5.2 Recommendations for preventing excess weight gain and obesity

5.2.1 *Background*

Almost all countries (high-income and low-income alike) are experiencing an obesity epidemic, although with great variation between and within countries. In low-income countries, obesity is more common in middle-aged women, people of higher socioeconomic status and those living in urban communities. In more affluent countries, obesity is not only common in the middle-aged, but is becoming increasingly prevalent among younger adults and children. Furthermore, it tends to be associated with lower socioeconomic status, especially in women, and the urban–rural differences are diminished or even reversed.

It has been estimated that the direct costs of obesity accounted for 6.8% (or US$ 70 billion) of total health care costs, and physical inactivity for a further US$ 24 billion, in the United States in 1995. Although direct costs in other industrialized countries are slightly lower, they still consume a sizeable proportion of national health budgets (*1*). Indirect costs, which are far greater than direct costs, include workdays lost, physician visits, disability pensions and premature mortality. Intangible costs such as impaired quality of life are also enormous. Because the risks of diabetes, cardiovascular disease and hypertension rise continuously with increasing weight, there is much overlap between the prevention of obesity and the prevention of a variety of chronic diseases, especially type 2 diabetes. Population education strategies will need a solid base of policy and environment-based changes to be effective in eventually reversing these trends.

5.2.2 *Trends*

The increasing industrialization, urbanization and mechanization occurring in most countries around the world is associated with changes in diet and behaviour, in particular, diets are becoming richer in high-fat, high energy foods and lifestyles more sedentary. In many developing countries undergoing economic transition, rising levels of obesity often coexist in the same population (or even the same household) with chronic undernutrition. Increases in obesity over the past 30 years have been paralleled by a dramatic rise in the prevalence of diabetes (*2*).

5.2.3 *Diet, physical activity and excess weight gain and obesity*

Mortality rates increase with increasing degrees of overweight, as measured by BMI. As BMI increases, so too does the proportion of people with one or more comorbid conditions. In one study in the USA (*3*), over half (53%) of all deaths in women with a BMI > 29 kg/m^2 could

be directly attributed to their obesity. Eating behaviours that have been linked to overweight and obesity include snacking/eating frequency, binge-eating patterns, eating out, and (protectively) exclusive breast-feeding. Nutrient factors under investigation include fat, carbohydrate type (including refined carbohydrates such as sugar), the glycaemic index of foods, and fibre. Environmental issues are clearly important, especially as many environments become increasingly "obesogenic" (obesity-promoting).

Physical activity is an important determinant of body weight. In addition, physical activity and physical fitness (which relates to the ability to perform physical activity) are important modifiers of mortality and morbidity related to overweight and obesity. There is firm evidence that moderate to high fitness levels provide a substantially reduced risk of cardiovascular disease and all-cause mortality and that these benefits apply to all BMI levels. Furthermore, high fitness protects against mortality at all BMI levels in men with diabetes. Low cardiovascular fitness is a serious and common comorbidity of obesity, and a sizeable proportion of deaths in overweight and obese populations are probably a result of low levels of cardio-respiratory fitness rather than obesity per se. Fitness is, in turn, influenced strongly by physical activity in addition to genetic factors. These relationships emphasize the role of physical activity in the prevention of overweight and obesity, independently of the effects of physical activity on body weight.

The potential etiological factors related to unhealthy weight gain are listed in Table 7.

5.2.4 *Strength of evidence*

Convincing etiological factors

Regular physical activity (protective) and sedentary lifestyles (causative). There is convincing evidence that regular physical activity is protective against unhealthy weight gain whereas sedentary lifestyles, particularly sedentary occupations and inactive recreation such as watching television, promote it. Most epidemiological studies show smaller risk of weight gain, overweight and obesity among persons who *currently* engage regularly in moderate to large amounts of physical activity (*4*). Studies measuring physical activity at baseline and randomized trials of exercise programmes show more mixed results, probably because of the low adherence to long-term changes. Therefore, it is ongoing physical activity itself rather than previous physical activity or enrolment in an exercise programme that is protective against unhealthy weight gain. The recommendation for individuals to accumulate at least 30 minutes of moderate-intensity physical activity on most days is largely aimed at

reducing cardiovascular diseases and overall mortality. The amount needed to prevent unhealthy weight gain is uncertain but is probably significantly greater than this. Preventing weight gain after substantial weight loss probably requires about 60–90 minutes per day. Two meetings recommended by consensus that about 45–60 minutes of moderate-intensity physical activity is needed on most days or every day to prevent unhealthy weight gain (*5, 6*). Studies aimed at reducing sedentary behaviours have focused primarily on reducing television viewing in children. Reducing viewing times by about 30 minutes a day in children in the United States appears feasible and is associated with reductions in BMI.

Table 7
Summary of strength of evidence on factors that might promote or protect against weight gain and obesity[a]

Evidence	Decreased risk	No relationship	Increased risk
Convincing	Regular physical activity High dietary intake of NSP (dietary fibre)[b]		Sedentary lifestyles High intake of energy-dense micronutrient-poor foods[c]
Probable	Home and school environments that support healthy food choices for children[d] Breastfeeding		Heavy marketing of energy-dense foods[d] and fast-food outlets[d] High intake of sugars-sweetened soft drinks and fruit juices Adverse socioeconomic conditions[d] (in developed countries, especially for women)
Possible	Low glycaemic index foods	Protein content of the diet	Large portion sizes High proportion of food prepared outside the home (developed countries) "Rigid restraint/periodic disinhibition" eating patterns
Insufficient	Increased eating frequency		Alcohol

[a] Strength of evidence: the totality of the evidence was taken into account. The World Cancer Research Fund schema was taken as the starting point but was modified in the following manner: randomized controlled trials were given prominence as the highest ranking study design (randomized controlled trials were not a major source of cancer evidence); associated evidence and expert opinion was also taken into account in relation to environmental determinants (direct trials were usually not available).
[b] Specific amounts will depend on the analytical methodologies used to measure fibre.
[c] Energy-dense and micronutrient-poor foods tend to be processed foods that are high in fat and/or sugars. Low energy-dense (or energy-dilute) foods, such as fruit, legumes, vegetables and whole grain cereals, are high in dietary fibre and water.
[d] Associated evidence and expert opinion included.

A high dietary intake of non-starch polysaccharides (NSP)/dietary fibre (protective). The nomenclature and definitions of NSP (dietary fibre) have changed with time, and many of the available studies used previous definitions, such as soluble and insoluble fibre. Nevertheless, two recent reviews of randomized trials have concluded that the majority of studies show that a high intake of NSP (dietary fibre) promotes weight loss.

Pereira & Ludwig (*7*) found that 12 out of 19 trials showed beneficial objective effects (including weight loss). In their review of 11 studies of more than 4 weeks duration, involving ad libitum eating Howarth Saltzman & Roberts (*8*) reported a mean weight loss of 1.9 kg over 3.8 months. There were no differences between fibre type or between fibre consumed in food or as supplements.

High intake of energy-dense micronutrient-poor foods (causative). There is convincing evidence that a high intake of energy-dense foods promotes weight gain. In high-income countries (and increasingly in low-income countries) these energy-dense foods are not only highly processed (low NSP) but also micronutrient-poor, further diminishing their nutritional value. Energy-dense foods tend to be high in fat (e.g. butter, oils, fried foods), sugars or starch, while energy-dilute foods have a high water content (e.g. fruits and vegetables). Several trials have covertly manipulated the fat content and the energy density of diets, the results of which support the view that so-called ''passive over consumption'' of total energy occurs when the energy density of the diet is high and that this is almost always the case in high-fat diets. A meta-analysis of 16 trials of ad libitum high-fat versus low-fat diets of at least 2 months duration suggested that a reduction in fat content by 10% corresponds to about a 1 MJ reduction in energy intake and about 3 kg in body weight (*9*). At a population level, 3 kg equates to about one BMI unit or about a 5% difference in obesity prevalence. However, it is difficult to blind such studies and other non-physiological effects may influence these findings (*10*). While energy from fat is no more fattening than the same amount of energy from carbohydrate or protein, diets that are high in fat tend to be energy-dense. An important exception to this is diets based predominantly on energy-dilute foods (e.g. vegetables, legumes, fruits) but which have a reasonably high percentage of energy as fat from added oils.

The effectiveness over the long term of most dietary strategies for weight loss, including low-fat diets, remains uncertain unless accompanied by changes in behaviour affecting physical activity and food habits. These latter changes at a public health level require an environment supportive of healthy food choices and an active life. High quality trials to address these issues are urgently needed. A variety of popular weight-loss diets that restrict food choices may result in reduced energy intake and short-term weight loss in individuals but most do not have trial evidence of long-term effectiveness and nutritional adequacy and therefore cannot be recommended for populations.

Probable etiological factors

Home and school environments that promote healthy food and activity choices for children (protective). Despite the obvious importance of the

roles that parents and home environments play on children's eating and physical activity behaviours, there is very little hard evidence available to support this view. It appears that access and exposure to a range of fruits and vegetables in the home is important for the development of preferences for these foods and that parental knowledge, attitudes and behaviours related to healthy diet and physical activity are important in creating role models (*11*). More data are available on the impact of the school environment on nutrition knowledge, on eating patterns and physical activity at school, and on sedentary behaviours at home. Some studies (*12*), but not all, have shown an effect of school-based interventions on obesity prevention. While more research is clearly needed to increase the evidence base in both these areas, supportive home and school environments were rated as a probable etiological influence on obesity.

Heavy marketing of fast-food outlets and energy-dense, micronutrient-poor foods and beverages (causative). Part of the consistent, strong relationships between television viewing and obesity in children may relate to the food advertising to which they are exposed (*13–15*). Fast-food restaurants, and foods and beverages that are usually classified under the "eat least" category in dietary guidelines are among the most heavily marketed products, especially on television. Young children are often the target group for the advertising of these products because they have a significant influence on the foods bought by parents (*16*). The huge expenditure on marketing fast-foods and other "eat least" choices (US$ 11 billion in the United States alone in 1997) was considered to be a key factor in the increased consumption of food prepared outside the home in general and of energy-dense, micronutrient-poor foods in particular. Young children are unable to distinguish programme content from the persuasive intent of advertisements. The evidence that the heavy marketing of these foods and beverages to young children causes obesity is not unequivocal. Nevertheless, the Consultation considered that there is sufficient indirect evidence to warrant this practice being placed in the "probable" category and thus becoming a potential target for interventions (*15–18*).

A high intake of sugars-sweetened beverages (causative). Diets that are proportionally low in fat will be proportionally higher in carbohydrate (including a variable amount of sugars) and are associated with protection against unhealthy weight gain, although a high intake of free sugars in beverages probably promotes weight gain. The physiological effects of energy intake on satiation and satiety appear to be quite different for energy in solid foods as opposed to energy in fluids. Possibly because of reduced gastric distension and faster transit times, the energy contained in fluids is less well "detected" by the body and subsequent

food intake is poorly adjusted to account for the energy taken in through beverages (*19*). This is supported by data from cross-sectional, longitudinal, and cross-over studies (*20–22*). The high and increasing consumption of sugars-sweetened drinks by children in many countries is of serious concern. It has been estimated that each additional can or glass of sugars-sweetened drink that they consume every day increases the risk of becoming obese by 60% (*19*). Most of the evidence relates to soda drinks but many fruit drinks and cordials are equally energy-dense and may promote weight gain if drunk in large quantities. Overall, the evidence implicating a high intake of sugars-sweetened drinks in promoting weight gain was considered moderately strong.

Adverse socioeconomic conditions, especially for women in high-income countries (causative). Classically the pattern of the progression of obesity through a population starts with middle-aged women in high-income groups but as the epidemic progresses, obesity becomes more common in people (especially women) in lower socioeconomic status groups. The relationship may even be bi-directional, setting up a vicious cycle (i.e. lower socioeconomic status promotes obesity, and obese people are more likely to end up in groups with low socioeconomic status). The mechanisms by which socioeconomic status influences food and activity patterns are probably multiple and need elucidation. However, people living in circumstances of low socioeconomic status may be more at the mercy of the obesogenic environment because their eating and activity behaviours are more likely to be the "default choices" on offer. The evidence for an effect of low socioeconomic status on predisposing people to obesity is consistent (in higher income countries) across a number of cross-sectional and longitudinal studies (*23*), and was thus rated as a "probable" cause of increased risk of obesity.

Breastfeeding (protective). Breastfeeding as a protective factor against weight gain has been examined in at least 20 studies involving nearly 40 000 subjects. Five studies (including the two largest) found a protective effect, two found that breastfeeding predicted obesity, and the remainder found no relationships. There are probably multiple effects of confounding in these studies; however, the reduction in the risk of developing obesity observed in the two largest studies was substantial (20–37%). Promoting breastfeeding has many benefits, the prevention of childhood obesity probably being one of them.

Possible etiological factors

Several other factors were defined as "possible" protective or causative in the etiology of unhealthy weight gain.

Low-glycaemic foods have been proposed as a potential protective factor against weight gain and there are some early studies that support

this hypothesis. More clinical trials are, however, needed to establish the association with greater certainty.

Large portion sizes are a possible causative factor for unhealthy weight gain (*24*). The marketing of "supersize" portions, particularly in fast-food outlets, is now common practice in many countries. There is some evidence that people poorly estimate portion sizes and that subsequent energy compensation for a large meal is incomplete and therefore is likely to lead to overconsumption.

In many countries, there has been a steady increase in the proportion of food eaten that is prepared outside the home. In the United States, the energy, total fat, saturated fat, cholesterol and sodium content of foods prepared outside the home is significantly higher than that of home-prepared food. People in the United States who tend to eat in restaurants have a higher BMI than those who tend to eat at home (*25*).

Certain psychological parameters of eating patterns may influence the risk of obesity. The "flexible restraint" pattern is associated with lower risk of weight gain, whereas the "rigid restraint/periodic disinhibition" pattern is associated with a higher risk.

Several other factors were also considered but the evidence was not thought to be strong enough to warrant defining them as protective or causative. Studies have not shown consistent associations between alcohol intake and obesity despite the high energy density of the nutrient (7 kcal/g). There are probably many confounding factors that influence the association. While a high eating frequency has been shown in some studies to have a negative relationship with energy intake and weight gain, the types of foods readily available as snack foods are often high in fat and a high consumption of foods of this type might predispose people to weight gain. The evidence regarding the impact of early nutrition on subsequent obesity is also mixed, with some studies showing relationships for high and low birth weights.

5.2.5 *General strategies for obesity prevention*

The prevention of obesity in infants and young children should be considered of high priority. For infants and young children, the main preventive strategies are:

- the promotion of exclusive breastfeeding;
- avoiding the use of added sugars and starches when feeding formula;
- instructing mothers to accept their child's ability to regulate energy intake rather than feeding until the plate is empty;
- assuring the appropriate micronutrient intake needed to promote optimal linear growth.

For children and adolescents, prevention of obesity implies the need to:

- promote an active lifestyle;
- limit television viewing;
- promote the intake of fruits and vegetables;
- restrict the intake of energy-dense, micronutrient-poor foods (e.g. packaged snacks);
- restrict the intake of sugars-sweetened soft drinks.

Additional measures include modifying the environment to enhance physical activity in schools and communities, creating more opportunities for family interaction (e.g. eating family meals), limiting the exposure of young children to heavy marketing practices of energy-dense, micronutrient-poor foods, and providing the necessary information and skills to make healthy food choices.

In developing countries, special attention should be given to avoidance of overfeeding stunted population groups. Nutrition programmes designed to control or prevent undernutrition need to assess stature in combination with weight to prevent providing excess energy to children of low weight-for-age but normal weight-for-height. In countries in economic transition, as populations become more sedentary and able to access energy-dense foods, there is a need to maintain the healthy components of traditional diets (e.g. high intake of vegetables, fruits and NSP). Education provided to mothers and low socioeconomic status communities that are food insecure should stress that overweight and obesity do not represent good health.

Low-income groups globally and populations in countries in economic transition often replace traditional micronutrient-rich foods by heavily marketed, sugars-sweetened beverages (i.e. soft drinks) and energy-dense fatty, salty and sugary foods. These trends, coupled with reduced physical activity, are associated with the rising prevalence of obesity. Strategies are needed to improve the quality of diets by increasing consumption of fruits and vegetables, in addition to increasing physical activity, in order to stem the epidemic of obesity and associated diseases.

5.2.6 *Disease-specific recommendations*

Body mass index (BMI)

BMI can be used to estimate, albeit crudely, the prevalence of overweight and obesity within a population and the risks associated with it. It does not, however, account for the wide variations in obesity between different individuals and populations. The classification of overweight and obesity, according to BMI, is shown in Table 8.

Table 8
Classification of overweight in adults according to BMI[a]

Classification	BMI (kg/m^2)	Risk of comorbidities
Underweight	<18.5	Low (but risk of other clinical problems increased)
Normal range	18.5–24.9	Average
Overweight	⩾25.0	
Pre-obese	25.0–29.9	Increased
Obese class I	30.0–34.9	Moderate
Obese class II	35.0–39.9	Severe
Obese class III	⩾40.0	Very severe

[a] These BMI values are age-independent and the same for both sexes. However, BMI may not correspond to the same degree of fatness in different populations due, in part, to differences in body proportions. The table shows a simplistic relationship between BMI and the risk of comorbidity, which can be affected by a range of factors, including the nature and the risk of comorbidity, which can be affected by a range of factors, including the nature of the diet, ethnic group and activity level. The risks associated with increasing BMI are continuous and graded and begin at a BMI below 25. The interpretation of BMI gradings in relation to risk may differ for different populations. Both BMI and a measure of fat distribution (waist circumference or waist : hip ratio (WHR)) are important in calculating the risk of obesity comorbidities.

Source: reference *26*.

In recent years, different ranges of BMI cut-off points for overweight and obesity have been proposed, in particular for the Asia-Pacific region (*27*). At present available data on which to base definitive recommendations are sparse.[1] Nevertheless, the consultation considered that, to achieve optimum health, the median BMI for the adult population should be in the range 21–23 kg/m^2, while the goal for individuals should be to maintain BMI in the range 18.5–24.9 kg/m^2.

Waist circumference

Waist circumference is a convenient and simple measure which is unrelated to height, correlates closely with BMI and the ratio of waist-to-hip circumference, and is an approximate index of intra-abdominal fat mass and total body fat. Furthermore, changes in waist circumference reflect changes in risk factors for cardiovascular disease and other forms of chronic diseases, even though the risks seem to vary in different populations. There is an increased risk of metabolic complications for men with a waist circumference ⩾102 cm, and women with a waist circumference ⩾88 cm.

[1] A WHO Expert Consultation on Appropriate BMI for Asian Populations and its Implications for Policy and Intervention Strategies was held in Singapore from 8 to 11 July 2002 in order to: (i) review the scientific evidence on the relationship between BMI, body composition and risk factors in Asian populations; (ii) examine if population specific BMI cut-off points for overweight and obesity are necessary for Asian populations; (iii) examine the purpose and basis of ethnic-specific definitions; and iv) examine further research needs in this area. As one of its recommendations, the Consultation formed a Working Group to examine available data on the relationship between waist circumference and morbidity, and the interaction between BMI, waist circumference and health risk in order to define future research needs and develop recommendations for the use of additional waist measurements to further define risks.

Physical activity

A total of one hour per day of moderate-intensity activity, such as walking on most days of the week, is probably needed to maintain a healthy body weight, particularly for people with sedentary occupations.[2]

Total energy intake

The fat and water content of foods are the main determinants of the energy density of the diet. A lower consumption of energy-dense (i.e. high-fat, high-sugars and high-starch) foods and energy-dense (i.e. high free sugars) drinks contributes to a reduction in total energy intake. Conversely, a higher intake of energy-dilute foods (i.e. vegetables and fruits) and foods high in NSP (i.e. wholegrain cereals) contributes to a reduction in total energy intake and an improvement in micronutrient intake. It should be noted, however, that very active groups who have diets high in vegetables, legumes, fruits and wholegrain cereals, may sustain a total fat intake of up to 35% without the risk of unhealthy weight gain.

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[2] See also reference *5*.

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