which were almost totally dismantled. This is a priority for national leaders. The signing of the Paris Peace Accord in 1991 ended political isolation and allowed international donors to expand humanitarian initiatives. With the combined efforts of the national government and national and international organisations, particularly non-governmental organisations, parts of the health service have been revitalised rapidly and the transitional phase leading to long term development has begun.

The new royal Cambodian government, with much help from WHO technical experts, has taken important steps to re-establish a viable health care system. With its decimated health care workforce, low level of recurrent finance for health care, and limited managerial capacity, Cambodia has moved rapidly to establish sensible health policies and plans, mechanisms to coordinate external donors, and options to increase the finance available for health care and to improve the use of existing non-governmental health practitioners. The Cambodian ministry of health is one of the first in the world to lead the way for more widespread civil service reform, starting with changes in budget and accounting practice and moving into human resource planning and management. Senior health managers, working closely with the WHO and Unicef, have already earned the respect of professionals in the World Bank, Asian Development Bank, United Nations Development Programme, and major bilateral agencies, all of which are optimistic that Cambodia is pulling through and that there is a reasonable prospect within the next 10 years of establishing an appropriate and sustainable health system, suited to and meeting the needs of the Cambodian people.

There is, however, much more to be done before even a minimum package of primary health care activities is available to all Cambodians. Health services need to aim for reduced financial and technical dependence on external donors and for long term sustainability. This means devising alternative, indigenous methods of financing health services. Although foreign technical skills are available in abundance in Cambodia, what Cambodian health professionals need most now is to see for themselves how other countries in the region have tackled similar problems, and to learn from their experiences. The goals of Cambodia's national health development plan for 1994-6 are, by its own admission, ambitious, but they need to be because "the health needs of [the Cambodian] people are so great."

Obesity in Britain: gluttony or sloth?

Andrew M Prentice, Susan A Jebb

The prevalence of clinical obesity in Britain has doubled in the past decade. The Health of the Nation initiative has set ambitious targets for reversing the trend in recognition of the serious health burden which will accrue, but efforts to develop prevention and treatment strategies are handicapped by uncertainty as to the aetiology of the problem. It is generally assumed that ready access to highly palatable foods induces excess consumption and that obesity is caused by simple gluttony. There is evidence that a high fat diet does override normal satiety mechanisms. However, average recorded energy intake in Britain has declined substantially as obesity rates have escalated. The implication is that levels of physical activity, and hence energy needs, have declined even faster. Evidence suggests that modern inactive lifestyles are at least as important as diet in the aetiology of obesity and possibly represent the dominant factor.

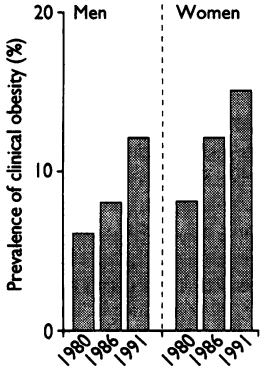

FIG 1—*Prevalence of clinical obesity (body mass index >30) in England. Source: Office of Population Censuses and Surveys*[1-3]

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The size of the problem

Department of Health statistics show that the prevalence of serious obesity doubled in Britain between 1980 and 1991 (fig 1) and is continuing to increase.[4] In the United States, latest survey data show that obesity is much more prevalent than in Britain and is still increasing; in certain ethnic and regional subgroups 50% of women are clinically obese.[5] The American experience provides no grounds for optimism regarding the developing epidemic in Britain.

Obesity is one of the most important avoidable risk factors for a number of life threatening diseases and for serious morbidity.[6] In the United States it has been estimated to contribute 8% of all illness costs (around £40 billion a year).[7] For these reasons the Health of the Nation initiative has recognised obesity as a key target and set ambitious goals for substantial reductions by the year 2005.

Uncertainty over the aetiology of obesity remains one of the chief barriers to designing effective strategies for prevention and treatment. It is certain that obesity develops only when there is a sustained imbalance between the amount of energy consumed by a person and the amount used up in everyday life. But which side of this energy balance equation has been most altered in recent decades to produce such rapid weight gain? Should obesity be blamed on gluttony, sloth, or both? This paper reviews evidence from diverse sources in an attempt to throw light on this debate.

Susceptibility to obesity: metabolic or behavioural?

Obesity exhibits both genetic and familial associations, suggesting an element of individual susceptibility that interacts with adverse environmental conditions to cause extreme weight gain. There has been a tendency for aetiological research to focus on possible metabolic defects which might explain why particular individuals are unable to regulate energy balance. For instance, in the 1970s the perception that obese people ate less than their lean counterparts triggered massive research investment into an abortive search for an energy sparing defect—the "Doctor, it's my metabolism" syndrome.

Such investigations have now largely been abandoned since it is clear that obese people tend to provide biased diet records and habitually eat far more than they claim, thus eliminating the initial basis of the hypothesis.[8,9] Many similar investigative trails could be cited. This emphasis on research into metabolic susceptibility persists and was exemplified most recently by intense public interest in a genetic cause for obesity following the sequencing of an "obesity gene" from ob/ob mice.[10]

Recent epidemiological trends in obesity indicate, however, that the primary causes of the problem must lie in environmental or behavioural changes affecting large sections of the population, since the escalating rates of obesity are occurring in a relatively constant gene pool and hence against a constant metabolic background.

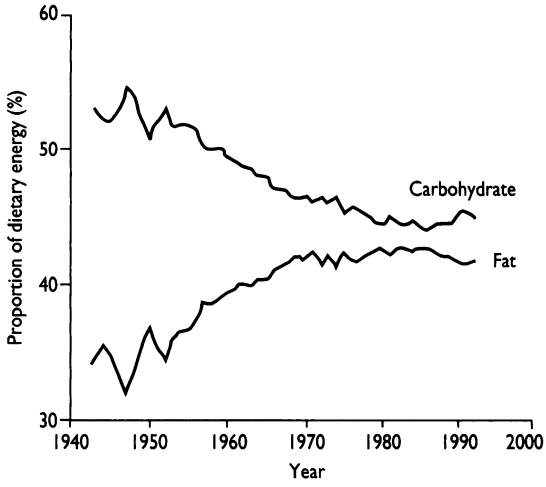

FIG 2—*Changes in fat: carbohydrate ratio of British diet. Source: National Food Survey*[11]

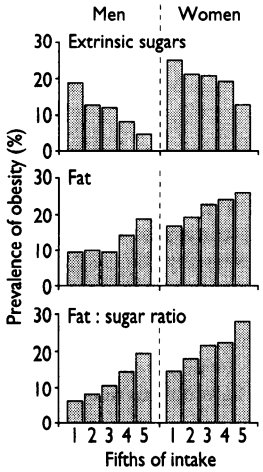

FIG 3—*Composition of habitual diet and prevalence of obesity. Data from 11 626 Scottish men and women*[14]*; 1=lowest fifth, 5=highest fifth of intake*

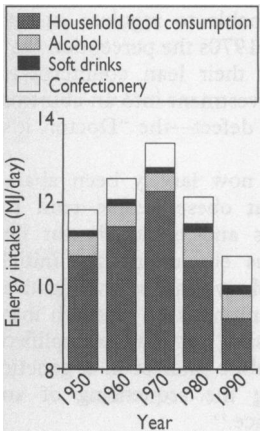

FIG 4—*Changes in average energy intake in Britain over 50 years. Household food consumption data from National Food Survey*[11]*; alcohol, soft drinks, and confectionery from disappearance data collated by Ministry of Agriculture, Fisheries, and Foods*[24]

Evidence implicating gluttony

Over the past 50 years there has been an increase in the proportion of fat in the British diet: in the 1940s each kJ of carbohydrate in the diet was associated with 0·6 kJ of fat and in the 1990s with 0·9 kJ of fat, an increase of 50% (fig 2). Many believe that this plays a key part in the fattening of Britain since there is evidence from several sources to indicate that the consumption of a high fat diet undermines the normal mechanisms regulating energy balance in humans.

Numerous dietary studies have shown an association between fatness and the consumption of a high fat diet.[12,13] Although suggestive of an association, these studies are compromised by the notorious unreliability of food intake data in overweight people[8,9] and because they may be recording a post hoc association between body fatness and a liking for high fat foods.

Other epidemiological studies provide more robust evidence by avoiding selective comparisons of lean and obese people. A striking example from a recently published study of over 11 600 Scottish men and women is illustrated in figure 3.[14] The prevalence of obesity was examined in different fifths of the population according to the subjects' relative intakes of sugars, fat, and the fat:sugars ratio. In contrast with popular belief, the groups consuming the highest proportion of energy as sugars were much less likely to be obese than low sugar consumers. This can almost certainly be explained by a phenomenon described as the fat-sugar seesaw: there seems to be an inbuilt reciprocity between people's intakes of fat and of simple sugars.[15] The lower sections of figure 3 show that obesity rates were highest in the groups consuming the highest proportion of energy as fat, and particularly in the highest category for the fat:sugars ratio. The strength of this analysis is that it uses diet quality as the dependent variable, rather than body mass index, and shows a consistent trend across all fat:sugar ratios, thus minimising the likelihood that the association could be an artefact generated by biased diet records in obese subjects.

The epidemiological data are reinforced by careful laboratory studies which also implicate a high fat diet in the aetiology of obesity and suggest that mechanisms for regulating body weight function much more effectively on a high carbohydrate (that is, low fat) diet. Such effects operate on both the intake and the expenditure sides of the energy balance equation.

In terms of fuel utilisation, it can readily be shown that carbohydrate balance is accurately regulated through automatic increases in carbohydrate oxidation in response to excess intake. In the case of fat there is virtually no autoregulatory linkage which would act to maintain fat balance.[16] Recent stable isotope studies have also shown that de novo fat synthesis from carbohydrate is a minor process in humans.[17] Each of these findings suggest a rather benign role for carbohydrate in the development of obesity.

With respect to the intake side of the equation, it has been proposed that carbohydrate is central to the regulation of appetite and satiety.[18] Experiments measuring food intake after covert preloads generally show that fat is less satiating than carbohydrate, particularly in subjects with a tendency to obesity.[19,20] Longer term covert manipulation of the diets of lean volunteers elicits spontaneous weight gain on high fat treatments through "passive overconsumption" (so called because the excess energy is ingested without a greater bulk of food being consumed).[21-23]

However, in sharp contrast with the suggestion that a secular drift towards high fat diets has induced people to overeat, there is evidence, based on the National Food Survey's annual measures of household food consumption, that the British are becoming fatter in spite of consuming less energy than in the 1970s.[11] Even after adjustments for meals eaten outside the home, and for consumption of alcohol, soft drinks, and confectionery, average per capita energy intake seems to have declined by 20% since 1970 (fig 4). Analysis of cross sectional surveys corroborates the data from the National Food Survey.

The paradox of increasing obesity in the face of decreasing food intake can only be explained if levels of energy expenditure have declined faster than energy intake, thus leading to an overconsumption of energy relative to a greatly reduced requirement.

Evidence implicating sloth

Historical and crosscultural observations suggest that the body's weight regulatory systems have evolved under conditions of high physical activity. Affluence is associated with a decline in energy expenditure as people adopt increasingly sedentary lifestyles in which motorised transport, mechanised equipment, and energy saving domestic appliances displace physically arduous tasks. Only 20% of men and 10% of women are employed in active occupations.[25] For many people leisure time pursuits are dominated by television viewing and other inactive pastimes.[26] Central heating also reduces the need to expend energy for thermoregulation and probably encourages lethargy.

Unfortunately there are few baseline data on physical activity against which to judge secular trends, since the health risks of inactivity have been the subject of detailed research only in recent years. Television viewing is one exception where historical trend data do exist.[27] The average person in England now watches over 26 hours of television a week, compared with 13 hours in the 1960s. Videos and computer games further contribute to inactivity in children. Excessive television viewing by some individuals may encourage both sloth and gluttony (the "couch potato" effect) and in the United States has been identified as one of the most important determinants of childhood and adolescent obesity.[28]

Other simple observations confirm that there have been profound changes in lifestyle over recent decades and that current levels of physical activity are exceptionally low in many individuals. The Allied Dunbar national fitness survey (1992)[25] and the health survey for England (1991)[1] used similar questionnaire methods to assess participation in sports and active pastimes during the four weeks before interview in large samples of adults. Their direct estimates of participation rates in various activities yield some telling statistics: 30-35% of men and women had undertaken fewer than four 20 minute periods of any type of moderate activity in the previous month; more than 80% had not walked continuously for two miles

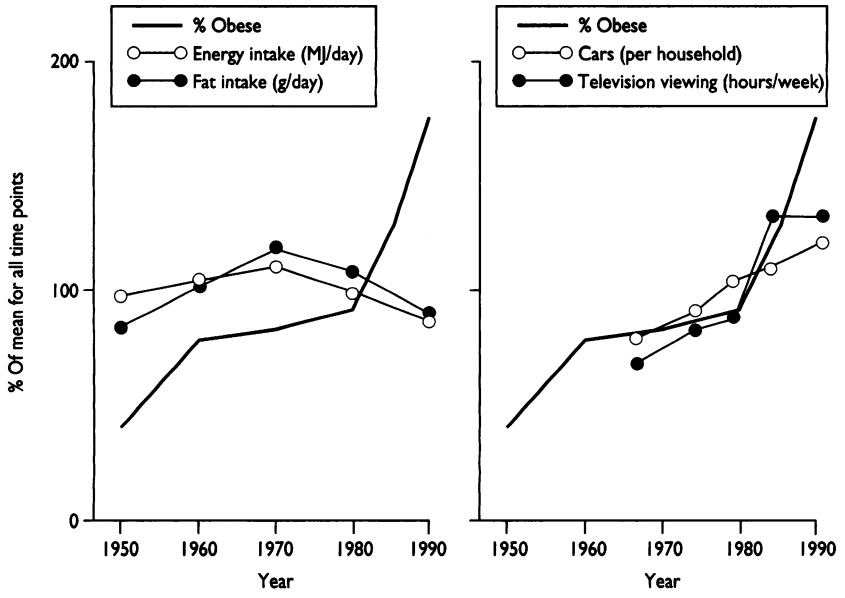

FIG 5—*Secular trends in diet (left) and activity (right) in relation to obesity in Britain. Data for diet from National Food Survey[11]; data for body mass index from Office of Population Censuses and Surveys[1-3] and historical surveys[30]; data for television viewing and car ownership from Central Statistical Office[26]*

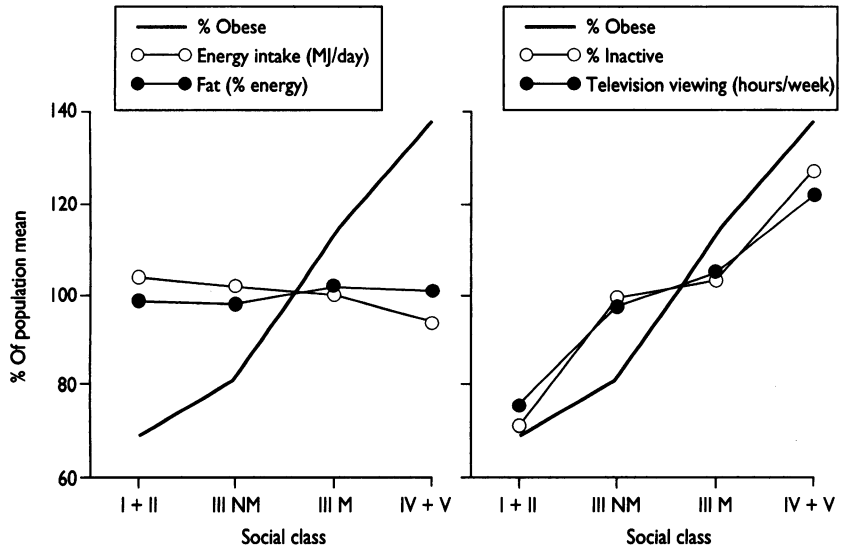

FIG 6—*Social class trends in diet (left) and activity (right) in relation to obesity. Data for diet (women only) from Gregory et al[3]; data for prevalence of clinical obesity (women only) from Office of Population Censuses and Surveys[1]; data for television viewing and car ownership (both sexes) from Central Statistical Office[26]*

(3·2 km); 90% had not cycled; 50-60% had not participated in any moderately vigorous sport; only 20-30% participated in vigorous activity of any type.

The hypothesis that exceptionally low levels of physical activity in certain subgroups of the population may be at least as important as dietary factors in the development of obesity has been confirmed by the largest available prospective study, which followed 12 000 Finnish adults over a five year period.[29] Low levels of physical activity were identified as a more important risk factor for excess weight gain than any features of the habitual diet.

Using the epidemiological data presented above we can perform further analysis of the relative importance of diet and of physical inactivity as likely causal factors for the rapid increase in obesity in Britain. Figure 5 examines the secular trends. It shows that the changes in prevalence of obesity seem to be unrelated to changes in the intake of total energy or of fat (or of sugar; not shown). Proxy measures of physical inactivity such as car ownership and television viewing seem more closely related to changes in obesity.

Figure 6 uses a cross sectional approach and exploits the strong social class trend for obesity in women to search for associations with diet and activity. In this quite separate analysis, based on different dietary and activity data, there is once again a much closer relation between obesity and measures of inactivity than there is between obesity and diet.

Conclusion

The above analyses rely on population based estimates and should not be overinterpreted, but they add a strong note of caution to the simple assumption that obesity in affluent societies is largely a matter of greed, encouraged by a highly palatable diet backed by persuasive advertising and available at ever diminishing cost relative to average income. Clearly, the food intake of obese people must have been excessive relative to their energy needs during the dynamic phase of weight gain. But it seems reasonable to conclude that the low levels of physical activity now prevalent in Britain must play an important, perhaps dominant, role in the development of obesity by greatly reducing energy needs. This analysis suggests that public health strategies must be targeted both at a reduction in the fat content of the diet and at avoidance of physical inactivity if they are to have any chance of reversing the current trends in obesity and of avoiding the associated health consequences.

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Conflict of interest: None.

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