Obesity and diabetes: The toxic state of the nation's waistline

Debbie Cook, David Haslam

The diabesity epidemic is increasing at an alarming rate along with other non-communicable diseases. In this article the authors consider the complex causes of obesity – including the obesogenic environment, genetic factors and the widespread habituation to sugar – and the interplay between overweight, obesity and type 2 diabetes. They look at the current efforts to tackle the crisis, which often focus on the prevention of obesity rather than its treatment or management. They argue that a greater understanding of the multifactorial causes of diabesity along with a more cohesive attempt to manage and reduce obesity might have better results. They revisit the Foresight report of 2007, which predicted that half the population would be obese by 2050 and suggest that unless public health initiatives are better informed this prediction will prove to be a vast underestimate.

The prevalence of non-communicable diseases is increasing globally at an alarming rate. Eighteen million people die every year from cardiovascular disease (Beaglehole et al, 2001), of which hypertension and type 2 diabetes are major contributors. Underpinning the upsurge of these chronic diseases is the growing prevalence of overweight and obesity (Hossain et al, 2007). Obesity is now the sixth most important risk factor contributing to the global health burden (Hainer et al, 2008), and high levels of physical inactivity and obesity coupled with the modern diet and the modern physical environment are the leading causes of a type 2 diabetes epidemic that has been accelerating over recent decades (Yates, 2012).

Prevalence of obesity

In the UK, research by the Health and Social Care Information Centre (HSCIC) has shown a sharp increase between 1993 and 2011 in the number of men and women with a BMI outside the normal range (*Figures 1* and *2*). Additionally, they highlighted that, in 2010, nearly one-third (31%) of boys and more than one in five girls (29%) aged between 2 and 15 were classified as overweight (BMI 25 to <30 kg/m^2) or obese (BMI ≥30 kg/m^2), and that a rise in waist circumference has outstripped increases in BMI measurements, suggesting a rise in harmful central obesity (HSCIC, 2012).

Aetiology of obesity

Obesity has multifactorial origins. We live in an "obesogenic environment" that facilitates obesity with the popularity of highly calorific fast food and increased sedentary behaviour. Other factors include genetic and epigenetic influences: "Genetics loads the gun and the environment pulls the trigger" is an often-cited analogy. Even abnormalities in gut microbiota and also adenoviruses – especially serotype 36 (Adv36) – have been shown to have a causative link with obesity (Dhurandhar et al, 2000), although the exact mechanisms require clarification. Adv36 infection has been associated with paediatric obesity, severe obesity in women and a lower risk of high blood lipid levels in a group of people without diabetes (Almgren et al, 2012).

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Article points

1. The causes of obesity are complex and multifactorial.
2. Public health initiatives often focus on prevention. Management and reduction of obesity should also be prioritised. Diet and lifestyle interventions can make a big difference to those who are already overweight or obese.
3. The aetiology of obesity and the progression to type 2 diabetes need to be better understood in order for the obesity epidemic to be slowed.

Key words

- Diabetes
- Obesity
- Public health strategies

Authors

Debbie Cook is Vice Chair of the National Obesity Forum and a Diabetes Specialist Nurse in Redbridge. David Haslam is Chair of the National Obesity Forum, a GP in Hertfordshire, and a Bariatric Physician, Luton and Dunstable Hospital, Luton.

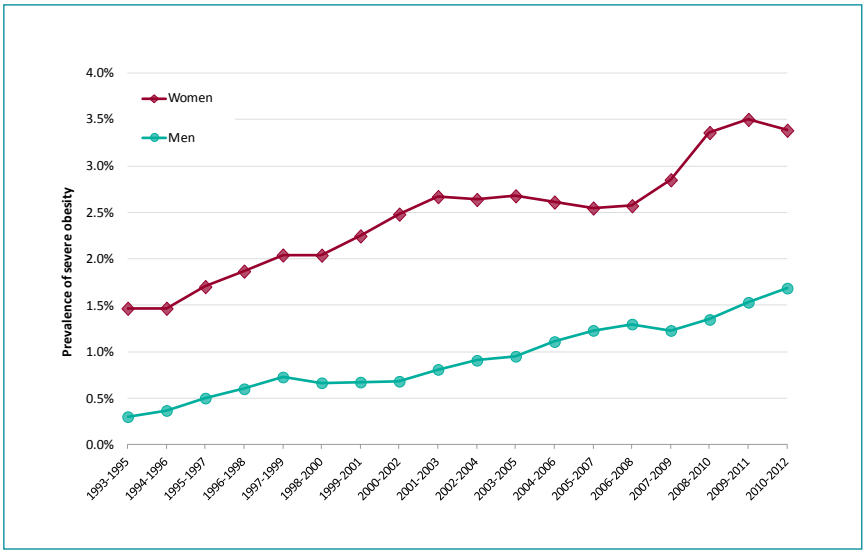

Figure 1. Trend in severe obesity among adults. Courtesey of Public Health England based on data from Health Survey for England (2013).

Sugar has been put forward as a major cause of the obesity epidemic (Lustig et al, 2012), and habituation to sugar-sweetened foods is widespread. The World Health Organization (WHO) currently recommends that the level of sugar intake per person is decreased to 5% rather than 10% of energy intake (WHO, 2013), and the newly published Scientific Advisory Committee on Nutrition (SACN) has produced similar 5% recommendations, particularly citing sugar-sweetened beverages as being problematic (SACN, 2014). It would be feasible to reformulate foods by increasing their nutrient density, reducing their energy density, aiming to raise satiety and changing the bioavailability or absorption of components. A strategy could be implemented that dishabituated people to sugar by gradually lowering the amounts added to foods – similar to the unobtrusive strategy used with salt – and substituting ingredients, such as using sweeteners (Winkler, 2013).

Social and economic conditions also have an impact on the health of an individual or population. The circumstances in which someone is born, lives and works influences their lifestyle and subsequent health. People from poor social and economic circumstances generally have a higher risk of morbidity and mortality throughout life (WHO, 2003). Obesity – especially central obesity – is more prevalent in more deprived areas and self-reported physical activity is lower in adults in the poorest domestic environments compared with more affluent households (Health Survey for England, 2006). Both obesity and low levels of physical activity are associated with increased diabetes risk. Ethnicity also affects obesity levels with white British people having the lowest prevalence of obesity in England and African-Caribbean and Bangladeshi people having much higher levels (Health Survey for England, 2011).

Morbid obesity (BMI ≥30 kg/m^2), which is associated with an increased risk of comorbidities, is also associated with lower socio-demographic profiles and lower educational attainment. More prevalent in women than men, morbid obesity is predicted to rise even further in the next 20–30 years (National Obesity Observatory, 2011).

Diabetes and the link to obesity

NICE (2012) public health guidance recommends screening for type 2 diabetes in:

- All eligible adults aged 40 and above, except pregnant women.
- People aged 25–39 of South Asian, Chinese, African-Caribbean, black African and other high-risk black and minority ethnic groups, except pregnant women.
- Adults with conditions that increase the risk of type 2 diabetes.

In addition, conditions including cardiovascular disease, hypertension, obesity, stroke, polycystic ovary syndrome, a history of gestational diabetes and mental health problems can all increase the risk of type 2 diabetes (NICE, 2012). The Nurses' Health Study (Colditz and Hankinson, 2005) demonstrates that a woman with a BMI of 35 kg/m^2 or above has a relative risk of 93 compared with a lean individual (BMI <22 kg/m^2) of being diagnosed with diabetes, whereas the Health Professionals' Follow-up Study, in men, showed a relative risk of about 42, comparing BMI values of 35 kg/m^2 or above and less than 22 kg/m^2 (Hu and Willett, 2001).

Treating type 2 diabetes and its complications costs the NHS £8.8 billion per year in the UK, with further indirect

costs of £13 billion for premature deaths, loss of productivity and increased care needs (Brown, 2012). Not everyone who is obese will develop type 2 diabetes (Haslam, 2012) and not everyone who has a high risk of type 2 diabetes is necessarily obese. The management of overweight and obese people with type 2 diabetes is a distinct issue that merits individualised considerations, especially as some glucose-lowering agents used in diabetes management are known to induce weight gain (Stein et al, 2013), which can be demoralising for people with the condition. The most challenging part of managing any person with obesity and diabetes is arguably the initial conversation aimed at engaging the individual from the outset. Continuing to encourage a healthy lifestyle and treat the encroaching cardio-metabolic disease in this group is an ongoing challenge.

Along with an increasing prevalence of obesity and related disorders, such as type 2 diabetes, research has also revealed the complicated relationship that exists between the comorbidities. The true costs of the obesity epidemic will only become known when current overweight and obese young people become older adults. They will contribute to the type 2 diabetes epidemic, which will in turn fuel the cardiovascular and hypertensive disease epidemic, as well as adding to the societal and personal burdens associated with sleep apnoea, certain cancers, arthritis, mental health issues and gout.

Public health and the complex issue of tackling obesity levels

Weight management and obesity represent significant public health issues for the UK. It is entirely reasonable to conclude that the shocking determinations of the 2007 Foresight Report (Butland et al, 2007) – that half the population might be obese by 2050 at an annual cost of nearly £50 billion – may actually underestimate the scale of the problem. The future is likely to be dominated by obesity and the accompanying disease burden.

The total NHS costs of diabetes itself that are attributable to overweight and obesity could increase by 75% in the next 40 years, reaching £3.5 billion in 2050 (National Obesity Forum, 2013).

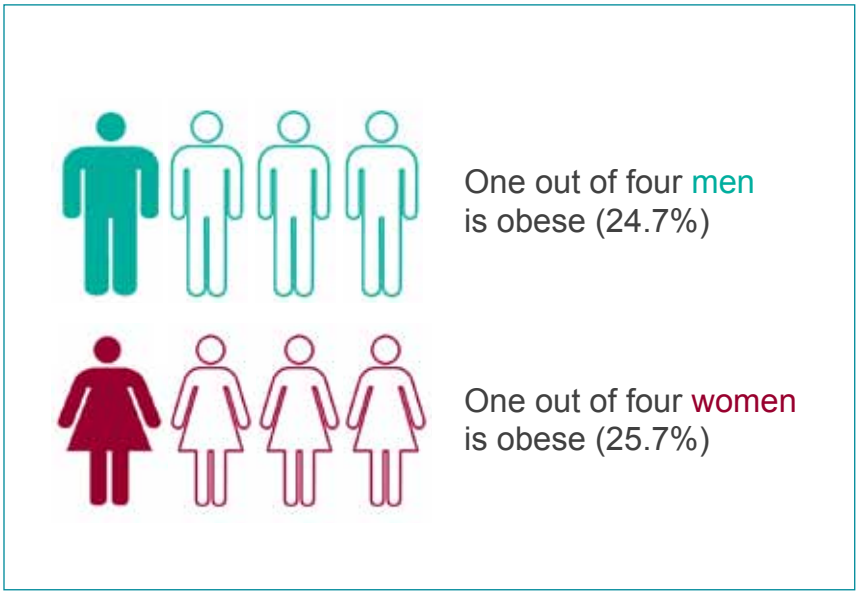

Figure 2. Obesity levels among adults in England. Courtesey of Public Health England based on data from Health Survey for England (2013).

In developed countries, the prevalence of obesity peaks at about age 70, before comorbid illness and failure to thrive tend to induce natural weight loss (Haslam and James, 2005). Leading up to 2050, the year that Foresight focused its crystal ball on, the population will be healthier to a later age; therefore, obesity levels are likely to peak at more like age 80, and this extra decade of the costs of obesity would mean that Foresight's predictions were significant underestimations.

The obesity epidemic has existed for approximately 30 years. A person who became obese at age 20 in the mid-1980s is now of an age when type 2 diabetes or heart disease is likely to develop, but a major effect on the statistics from the associated prematureness of death will not yet have unfolded. It will thus be in the coming decades that the full extent of the obesity crisis will become apparent.

Ideas about obesity in the past 50 years have slowly unravelled and experts now disagree about the root dietary causes of the obesity epidemic. An ageing, fattening population is contributing to the burden of this disease on the population. Elderly individuals also

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suffer from sarcopenia – increased fat within muscles that creates a less efficient metabolic pathway (Haslam and Cook, 2011). In general, the management of overweight in older people should prioritise physical activity, good nutrition and maintenance of good health, rather than simply being a stand-alone weight-loss strategy. Individualisation of care is important.

Also of relevance is a phenomenon known as the "obesity paradox": while overweight may be a precursor for certain conditions, its presence once a diagnosis has been made may be protective with regard to mortality (e.g. Haslam, 2014). Obesity adversely affects the cardiovascular system – haemodynamics, structure and function – as well as increasing the prevalence of most cardiovascular diseases, but despite this potential adverse impact, recent epidemiological data have demonstrated an association of mild obesity and overweight with reduced cardiovascular mortality (Haslam, 2014).

Political initiatives: Is prevention being emphasised at the cost of treatment?

The promotion of healthy living initiatives has not been confined to dietary restraint alone. There is a trend of reducing physical activity across age groups, and children seem to be spending far more time on activities that do not involve significant calorie expenditure, such as watching television and using computers. Recommending exercise to people, even as a brief intervention, is a classic, low-cost health promotion that is quick and easy to provide. Nudging a few patients in the right direction can induce a significant individual health gain and the NHS will benefit in terms of future health gains that will reduce care costs and the need for expensive medication. The costs of inactivity to the NHS are significant, being estimated at about £5 million per primary care trust in England back in 2006 (Department of Health, 2009).

It remains the case that many governmental interventions, policies and initiatives are focused on the promotion of healthy eating and living for individuals who may have some weight management issues but are not obese – and indeed may never be. Comparatively little in the way of support and guidance exists for individuals who are obese or even those who are morbidly obese.

Although obesity and its comorbidities are a major public health challenge facing the UK, government initiatives and policies have also been largely limited to promoting prevention and recording its prevalence without prioritising management. The Quality and Outcomes Framework (QOF) is an annual incentive programme that financially rewards high-quality and evidence-based care for a variety of long-term conditions. The diabetes domain has 86 points on the register and, among other indicators, requires that practices check blood pressure, lipid profiles and foot pulses and send patients for structured education. For obesity, a precursor of ischaemic heart disease, depression, hypertension and arthritis, as well as type 2 diabetes, QOF offers only 8 points. To gain the 8 points, practices only need to have a register of obese patients. Specifics of care for patients are not covered, and there is no incentive to measure lipid or liver or blood pressure profiles, or reduce the risk of developing other diseases, metabolic or otherwise (NHS Employers, 2014).

Other government initiatives that attempt to tackle the increasing problem of obesity include the Public Health Responsibility Deal (see https://responsibilitydeal.dh.gov.uk/ [accessed 29.07.14]), part of the Government's ambition for a more collaborative approach to tackling the challenges caused by the public's lifestyle choices in an obesogenic environment.

The key pledges agreed at the launch of the Public Health Responsibility Deal in 2011 included:

- Reducing salt in food, aiming for people to eat 1 g less per day.
- Getting calorific values of meals printed on menus in restaurants (in response to the increase in proportion of meals eaten outside the home to 20–25% of all eaten).
- Ensuring clear unit labelling on at least 80% of alcohol products.
- Removing artificial trans-fats from most processed food.

Focusing on obesity management: Ways to reduce the prevalence of obesity and diabetes

If the aetiology of obesity and the progression to type 2 diabetes was to be better understood, efforts could be focused on tackling the problem. The onset and development of type 2 diabetes is based on polygenic inheritance, with several of the 250 "candidate genes" being investigated to allow a better understanding of this complex disease (Clancy and Newell, 2011). Persistent environmental influences related to beta-cell over-activity, lipotoxicity and glucotoxicity, such as lack of exercise and overconsumption of carbohydrates and alcohol, all contribute to early adaptive changes in insulin target cell function (Ershow, 2009).

New research indicates that the incidence of childhood or adolescent obesity may also increase the risks of developing type 2 diabetes later in life. In a large study of 37 600 apparently healthy young men from the Israeli Medical Corps, participants were followed for 17 years. The researchers found that the BMI of adolescents was linked to their risk of developing both type 2 diabetes and heart disease, even though this was a group of very physically active people (Tirosh et al, 2011).

Diet and lifestyle interventions for obesity are not just pointless government interventions from the "nanny state". Clinical guidelines suggest that for most obese adults, losing 5–10% of initial body weight by behavioural and lifestyle changes is the best approach to achieve sustainable and achievable weight loss (SIGN, 2010). Behavioural changes include the use of very-low-calorie, low-carbohydrate or low-fat diets, together with an increase in physical exercise. Once patients are morbidly obese, more drastic solutions may be required, such as pharmacotherapy or bariatric surgery. Bariatric surgery – usually bypass surgery or sleeve gastrectomy but sometimes gastric band or more rarely duodenal switch – may also reverse diabetes in up to 80% of cases (Keidar, 2011).

The use of very-low-calorie diets has generated a great deal of public interest. A recent analysis of the self-reported experiences of 77 people with type 2 diabetes (following publication of the Counterpoint Study) revealed significant weight loss after following a calorie-restricted diet. Diabetes remission occurred in 61% of all individuals, and 80% of those who lost more than 20 kg. Reversal rates varied with diabetes duration, with the group who had a shorter duration of diabetes displaying a higher percentage of normoglycaemia (Steven et al, 2013).

Finally, reports such as the *State of the Nation's Waistline* (National Obesity Forum, 2014), along with initiatives such the National Obesity Awareness campaign, help to raise awareness about type 2 diabetes and its typical cause, obesity.

Conclusion

The causes of obesity and diabetes are complex and we require complex strategies to tackle the crisis and reduce the devastating and costly consequences of the diabesity epidemic. Public health strategies often focus on obesity prevention rather than treating pre-existing obesity, whereas evidence shows that there would be tremendous gains to be made in this area. Dietary and lifestyle interventions are essential along with the attempts to reduce the effects of the obesogenic environment. Strategies need to be informed by a better understanding of the complex causes of obesity and diabetes if we are going to tackle the toxic state of the nation's collective waistline. ■

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