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# Managing and Preventing Obesity

Behavioural Factors and Dietary  
Interventions

*Edited by*

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# Introduction: an overview of the key drivers of obesity and their influence on diet

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## 1 Introduction

Obesity results from a prolonged period of energy imbalance where the energy intake from food and drink exceeds energy expenditure for metabolic processes and physical activity. Excess energy is stored as fat within the body and is associated with a wide range of health, social and psychological problems.

Energy balance within the body is usually well regulated by a range of physiological responses which monitor food intake, metabolism and storage and send signals to influence appetite and to a lesser extent energy expenditure. Physiological energy regulation mechanisms operate within each person to keep weight and body fat stores stable in the long term (Schutz 1995). However, powerful societal and environmental forces influence energy intake and expenditure through effects on dietary and physical activity patterns, and may overwhelm the physiological control of body weight. The susceptibility of individuals to these forces is influenced by genetic and other biological factors such as gender, age and hormonal activities, over which they have little or no control.

The breadth of these ‘drivers of weight gain’ is addressed in this chapter but discussed in more detail in later chapters.

### 1.1 Key influences on energy balance and weight gain

A number of analyses have attempted to define the key determinants of obesity and there remains a degree of controversy over which factors have made the greatest contribution to the recent rise in the rates of obesity throughout the world. Comprehensive assessment of the situation has been undertaken by the World Health Organization in the *Expert Report on Diet, Nutrition and the Prevention of Chronic Disease* (WHO 2003) and the World Cancer Research Fund report *Food, Nutrition, Physical Activity, and the Prevention of Cancer: a Global Perspective* (WCRF 2007).

These reports examined the current literature and identified a range of key factors which either increase or decrease the risk of weight gain and the development of obesity. The results of both assessments are summarised in Table I.1.

**Table 1 Summary of the strengths of evidence on behaviours that might promote or protect against weight gain and obesity – agreement from WHO 2003 and WCRF 2007 reports**

Evidence	Decreases risk	Increases risk
Rated convincing or likely in both reports.	Regular physical activity. High intake of low energy-dense foods.*	Sedentary lifestyles. High intake of energy-dense foods.*
Rated probable or possible in both reports.	High dietary fibre intake. Promoting linear growth. Breastfeeding.	Sugar-sweetened soft drinks and juices. High proportion of food prepared outside of homes. High exposure to television (marketing).
Rated possible in one report only.	Low glycaemic index foods.	Adverse social and economic conditions in developed countries (especially for women). Large portion sizes. Rigid restraint/periodic disinhibition eating patterns.
Rated insufficient.	Increased eating frequency.	Alcohol.

\* Energy-dense foods are high in fat/sugar, and energy-dilute foods are high in fibre and water such as vegetables, fruits, legumes and whole grain cereals.

Source: Developed from WHO 2003 and WCRF 2007.

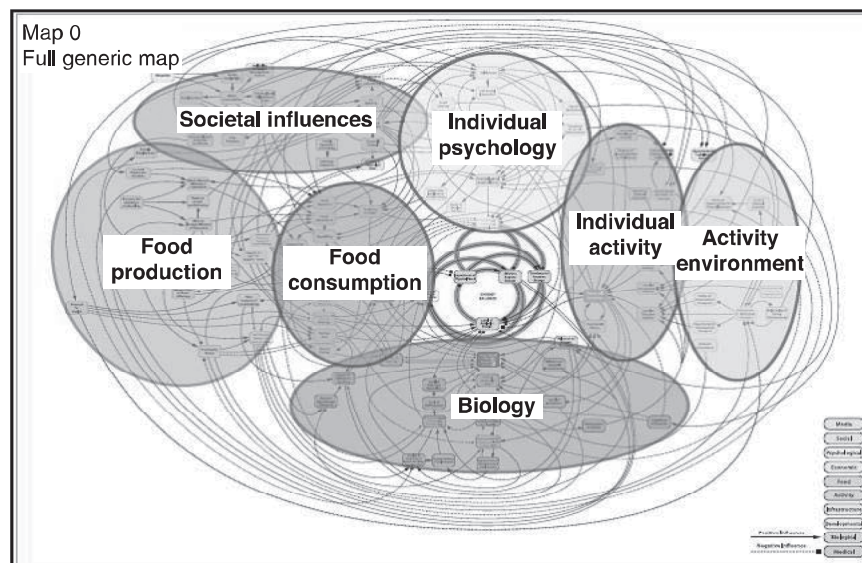
## 1.2 The complex web of influences on the aetiology of obesity

Although the WHO and WCRF reviews touched upon the array of behavioural and environmental influences in the aetiology of obesity at an individual and population level, they did not capture the interplay of these factors and how they operate at a societal level. One of the first attempts to represent the nature of the prevailing, multi-layered environmental factors that influence energy balance in the modern world was the International Obesity Task Force ‘causal web’ (Kumanyika *et al.*, 2002). The causal web illustrated that although food intake and energy expenditure ultimately influence energy balance, there are an array of forces operating at different layers of society that impact directly or indirectly upon these behaviours. The implications of this representation are apparent. Addressing obesity prevention will require action at many levels and must include a focus on many of the distal factors that influence our food and activity environment.

Although the causal web suggests that the genesis of and thus, the solution to obesity is complicated, its linear format does not clearly illustrate the complexity of the interactions between the various layers. The Foresight Programme of the UK Government Office for Science expanded on the causal web approach by using a systems approach to produce a complex conceptual model with 108 variables known

as the ‘obesity systems map’ (Vandenbroeck *et al.*, 2007). The relationships between the variables are illustrated with more than 300 solid or dashed lines to indicate positive and negative influences. All the variables are interconnected and these connections give rise to feedback loops. At the core (or engine) of the map is energy balance, surrounded by variables that directly or indirectly influence this key process. The relationships between each factor and their influence on the energy balance core is represented by a complex array of multi-directional arrows that illustrate the complex interaction between environment, behaviour and physiology. The original spaghetti-like, causal loop map has been simplified by dividing the factors represented into seven cross-cutting, principal themes (Figure 1):

- Biology: an individual's starting point – the influence of genetics and physiology.
- Food consumption patterns and behaviours: the quality, quantity and frequency of an individual's food intake.
- Food environment: the influence of the food environment on an individual's food choices.
- Physical activity behaviours: the type, frequency and intensity of an individual's physical activities.
- Activity environment: the influence of the environment on an individual's activity behaviour.
- Individual psychology: psychological influences food intake and consumption patterns, or physical activity patterns or preferences.
- Societal norms and influences: the impact of how society views and responds to the issue of obesity.



**Figure 1** A simplified version of the Foresight obesity system map identifying main sectors of influence

Source: Vandenbroeck *et al.* 2007.

A complete version of the Foresight Obesity System Map can be found at [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/296290/obesity-map-full-hi-res.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/296290/obesity-map-full-hi-res.pdf)

The Foresight map approach to defining the broad-ranging drivers of obesity and the inter-relationships between these factors has not met with universal approval. It has been criticised for being overly complex to the extent that it creates a sense of confusion and despair, when clarity is what is needed to effectively address this problem (Finewood *et al.*, 2010). Others have also questioned how comprehensive such a map could be, in that it implies that all potential drivers of obesity are captured within the map. It is probably true that very few people completely understand all the intricacies of the system it describes and that the map is not truly complete, as it reflects only the perceptions of the stakeholders engaged in its development. However, it has served some useful objectives in improving our perception of the nature of the obesity problem and the approach that will be required to successfully address it. Some of the principles that the Foresight map and process have reinforced are:

- the wide range of political, social, environmental, behavioural and physiological factors that influence individuals' and society's capacity to achieve energy balance, and the complex, multifactorial nature of the systems that give rise to obesity;
- the breadth of action that will be required to restore energy balance;
- the futility of attempting to address obesity by focusing attention solely on individual behaviour change or within one domain of action;
- the need to consider the interaction between factors that either enable or amplify, or conversely, inhibit the behaviour change process required to achieve energy balance;
- the interaction between factors within the system, which is currently driving energy accretion and disrupting individual efforts to achieve energy balance.

## 2 Behavioural factors

Food intake and physical activity behaviours are the two key factors that have potential to directly influence energy balance and weight status. Historically they have been considered a product of free will under the direct cognitive control of the individual. However, as previous sections have indicated, there are a range of biological as well as social and environmental forces that constrain these behaviours in individuals. However, an appreciation of the dietary and activity behaviours that have been linked to weight gain and the development of obesity is important if we are to usefully define these problems and decide how best to address them.

Both energy expenditure and energy intake contribute to weight gain and the development of obesity, and it is not possible to clearly apportion the contribution that each makes to the problem. There has been a lot of unnecessary debate over which factor is more important in the genesis of obesity. Attempts to selectively promote one factor over the other as the major cause are counterproductive, as both will need to be addressed in tackling the problem.



## 2.1 *The formation of habits*

When a behaviour relating to food intake or activity is repeated often for a long period of time, it becomes a habit, meaning that it becomes almost an automatic response to certain cues or situations. Habits often remain well after the original reason for adoption of the behaviour has passed, making them difficult to change. Often, people passively adopt or continue a behaviour rather than making an active decision to do so. Once habits are formed, individuals show little inclination to change them. In addition, attitudes and intentions have less of an impact when a habit has been established, making changes to inappropriate food and activity behaviours less likely even when the need for such a change is accepted (Vandenbroeck *et al.*, 2007).

Food and activity habits are often associated with an increased energy intake, and as environments become more ‘obesogenic’ (obesity-promoting), the behaviours that lead to obesity are increasingly the default or automatic ones.

## 2.2 *Dietary behaviours*

A number of dietary factors have been identified as potential contributors to weight gain and obesity by undermining the innate regulatory control of body weight. There are multiple mechanisms by which this can occur, including satiety, palatability, food availability or low energy needs as a consequence of physical inactivity. Despite great interest in this area, evidence linking specific dietary behaviours to weight gain is limited and is largely restricted to observational and intervention studies.

Although surplus energy intake is an obvious cause of weight gain, there is little evidence to link high kilojoule intake directly to obesity. This may be the result of large individual variability in energy requirements, with higher requirements often being associated with higher levels of activity. In addition, total kilojoule intake is not reported accurately or consistently in most dietary surveys (Willett and Stampfer 1986). This has led to the exploration of the role of a range of dietary behaviours associated with weight gain and obesity. The key elements of these behaviours are addressed in separate chapters within this book including:

- Energy density of the diet
- Fat composition of the diet
- Protein intake
- Carbohydrate intake and glycaemic index of the diet
- Fibre
- Alcohol
- Fruit and vegetable consumption
- Consumption of sugar-sweetened beverages
- Portion size
- Increased consumption of takeaway foods and foods prepared away from home
- Eating frequency.

### **2.3 Physical activity behaviours**

Although it may appear obvious that inactive people will gain more weight over time than active people, the true impact of reduced activity on weight gain is not easy to clarify for a number of reasons (WHO Euro 2007, Wareham 2007, Fox and Hillsdon 2007).

Unfortunately, we do not have high quality data on the amount of physical activity undertaken over time and most of the data we do have is self-reported, with little objective validation. In addition, the relationship between physical inactivity/sedentary behaviour and obesity is complex and is subject to a wide array of confounding factors which are difficult to exclude.

Although data is now available from large prospective studies, it is difficult to exclude the possible influence of reverse causality; that is, a high BMI at the start of the study may be a cause of decreasing physical activity and may also be independently associated with an increased risk of weight gain. In addition, most studies have examined only leisure time physical activity and have ignored the impact of occupational and incidental activity.

Despite these limitations, most reviews of research consistently show the expected inverse relationship between leisure time physical activity and obesity in all but the youngest children (Fogelholm and Kukkonen-Harjula 2000, Summerbell *et al.*, 2009).

### **2.4 Sedentary behaviours**

Sedentary behaviours are not merely the inverse of being physically active. They are different but interlinked behaviours and there is a growing body of evidence that sedentary behaviour may be a distinct risk factor, independent of physical inactivity, for multiple adverse health outcomes including obesity in adults (Thorp *et al.*, 2011). The most commonly utilised indicator of sedentary behaviour is television viewing time and many (but not all) studies have found a positive association between hours of TV watched and increased body weight. A study by Hardy *et al.* (2009) indicated that more than two hours a day of screen time was associated with reduced fitness, increased weight and a greater risk of ill health in schoolchildren. A number of studies have examined the level of sitting time among workers and have found that sitting for more than six hours a day doubles a person's risk of being overweight compared to those who spend less than one hour a day sitting (Brown *et al.*, 2003, Mummery *et al.*, 2005).

## **3 Environmental and structural factors**

The external social, political and economic environment in which people live has a profound effect on the way people behave. Each day, people interact with a wide range of services, systems and pressures in settings such as schools, the workplace, home, restaurants and takeaway food outlets. In addition, these settings are