the energy density increased, and in the same portion of food there was more energy. Their appetite control systems were duped and without realising, they ate too much and gained weight. This process is called 'passive over-consumption'. In the

second experiment, when the energy density was equalised, the type of macronutrient, fat or carbohydrate, made no difference to their ability to match their energy intake to meet their energy needs.

Figure 10
Importance of dietary fat and energy density on ad libitum energy intake [20, 22]



In the longer term it is difficult to conduct such carefully controlled studies and the results are more difficult to interpret. Trials of up to six months duration in which people are advised to choose low fat foods, but otherwise eat as much as they wish, consistently show modest decreases in weight[23], but in the longer term it is apparent that this advice alone is not sufficient for sustained weight loss[24].

In the 'real world' high fat foods usually have a high energy density, so choosing a low fat diet is a practical step to reduce the risk of weight gain. In Britain, people report that they are eating less fat today than 20 years ago. But there is a legitimate suspicion that the recent emphasis on the need to cut down on fat has encouraged people to report eating less fat, rather than to actually eat less fat, since food disappearance records show as much, or even more, fat in our food supply than ever before. Other people may choose low fat foods but eat more than usual in the mistaken belief that you can't gain weight on a low fat diet. To tackle the weight of the nation we need to combine a low energy dense diet with other dietary strategies.

4.3 Added sugars

For many years now the focus has been on cutting fat to lose weight and less attention has been paid to the type of carbohydrate. Some foods that are low in fat but high in added sugars actually have a rather similar energy density to the regular fat alternative. These foods may impair appetite control in an analagous manner to fat. Most of the added sugars in the diet come from confectionery, drinks and preserves, each of which provide about a third of the added sugars in the diet[25]. Soft drinks alone provide 16% of the added sugars in the diet of British adults[25] and 26% for young people (4-18y)[26]. The evidence is growing that the rise in consumption of sugar-rich soft drinks may be fuelling the increase in obesity[27].

Carefully controlled experimental studies reveal the potential impact of added sugars on body weight. Studies in which volunteers are given sugar-rich drinks compared to artificially-sweetened drinks or water, show that at a subsequent meal they fail to decrease their intake appropriately to allow for the energy previously consumed in the drink. The net effect is that the sugar-rich drink supplements, rather than substitutes, for food, increasing the risk of consuming too much. In one study volunteers received one of three drinks on four occasions each day for three weeks. In spite of the extra energy from

the sugar-rich drink, spontaneous food intake was not significantly different in any of the tests[28]. Adding the energy from food together with the drinks showed on average volunteers consumed 2801 ± 150 kcal/d during the water treatment, 2647 ± 153 kcal/d with artificially sweetened drinks and 3175 kcal/d with the sugar-rich drinks.

Figure 11 shows the effect on body weight in a group of overweight volunteers who were given sugar-rich or artificially sweetened foods and drinks for 10 weeks (approximately 80% of which were beverages)[29]. Although the weight changes were small this study again shows the positive effect on weight that can be achieved by simply reducing added sugars, without any specific attempt to lose weight.

Thus it seems plausible that a low fat/low sugar diet will lead to greater spontaneous weight loss than low fat diets alone, but remarkably few studies have put this to the test. The multicentre 'CARMEN' trial examined the impact on body weight of a low fat/low sugar diet and a low fat/high sugar diet relative to habitual diets. This study did not attempt to impose a calorie-controlled diet and subjects were allowed to eat ad libitum. Overall both low fat groups lost a small amount of weight, but restricting sugars had no significant additional effect. However in a sub-group analysis in the Cambridge centre those following the low fat/low sugar diet lost -4.25 kg, which was significantly greater than those on a low fat/high sugar diet who lost only -0.28 kg ($p<0.05$)[30]. Importantly those who persisted with a high fat diet gained weight +1.03 kg *(Figure 12)*.

Figure 11
Effect of sugar-rich foods and beverages vs. artificially sweetened varieties on body weight (n=41)[29]
(Reproduced with permission)

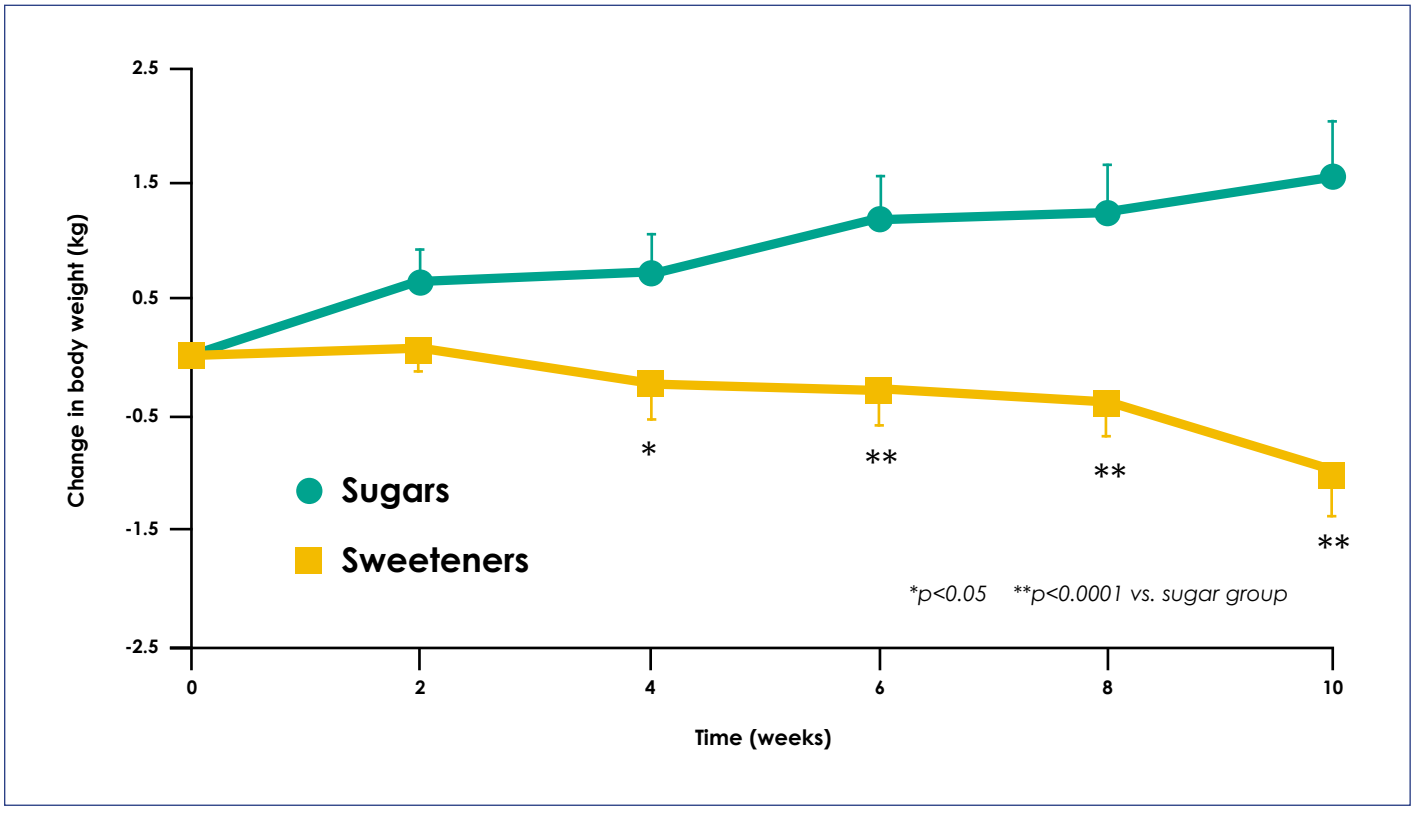
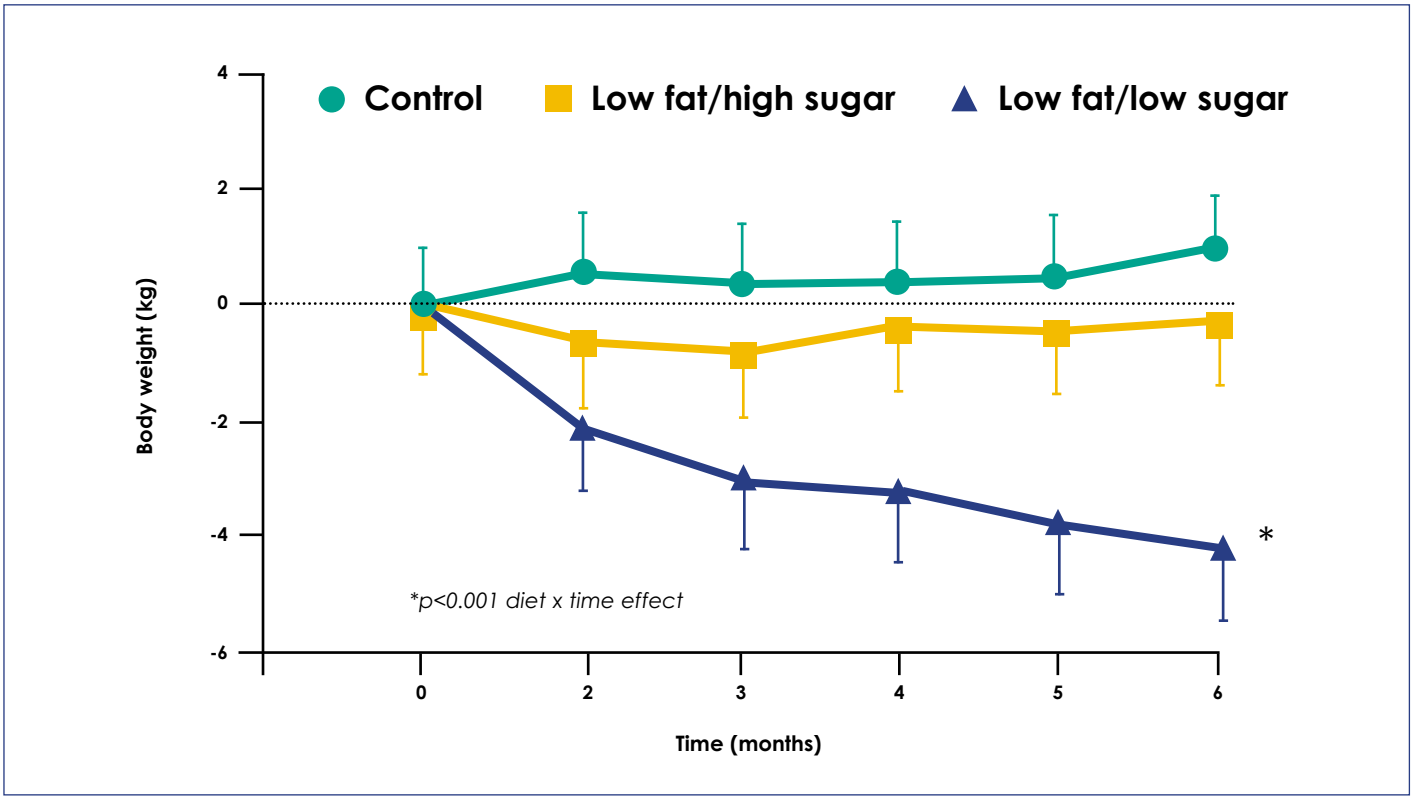


Figure 12
Low-fat, low-sugar diets increase weight loss (n=46)[30] *(Reproduced with permission)*



Alcohol (7 kcals/g) has a much greater energy density than carbohydrate (4 kcals/g) and many alcoholic drinks contain, or are served with drinks containing added sugars. In addition, alcoholic drinks have the potential to contribute excess energy to the diet since like softdrinks, they do not appear to displace energy from food[31]. Furthermore, the disinhibition that accompanies alcohol consumption may reduce dietary restraint, compounding attempts to lose weight.

The implications for weight control are clear. Diets containing proportionally less fat and more carbohydrate are associated with modest spontaneous weight loss and it is probable that this can be enhanced by selecting unrefined carbohydrates rather than foods containing a high proportion of added sugars or alcohol.

4.4 Portion size

Portion size is increasing[32]. The origins of this trend are usually attributed to the 'fast-food' industry, but today it stretches across the whole food supply. Ready meals often offer 25% or 33% extra. The standard 330 ml can of fizzy drinks is gradually giving way to half litre bottles. Bags of crisps have increased from 25 g to 35 g or even 55 g and confectionery is now offered in 'King-size' bars. Moreover where the same food is available in various sizes, the larger portion usually costs proportionally less, making it seem like an attractive option. The risks to body weight are most acute for foods with a high energy density, since the portion size of low energy-dense foods, such as fruit and vegetables, is naturally constrained by the satiating properties of these foods and the quantity of food people are prepared to eat.

Supersizing may be good for the wallet but not for the waistline. Evidence from a series of research studies shows that when faced with larger portions, people tend to eat more[33]. Moreover, they feel equally full at the end of the meal and fail to adjust intake at the next meal, leading to relative overeating. In the longer term the risk is that people become accustomed to large portions and lose sight of the appropriate amount of food to match their energy needs.

The irony of the 'supersize' era is that it coincides with a period in which physical activity levels are so low that people simply don't need the extra energy. The key to effective weight control is to choose food of high nutritional quality rather than large quantities.

4.5 Structured eating plans

Traditional 'three-meal-a-day' eating habits have long gone for many people. Today food is frequently eaten on the run, often in a series of small eating episodes throughout the day. The effect of this change on body weight is hard to assess because it is so difficult to accurately measure food intake[34]. Studies in the laboratory show that the total energy consumed is the critical determinant of the effect on body weight. If energy is controlled there is no measurable difference to body weight of consuming food in a limited number of large meals or multiple smaller 'snacks'[35]. It is however extraordinarily difficult within experimental models to mimic the social context and environmental cues to snacking experienced in 'real-life'. The true impact on body weight is likely to be determined by the quantity and quality of snacks consumed rather than by eating frequency per se.

However there is emerging evidence that careful planning of meals or snacks can help people to effectively control their weight[36]. In cross-sectional surveys people who skip breakfast often have a higher body mass index (BMI) than regular breakfast consumers[37]. This is perhaps because overweight people mistakenly hope that skipping breakfast will help them to lose weight. Instead, adopting a structured eating plan can make it easier to stick to a calorie-controlled diet. A structured approach to eating may simply involve making time to eat breakfast, writing a shopping list and sticking to it, preparing a sandwich for lunch rather than hoping to find a local take-away, or keeping healthy snacks available, such as fruit or yoghurts, rather than being caught out on a long journey and tempted to buy crisps or confectionery. Others have shown that structured eating habits can be made easier by using ready-meals rather than preparing foods from basic ingredients[36]. People who regularly incorporate meal replacement products maintain their weight better than the rest of the population[38] and these products can also be an effective way to lose weight[39].

This experimental evidence offers an insight into the strategies for effective weight control. The next step is to put it into practice *(Table 2)*.

Table 2
Effective strategies for weight control

- ***Be more active***
- ***Reduce dietary fat***
- ***Reduce added sugars***
- ***Decrease portion size***
- ***Develop a structured eating plan, including breakfast***

5 Tackling the Weight of the Nation

The growing recognition of obesity as the missing link in a whole cluster of metabolic diseases has underpinned the search for a solution to the problem. Effective treatment of obesity is about more than just weight control – it must also cut the risk of disease and improve overall health.

Over the last few years, building on the experimental evidence outlined above, major lifestyle intervention trials have shown that it is possible for overweight people to lose weight successfully, to keep it off and to cut their risk of diabetes. In addition a series of trials to assess the effectiveness of drug treatments for obesity have shown that helping people to change their diet is the foundation for successful drug treatment of obesity and can lead to significant improvements in the risk of cardiovascular disease and diabetes. Unfortunately, in the face of year-on-year increases in the proportion of people who are obese, this success has gone largely unheeded outside the field of obesity specialists.

...treatment of obesity must cut the risk of disease and improve overall health...

5.1 Lifestyle intervention studies to treat obesity

Many studies have looked at the effect of changes in diet and/or physical activity and examined the change in various risk for disease. More importantly, there have been two recent studies involving large groups of overweight people over periods of at least 2 years which have looked directly at the risk of developing diabetes. The first trial, conducted in Finland, studied overweight individuals with impaired glucose tolerance (IGT)[40]. This is a condition sometimes described as pre-diabetes, because of the very high risk of subsequently developing diabetes. In total 522 subjects were randomly assigned to a lifestyle intervention group or a control group. Subjects in the control group were given a short standard leaflet with general information about diet and exercise. The lifestyle group met regularly with a nutritionist and were individually advised to reduce their weight by 5% or more by adopting a diet low in fat, especially saturated fat, and increasing their consumption of fibre-rich foods including wholegrain carbohydrates, fruits and vegetables. They were encouraged to increase their physical activity at home and were given the opportunity to attend supervised exercise classes. This continued for two years.

At the end of the first year the control group showed little change in weight (-0.8 ± 3.7 kg), whereas those in the healthy lifestyle group lost -4.2 ± 5.2 kg ($p < 0.001$). By the end of the second year the weight of the control group was unchanged (-0.8 ± 4.4 kg) and the intervention group remained -3.5 ± 5.5 kg lighter

Figure 13
Successful weight loss with a low fat-high carbohydrate diet and physical activity (n=522) [40]

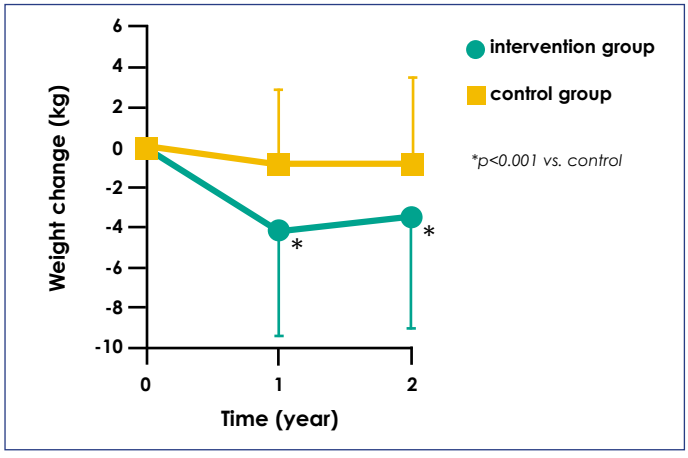
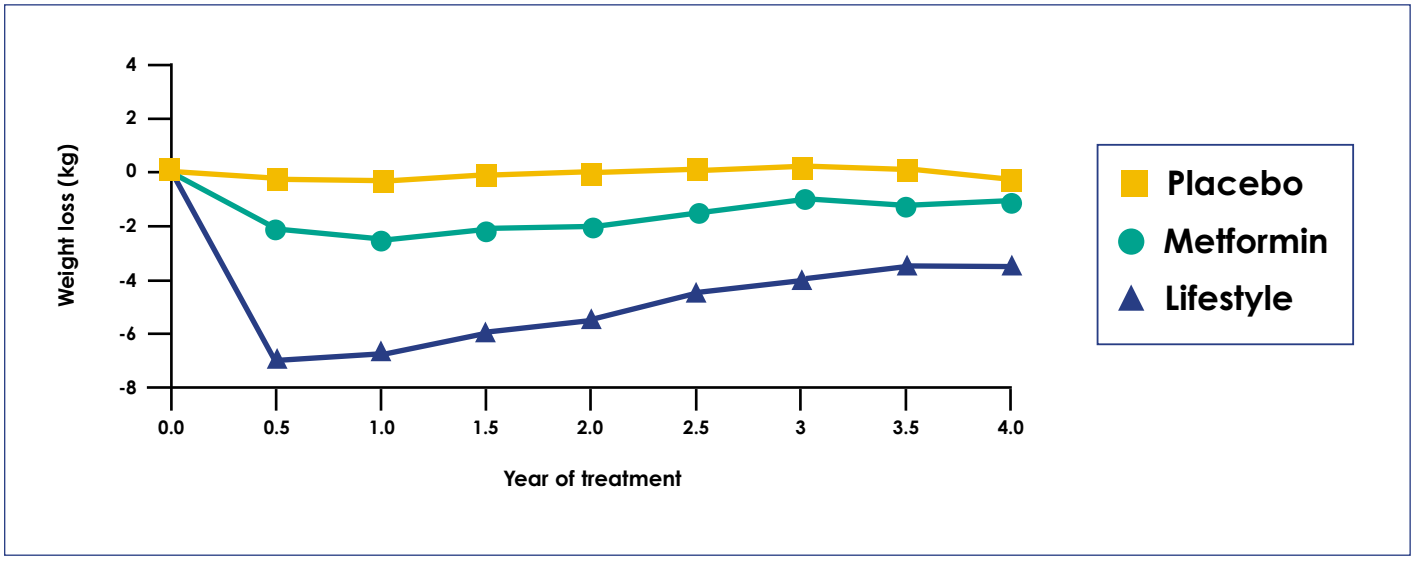


Figure 14
Successful weight loss with a hypo energetic-low fat diet and increased physical activity (n=3234)[41]
(Reproduced with permission)



than at the start of the study *(Figure 13)*. Most importantly there was a significant reduction in the number of subjects developing diabetes. Indeed after four years the incidence of diabetes was 58% lower in the healthy lifestyle group than the subjects in the control group.

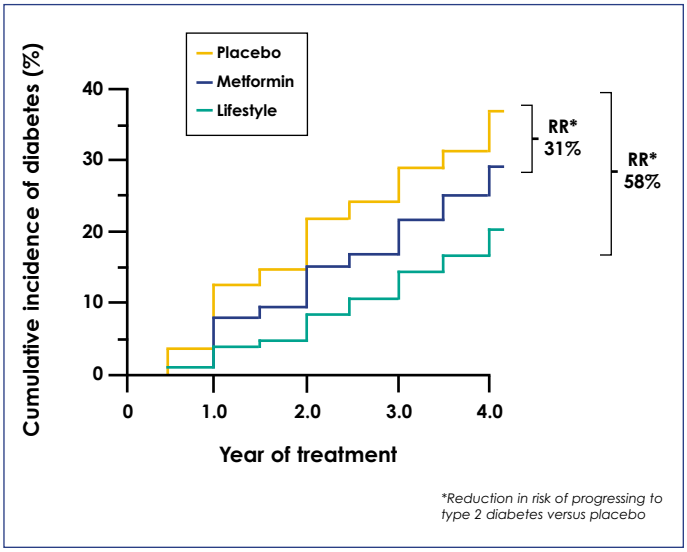
These results were supported by a second, much larger, trial conducted in the USA, known as the Diabetes Prevention Program (DPP)[41]. Here 3234 overweight subjects were randomly assigned to either (i) a control group, taking a placebo designed to mimic a drug treatment, (ii) a group taking the drug metformin which can slow the development of diabetes, and (iii) a lifestyle intervention group. The latter met individually with health professionals on a regular basis and were encouraged to lose at least 7% of their body weight through a low energy, low fat diet with at least 150 minutes of moderate-intensity exercise each week. The participants were studied for an average of 2.8 years. Half of the participants in the lifestyle intervention group lost 7% of their initial weight or more in the first six months and over a third had lost 7% or more at the final study visit. Three-quarters reached 150 minutes per week of activity at six months and over half achieved this goal at their last visit.

There was a significant decrease in body weight in both the metformin and, particularly, in the lifestyle intervention group. The average weight loss was -0.1 kg, -2.1 kg and -5.6 kg in the placebo, metformin and lifestyle groups respectively *(Figure 14)*. Even more importantly there was a 58% reduction in the incidence of diabetes in the lifestyle group and 31% lower in the metformin group compared to the placebo *(Figure 15)*.

5.2 Lifestyle lessons from drug treatment of obesity

In parallel with these trials of lifestyle interventions alone there has been an intense period of research into potential pharmacological treatments for obesity. Two prescription-only medications have been licensed in the UK and guidelines for their use

Figure 15
Reductions in the incidence of diabetes with a hypo energetic-low fat diet and increased physical activity[41]
(Reproduced with permission)



have been issued by the National Institute of Clinical Effectiveness (NICE).

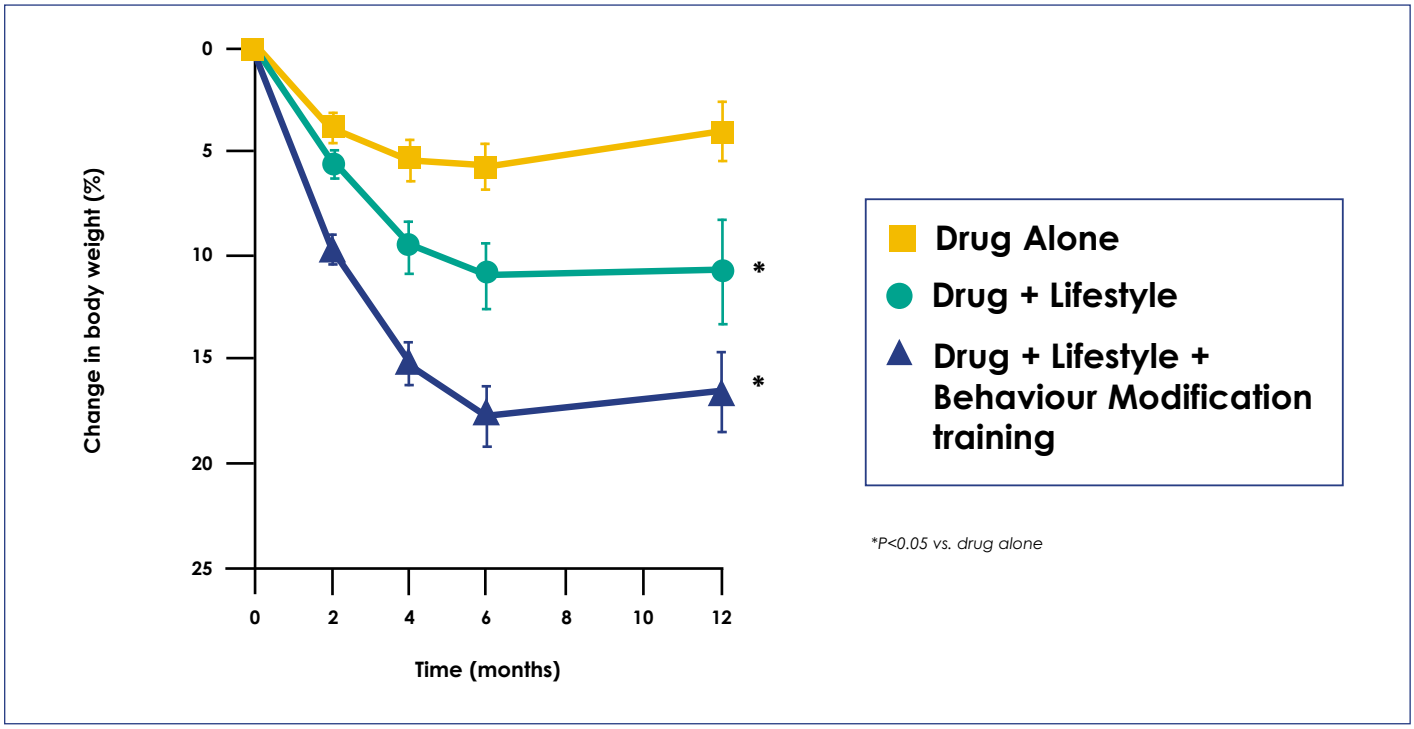
Sibutramine is a serotonin and noradrenaline re-uptake inhibitor that reduces energy intake by increasing the sense of fullness. Orlistat is a gastrointestinal lipase inhibitor which blocks the absorption of about a third of the fat consumed in the diet. Dietary advice is a critical element in the management of patients taking these medications since it is recognised that the drug alone is relatively ineffective *(Figure 16)*[42]. Patients receiving Sibutramine are advised to adopt a low-calorie diet plan, aiming for a reduction of about 600 kcal/d through reductions in dietary fat and portion size. Patients taking Orlistat are recommended to follow a low fat eating plan both to achieve a hypocaloric diet and to minimise the risk of any adverse gastrointestinal effects.

Most well-conducted trials of the two treatments have followed a similar design. All patients receive dietary advice to decrease fat, increase the proportion of carbohydrate, especially from wholegrain or high fibre sources and to eat more fruit and vegetables. Sometimes they may receive a specific energy-prescription, usually involving a reduction of about 500 – 1000 kcal/d. Others are encouraged to change the type of food consumed and to choose smaller portions without a specific calorie-target. Usually patients are encouraged to become more active. One group of subjects are then randomised to receive the active drug treatment, while the other receives a placebo treatment and all subjects are monitored for a year or more.

In nearly all of these clinical trials there has been a significant reduction in weight in both groups. Drug treatment plus lifestyle modification induces weight losses of 3 to 13% of initial body weight and 2 to 9 percentage points greater than lifestyle modification alone[43]. The changes in body weight from the most recent trial, which is also the largest and longest of these studies, involving 3304 patients taking Orlistat or a placebo, are shown in *Figure 17*. After 4 years patients following the lifestyle intervention had maintained a weight loss of -4.1 kg below their initial

...dietary advice is a critical element in the management of patients taking anti-obesity medications since it is recognised that the drug alone is relatively ineffective...

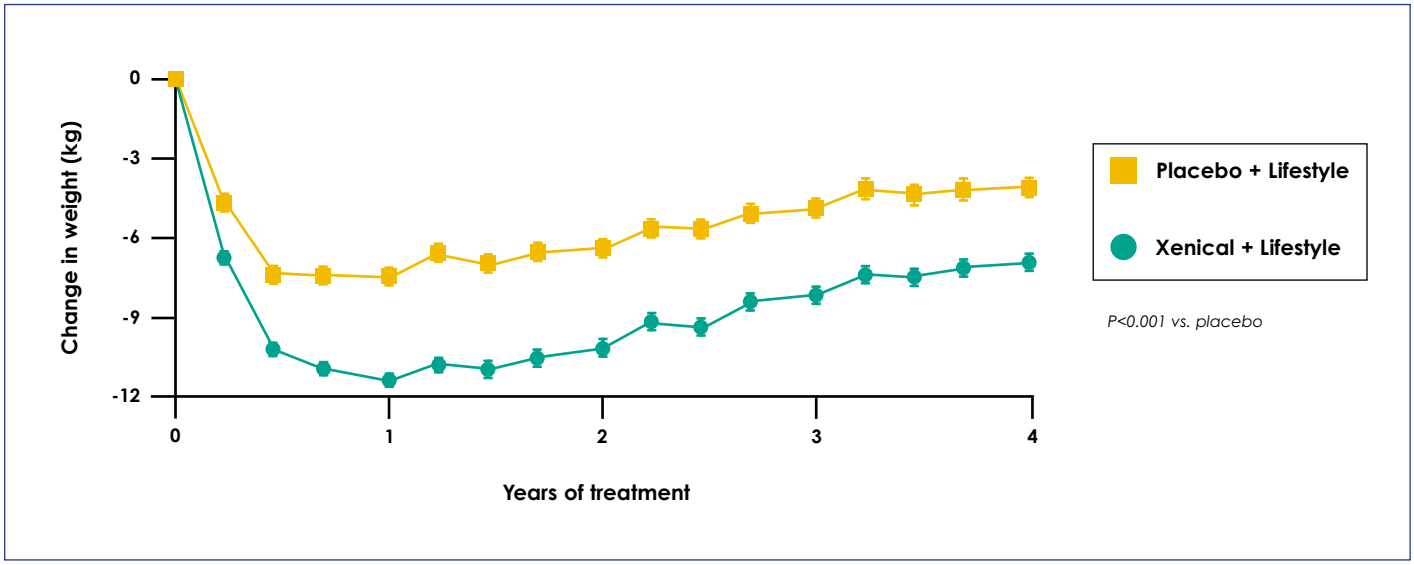
Figure 16
Dietary change is critical to the success of anti-obesity drug treatment (n=53)[42] (Reproduced with permission)



weight, compared to -6.9 kg in the group receiving the lifestyle intervention plus Orlistat. This trial also confirmed that weight loss is associated with reductions in the incidence of diabetes.

These trials are important because they demonstrate that a low-calorie diet, based on the principle of choosing low fat with proportionally more carbohydrate is associated with significant weight

Figure 17
Changes in body weight in a clinical weight management programme (n=3304)
(Reproduced with permission)



loss and reductions in the risk of disease in people at increased risk. Importantly these studies included thousands of overweight and obese people, leading their usual everyday lives across Europe and North America. They were not following radical, extreme diet plans. Instead they were following the conventional advice recommended by doctors across the world to help people lose weight. Anti-obesity drug therapy is an important advance for patients with clinical obesity or those who are already exhibiting symptoms of chronic metabolic diseases. However it is only appropriate for a small minority of the UK population who are overweight or obese. In contrast, everyone can benefit from a healthy lifestyle. There is now clear scientific evidence that low-calorie diets, achieved by cutting down on fat and incorporating wholegrain cereals and carbohydrates, fruits and vegetables, together with modest increases in physical activity, can offer a viable strategy to lose weight.

Guidelines for the management of obesity have brought together evidence from many sources to give an indication of the benefits that can realistically be achieved with weight loss *(Table 3)*[44]. In addition many people benefit from the increased mobility, decreased joint pain and improved sleep patterns that result from successful weight loss. Importantly these benefits depend on only small reductions in weight. The goal is not to continually strive for an almost unachievable goal of unrealistic thinness, but to lose a modest amount of weight and keep it off.

Table 3
The health benefits of modest (10%) weight loss[44]

Mortality

- ***20-25% reduction in premature death***
- ***30% reduction in the risk of dying from diabetes-related complications***
- ***40% reduction in the risk of dying from obesity-related cancer***

Blood pressure

- ***10mmHg decrease in systolic blood pressure***
- ***20mmHg decrease in diastolic blood pressure***

Diabetes

- ***50% fall in fasting blood glucose levels***

Lipids

- ***10% fall in total cholesterol***
- ***15% fall in LDL 'bad' cholesterol***
- ***8% increase in HDL 'good' cholesterol***

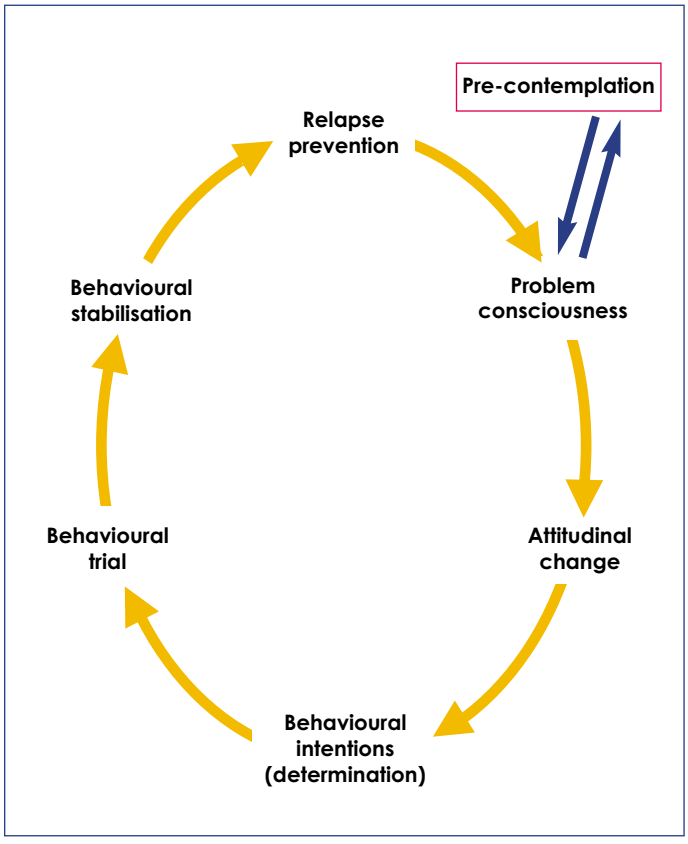
6 Barriers to Effective Action

6.1 Assessing readiness to change

Losing weight is theoretically a simple process of cutting energy intake, ideally coupled with an increase in energy needs through physical activity. However this simple analysis conceals the complex web of genetic, behavioural, social and environmental factors that determine an individual's chances of success. It is essential that individuals wishing to embark on weight-loss programmes are psychologically ready to make the necessary changes to their lifestyle.

The successful acquisition and maintenance of new behaviour to modify energy intake and energy expenditure can be described in a six-stage process *(Figure 18)*[45]. This includes firstly becoming aware of the problem (problem consciousness), accepting the need to change (attitudinal change), deciding what needs to change (behavioural intentions), actually carrying out the change (behavioural trial), continuing with the adopted change (behavioural stabilisation) and preventing the reversion to old habits (relapse prevention). These models acknowledge that the messages to initiate change among individuals need to be tailored to their needs at the time. Some individuals who have not yet even acknowledged the possibility of change and are described as 'pre-contemplative' will need the motivation to even consider the need to change, while an individual who has arrived at the action stage needs practical implementation strategies.

Figure 18
Stages of Change model[45]



Given the emphasis in today's society on the achievement of a healthy weight it is easy to assume that everyone is aware of the problem and has accepted the need to change. The tendency for health professionals is to leap to action-orientated messages, yet the majority of the population have not yet reached this stage of change and hence the information fails to initiate change. For some people it may be important to acknowledge that embarking on a weight loss programme is not appropriate at the present time. For example, during times of emotional stress the contemplation and adoption of lifestyle changes is unlikely to be successfully maintained. By selecting the time to embark on a weight-loss programme carefully it may be possible to avoid a failed weight loss attempt which simply serves to undermine an individuals confidence even further.

Assessing readiness to change, together with an individual's motivation and confidence is a critical preliminary step to effective weight control.

...today there is a plethora of diet plans ...frequently supported by celebrity endorsements and anecdotal reports ...rather than scientific evidence

6.2 Setting realistic goals and expectations

Individuals are constantly bombarded with messages about body weight by a society obsessed with the pursuit of thinness. As a consequence, there is a dramatic disparity between individuals' expectations of a weight loss programme and realistic goals of treatment. When questioned, the majority of those individuals who wish to lose weight often express a desire to reduce their body weight by as much as 20%[46]. In a study of 60 obese women embarking on a 48 week weight loss programme the average weight loss goal was 32% while a weight loss of 17 kg was described as 'disappointing'[47]. Setting realistic goals for weight loss challenges the value system in Western societies that places a premium on thinness. However the evidence suggests that setting achievable goals is linked to greater long-term success[48].

The desire for substantial weight loss is further fuelled by claims for diet plans or other 'obesity cures' promising dramatic results. Few people realise that even to lose 1 kg/week requires an energy deficit of approximately 1000 kcal/day. Claims which suggest it is possible to eat and drink with no constraint, to reside in front of the television for hours each day and yet still lose weight provide false hope, discourage personal responsibility and undermine credible weight management programmes.

6.3 Developing consistent messages

Knowledge is not sufficient for weight control but it is a necessary part of the whole strategy. Communicating accurate information about weight management is difficult because the process is complex. Body weight is the integrated product of a lifetime's diet and activity habits. It is rarely possible to identify a single factor causing obesity and this provides ample opportunity for debate about possible solutions, but it is clear that effective intervention will require long-term changes in diet, activity or both. In addition it is important that dietary strategies for weight control should also be linked to reductions in the risk of obesity-related diseases. The nutritional messages are therefore not just about energy balance, but also about the proportion of protein, fat and carbohydrate and the additional importance of vitamins and minerals for good health.

Today there is a plethora of diet plans promoted to the public. Most focus on short-term weight loss alone. They are frequently supported by celebrity endorsements and anecdotal reports of successful outcomes from other individuals, rather than scientific evidence. They range from simply eating less, to cutting down on specific macronutrients, such as low fat or low carbohydrate diets, prohibiting certain foods, specifying certain eating occasions or requiring food to be eaten in certain combinations. The apparent disparity between this multitude of approaches leads to confusion about their relative merits. However there is no evidence to suggest any of these various diet plans offer any specific metabolic advantage in terms of weight loss, over and above the energy content of the food consumed. They simply represent a range of strategies to help individuals modify their eating habits to eat less energy.

Success in the longer term depends on the adoption of eating and exercise habits that are consistent with everyday life and maintain a balance between energy intake and energy needs. Here different approaches will suit the lifestyle, eating habits and food preferences of different individuals. Adherence to changes in diet and activity is the real challenge in the management of obesity. Initially many obese people succeed in losing weight, but most find it difficult to maintain their reduced weight. Effective weight control programmes must therefore demonstrate sustained reductions in body weight over at least a one-year period and preferably much longer.

At the present time there is particular public interest in the effect of low carbohydrate diets. The limited scientific evidence available suggests that in the short term (up to 6 months) they may be associated with greater weight loss than a low fat diet. However in the longest study to date, the greater initial weight loss was not sustained and there was no significant difference in weight loss between the two groups after one year[49]. This implies that the subjects were unable to maintain their adherence to the low carbohydrate diet. A review of low carbohydrate diets containing up to 60 g carbohydrate per day concluded that there was insufficient evidence to make public health recommendations for these diets, especially very low carbohydrate diets (<20g/d) or for prolonged periods (> 90 days)[50]. A further review which examined the wider nutritional implications of high fat/low carbohydrate diets concluded that they were deficient in a range of vitamins and minerals that are essential for good health[51]. Short-term weight loss is usually associated with improvements in many metabolic risk factors but the longer term impact of low carbohydrate diets on the risk of developing diseases such as diabetes, heart disease or cancer is unknown. At present, a weight-loss plan which reduces total energy intake through reductions in fat diet combined with an increased proportion of carbohydrate, especially from unrefined carbohydrates, together with abundant fruits and vegetables, is the only approach to have demonstrated sustained reductions in body weight and a decrease in the risk of diabetes in overweight people. The concern for public health nutritionists is that unsubstantiated claims about the dietary treatment of obesity contribute to a climate of confusion and public distrust that undermines credible treatments for obesity with proven health benefits.

6.4 Getting the right support

One of the key features of successful lifestyle intervention trials is the degree of lifestyle training and ongoing support provided to participants. Most had a programme of regular and frequent visits to a doctor or other health professionals that is beyond the scope of today's NHS. Nonetheless, even occasional meetings with a health professional are helpful. In some areas weight management clinics are being established or there may be a community dietitian or practice nurse able to offer brief meetings to check on a patient's progress.

In addition, it is important for individuals to identify other sources of support. Enlisting the help of family and friends is vital to ensure they support, rather than undermine, attempts at weight loss. 'Buddy' systems have been successfully used, although the intensity of a one-to-one relationship can be testing for both parties. Commercial weight loss groups provide an opportunity to share experiences with other group members and are usually run by empathetic leaders with a wealth of practical experience. Some internet sites provide web-based support. This can be helpful especially if there is a two-way flow of information.

6.5 Making life-long changes

For many people it is not losing weight that presents a problem, but maintaining the weight loss in the longer term. All long-term clinical trials show some degree of weight regain, but there is growing evidence that specific weight maintenance strategies can help to capitalise on early weight loss success.

Some clues to long-term weight loss maintenance come from those people who have successfully lost weight and kept it off *(Table 4)*[48, 52]. The best example comes from the National Weight Control Registry (NWCR) in the USA. A study of 784 NWCR members who had lost an average of 30 kg and had maintained the minimum weight loss required for membership of at least 13 kg for 5 years[48]. NWCR members adopt a different kind of lifestyle to most Americans. Firstly, they are more active. Over three-quarters of NWCR members exceed the American College of Sports Medicine goal for physical activity. Secondly they have changed their eating habits. They choose a low fat diet, averaging only 25% energy from fat and 92% of members limit the intake of certain foods. Members report eating regular meals and snacks and limiting meals eaten in fast-food restaurants. Finally three-quarters of participants weigh themselves at least once a week, including over a third who weigh themselves daily. In this way they can monitor their weight and correct any minor weight gains before they turn into a major relapse.

To maintain a reduced body weight it is important that people do not revert back to diet and lifestyle habits which led to the initial weight gain. To adhere to these new habits in the long-term, individuals need a range of practical skills to sustain their new lifestyle. This includes developing new shopping and cooking habits and techniques to identify and manage difficult situations. There is growing evidence that these skills are critical to help people to turn these complex changes in behaviour into new life-long habits.

Table 4
Key characteristics for successful weight control

- ***Low fat foods***
- ***Proportionally more carbohydrates***
- ***Reduced fat cooking methods***
- ***Smaller portion sizes***
- ***Restricted intake of energy dense foods***
- ***Regular meals and snacks***
- ***Increased fruit and vegetable intake***
- ***Increased physical activity***
- ***Small realistic goals set***
- ***Regular weighing***
- ***Information obtained from a variety of sources to devise personal weight loss strategies***
- ***Help and support from family, friends and health professionals***

7 Conclusion

Obesity is common, but it is not inevitable, and it can be treated. This report has reviewed the evidence from randomised controlled trials, involving thousands of ordinary people, that show it is possible to achieve and maintain a healthier weight.

Changes in dietary habits to produce a low-calorie diet are the foundation for successful weight loss. Proven dietary strategies include reducing the size of portions of energy-dense foods, choosing low fat foods, increasing the proportion of carbohydrate in the diet, especially from unrefined sources, cutting back on added sugars and increasing fruit and vegetables. Adopting a structured eating pattern, with planned meals and snacks, can also improve adherence to the dietary plan. Physical activity makes an important additional contribution and its value is especially evident in long-term weight-loss maintenance.

There is now clear evidence that making these changes will lead to sustained reductions in body weight of sufficient magnitude to reduce the risk of diabetes and heart disease in overweight people. Decreases of just 4 kg over a 4-year period have been shown to cut the risk of diabetes by more than half. The challenge is to translate these findings from clinical research into everyday practice.

This report has focused on the lifestyle changes that individuals need to make to achieve and maintain a healthier body weight. However in today's world where it is easy to slip into an inactive lifestyle, and we are surrounded by intensive marketing for cheap, palatable food, the forces mitigating against effective weight loss can sometimes overwhelm an individual's own efforts. Although beyond the scope of this report, the importance of wider changes in the environment to facilitate and sustain the efforts of individuals to control their weight cannot be overestimated. This is particularly important within the context of preventing excess weight gain in children, young people and other vulnerable groups.

...making these (lifestyle) changes will lead to sustained reductions in body weight ...to reduce the risk of diabetes and heart disease...

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