CHAPTER 13

NUTRITION AND CHRONIC DISEASE

Looking at the Big Picture

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Outline

• Chronic diseases of lifestyle in developing countries: the size of the problem
• The role of diet in the causation and prevention of cancer, ischaemic heart disease, cardiovascular disease, type 2 diabetes, and obesity
• The treatment of obesity
• The design of prevention programmes
• Major causes of death and disease in developing countries
• Dietary advice for maintaining health

Objectives

At the completion of this chapter you should be able to:

• Describe the size of the disease burden in developing countries that is caused by chronic diseases of lifestyle
• Discuss the role of diet, and of other lifestyle factors, in cancer, ischaemic heart disease, cardiovascular disease, type 2 diabetes, and obesity, with respect to both in causation and prevention
• Describe appropriate methods for the treatment of overweight and obesity
• Discuss the design of programmes for the prevention of ischaemic heart disease, type 2 diabetes, and obesity
• State the major causes of death and disease in developing countries
• Discuss the most appropriate dietary advice for maintaining health

Abbreviations

CDL chronic diseases of lifestyle
CVD cardiovascular disease
DALYs disability-adjusted life years
DM diabetes mellitus
IHD ischaemic heart disease
TG triglyceride
1. CHRONIC DISEASES OF LIFESTYLE IN DEVELOPING COUNTRIES

Over recent decades, chronic diseases of lifestyle (CDL; often referred to as chronic non-communicable diseases) have become major health problems in many developing countries. The previous chapter covered several aspects of this growing concern: the management of diabetes mellitus (DM); the prevention and control of elevated blood lipids, hypertension, and other risk factors that can lead to cardiovascular disease (CVD); and the role of diet in the treatment of cancer. The dramatic rise in the prevalence of CDL in developing countries is best understood from the perspective of the nutrition transition, a subject discussed in Chapter 4. In the present chapter we take a broader view of the role of diet, and other lifestyle factors, in CDL. The main focus of this chapter is the prevention of cancer, ischaemic heart disease (IHD), type 2 DM, and obesity.

A detailed analysis of CDL in developing countries was undertaken by Abegunde and colleagues from the World Health Organization (Abegunde et al., 2007). They analyzed disease statistics for 2005 in twenty-three low-income and middle-income countries. Several of these countries are quite well developed, including Poland, Russia, Mexico, Argentina, and Brazil. Most, however, are located in Africa and Asia and are firmly in the camp of “developing” countries.

Here are key findings from that study:

- 80% of deaths from chronic disease worldwide occurred in low-income and middle-income countries.
- In the twenty-three countries examined, chronic diseases were responsible for 61% of all deaths.
- This proportion was lower for those under the age of 70: only 46% of all deaths.
- The majority of these deaths were due to the following causes: CVD and DM (21%), cancer (12%), and chronic respiratory disease (5%). In other words, in these countries, a total of 38% of all deaths of people under the age of 70 were caused by this handful of major diseases. (Note: For the purposes of their study, the authors combined CVD and DM. CVD is itself the combination of heart disease, mainly IHD, and stroke.)

Chronic diseases are playing a steadily more important role as a cause of death. For people under 70 years of age, they accounted for 46% in 2005, but this figure is projected to rise to 53% in 2030.

The actual number of deaths is also rising. However, most of this increase reflects population growth and the ageing of the population (risk of chronic diseases rises sharply with age). At the same time real increases (i.e., age-adjusted death rates) are expected to occur for DM (owing to the epidemic of obesity) and for both chronic obstructive pulmonary disease (COPD) and lung cancer (owing to the tobacco epidemic). But there may be some decrease in CVD death rates because of improved control of risk factors, especially blood pressure and blood cholesterol.

Death rates from chronic diseases are now higher in many low-income and middle-income countries than in high-income countries: they are 54% higher for men and 86% higher for women. The data are adjusted for the age distributions of the different populations (Abegunde et al., 2007).

Mortality rates do not tell the whole story: diseases often cause disability rather than death. One way to measure this is to estimate the number of disability-adjusted life years (DALYs) lost. This is the total of years of life lost as a result of premature death plus years of life lived with disability. One DALY corresponds to one lost year of healthy life. The total number of lost DALYs is known as the “burden of disease.”

In the twenty-three countries studied by Abegunde et al. (2007), chronic diseases were responsible for 50% of DALYs lost in 2005. Of these, 12% (i.e., about one quarter) were from CVD and DM, 5% from cancer, and 4% from chronic respiratory disease. However, a much lower figure was reported for South Africa, where these diseases were estimated to be responsible for only 12% of the total burden of disease (Mayosi et al., 2009).

Other studies have documented high rates of deaths from stroke in many developing countries, including India, Pakistan, China, and much of sub-Saharan Africa (Mensah, 2008a; Strong et al., 2007). Indeed, the age-adjusted mortality is often similar to or even higher than in high-income countries. Hypertension is also common; the prevalence is often more than 20% to 25% among adults, with higher rates in urban areas than rural areas (Mensah, 2008a).
A large body of hard evidence collected during the 1950s documented the rarity of IHD among black Africans. However, this situation has changed dramatically: IHD is now the eighth leading cause of death in sub-Saharan Africa and is projected to become the leading cause in 2030 (Mensah, 2008b).

The obesity epidemic emerged in Europe and North America in the 1970s but has now spread to all parts of the world (Prentice, 2006). In South Africa obesity was formerly seen mainly among the relatively affluent white population, but the condition is now common among all groups of the population (Goedecke et al., 2006). Indeed, women in South Africa have now overtaken American women as having the world’s highest level of obesity (Finucane et al., 2011). China also illustrates the problem: 6-year-old children at the 95th percentile (i.e., near the upper end of the weight range of Chinese children) are now significantly heavier than American children at the 95th percentile of American children (Popkin, 2010). Thus, in a dramatic turnaround from the situation a mere 30 years ago, overweight Chinese children are now more overweight than overweight American children!

The previous chapter gave more specific information on the distribution of diabetes, CVD, and cancer around the world.

2. THE PREVENTION OF CANCER

In the previous chapter we looked at aspects of diet relevant to the treatment of cancer. We also listed the most common types of cancers. Here we summarize the most effective strategies for the prevention of cancer.

2.1 Diet

Diet and different food items and their effects on cancer have been studied over many years. Some of the research is still controversial, and further research is therefore imperative. Since the 1990s, more emphasis has been given to performing systematic reviews and meta-analyses to better understand, judge, grade, and interpret cancer research evidence. Strong evidence now exists that diet has a major effect on the risk of most types of cancer: foods contain many substances that either increase risk or are protective. A collaboration of leading researchers and experts from several countries developed global recommendations for the prevention of cancer (WCRF/AICR, 2007). These are based on an extensive review of the published evidence. Much of this section is based on their conclusions.

2.1.1 Fruit and vegetables

Based on several hundred epidemiological studies we can assert that an increased consumption of a variety of fruit and non-starchy vegetables is protective against a diverse assortment of cancers, including lung, stomach, mouth, throat, larynx, and oesophagus (WCRF/AICR, 2007). The likely explanation for this is that the assorted substances present in these foods, including vitamins, minerals, phytochemicals, and fibre, are protective. In some cases the protective association is especially strong with one type of food. Examples include: food rich in lycopene (the red substance in tomatoes and watermelon) with prostate cancer; foods containing folate with cancer of the pancreas; and onion and garlic with stomach and colorectal cancer.

While many studies have reported an inverse relationship between intake of fruit and vegetables and risk of cancer, the extent of this protective benefit seems quite small. This was shown in the EPIC study, an especially large cohort study carried out in ten countries spread across Europe. In all the study included nearly 480,000 subjects (143,000 men and 336,000 women). Subjects were followed for almost 9 years, during which time 30,600 subjects developed cancer (9600 men and 21,000 women). The findings indicate that for each extra 200 grams per day of fruit and vegetables, the risk of developing cancer was reduced by only 4% (Boffetta et al., 2010).

A great many laboratory-based experiments have been conducted that investigated how different phytochemicals might block the pathways that lead to cancer. However, as yet, little has been firmly established.

2.1.2 Fibre

Diets high in fibre have been associated with a reduced risk of colorectal cancer (WCRF/AICR, 2007). Various mechanisms have been proposed for this relationship, including how fibre increases stool bulk, speeds up transit time, and lowers intraluminal pH (Key, 2005).
It is important to recall the fundamental rule in epidemiological studies: association does not mean causation. In other words, merely because many studies have reported an inverse association between intake of fibre and risk of colorectal cancer, we must be very hesitant before concluding that fibre actually prevents the disease. We are on much more solid ground if instead of stating that “fibre prevents colorectal cancer,” we say that “foods rich in fibre prevent colorectal cancer.” This means that vegetables, fruit, and wholegrain cereals likely help to prevent colorectal cancer, although the extent of this action is uncertain. It is difficult to determine whether this connection is due to the fibre content of these foods or to other substances found in them.

2.1.3 Fat and meat
There is no significant correlation between a high fat intake and cancer. However, there is convincing evidence that consumption of red meat and processed meat increases the risk of colorectal cancer by about 20% (WCRF/AICR, 2007).

2.1.4 Tea and coffee
Green tea contains a class of phytochemicals called catechins. These are a type of chemical called polyphenols, and they are strong antioxidants. Numerous reports have stated that drinking green tea may reduce cancer risk. However, the supporting evidence is not entirely consistent (Boehm et al., 2009); any protective benefit seems to require eight or more cups per day, an amount commonly consumed in parts of Asia.

Coffee consumption appears to pose a negligible risk of causing cancer (WCRF/AICR, 2007).

2.1.5 Alcohol
Alcohol consumption has been identified as a risk factor for various cancers, including cancers of the colorectum, breast, oesophagus, mouth, throat, and larynx (WCRF/AICR, 2007). As with tobacco, the risk increases in proportion to intake. For all types of cancer combined, a significant risk is seen starting at an alcohol intake of 2 drinks per day; persons consuming 4 drinks per day have a 22% increased risk of cancer compared with non-drinkers (Bagnardi et al., 2001).

2.1.6 Vitamin D
It is well known that overexposure to sunshine increases the risk of skin cancer. However, a lesser-known story is that sunshine is beneficial for protection against cancer (Grant, 2012). The mechanism of action is the boosting of body levels of vitamin D. Strong evidence has emerged in recent years that when vitamin D concentrations are optimal, the risk of cancer is significantly reduced, perhaps by around one quarter (Scrugg, 2011). The evidence is strongest for colon cancer. The possible benefits of supplemental intake are examined later in this chapter.

2.1.7 Dietary supplements
Vitamin D appears to be the only dietary supplement for which there is strong supporting evidence of a cancer-protective action, at least for colon cancer. As a rule, dietary supplements should not replace whole foods. It is quite possible that there is a synergistic interaction between the different nutrients and phytochemicals contained in foods that cannot be replicated by supplements. The problem of the marketing of dietary supplements is further discussed in Chapter 26.

2.2 Possible carcinogens in food
Several substances present in food can act as mutagens or can generate mutagens that cause direct damage to the DNA of cells (Key, 2005). Mutagens can therefore act as carcinogens. Here we briefly examine some examples.

A number of fungi can grow on grains, nuts, and dried fruit during hot and humid conditions (Key, 2005). They can contaminate food with aflatoxins. These substances can cause tissue necrosis, haemorrhage, and
degeneration of the liver that eventually leads to liver cancer (Arab & Steck-Scott, 2004).

It is speculated that nitrate, which occurs in vegetables, is converted to nitrite, which is then changed to nitrosamines, a potentially carcinogenic group of substances. These chemical reactions may occur in the food before it is eaten. Vitamins C and E and phenolic compounds can inhibit the change from nitrate to nitrite, counteracting the risk posed by the nitrate (Steinmetz & Potter, 1996).

Cooking has several possible links to the production of carcinogens. Polycyclic aromatic hydrocarbons (PAH) are mutagens formed when fats drip into the fire during the grilling of fish and meat. PAH are associated with cancers of the stomach and colorectum (Arab & Steck-Scott, 2004). Similarly, heterocyclic amines, another group of highly mutagenic substances, are formed when meat is cooked under high temperatures. They may be related to the development of colorectal cancer (Key, 2005) but this is not clear (Arab & Steck-Scott, 2004).

Starchy food items, including bread, cereals, and fried potatoes, may contain relatively high levels of acrylamide when cooked at high temperatures. Whether acrylamide is carcinogenic to humans is still under investigation. The International Agency for Research on Cancer (IARC) classifies acrylamide as a “probable carcinogen” (Key, 2005; WCRF/AICR, 2007).

Questions have often been raised as to whether pesticides and herbicides may pose a risk of causing cancers in humans. However, there is no epidemiological evidence that this is in fact the case (WCRF/AICR, 2007). Another suspect group of substances is hormonal anabolic agents that are used in some countries to stimulate milk production in cows. Their use is allowed in some countries, such as the United States, but they are banned in the European Union. Some suspect that these hormones may subsequently be consumed with the milk and then act as carcinogens. However, there is little epidemiological evidence to support this suspicion (WCRF/AICR, 2007).

Last, but by no means least, we consider salt. As we discuss later in this chapter, salt is added to food in relatively large amounts. It is believed to be an important causative factor in stomach cancer (WCRF/AICR, 2007; D’Elia et al., 2012).

2.3 Physical Inactivity

Physical activity has been linked to reduced cancer risk, especially risk of breast cancer in post-menopausal women and of cancer of the colorectum and endometrium (WCRF/AICR, 2007). Physical activity may also help prevent cancer indirectly by retarding the development of obesity. Lack of physical activity should therefore be viewed as a cancer risk. These findings are yet one more reason why everyone, especially children, should be encouraged to engage in at least 30 minutes (preferably 60 minutes) of moderate-intensity physical activity per day (Kushi et al., 2006).

2.4 Obesity

Obesity has been identified as a risk factor for several cancers, especially of the colorectum, pancreas, endometrium, oesophagus, kidney, and (in post-menopausal women) of the breast (WCRF/AICR, 2007).

2.5 Cancer Prevention Recommendations

Much about the relationship between diet and cancer is still unclear. However, on the basis of the most reliable evidence, we can now summarize the approach to diet and lifestyle that is associated with a much reduced risk:

• Keep body weight in check. Ideally, adult body mass index (BMI) should be between 21 and 23, depending on the normal range for different populations.

• Eat mostly foods of plant origin:
  • Limit intake of red meat; eat very little if any processed meat.
  • Eat at least five servings (at least 400 grams or 14 ounces) of a variety of fruit and non-starchy vegetables every day.
  • Eat relatively unprocessed cereals (grains) and other foods that are good sources of dietary fibre, such as legumes (pulses).
• Limit intake of refined cereals.
• Limit alcoholic drinks.
• Limit consumption of salt.
• Avoid mouldy cereals or pulses (legumes).
• Be physically active as part of everyday life.
• Do not smoke. Tobacco plays a major role in many types of cancer and numerous other diseases. It is therefore crucially important that any strategy intended to prevent cancer give serious attention to this lifestyle factor.

3. THE PREVENTION OF CARDIOVASCULAR DISEASE

In Chapter 12, we provided information on the numbers of deaths from CVD around the world. The main focus of that chapter was the management of risk factors for CVD, especially abnormalities of blood lipid concentrations (dyslipidaemia) and hypertension. Here we summarize the most effective approach to the prevention of CVD, especially of IHD but also of stroke. (IHD and stroke account for the majority of cases of CVD. IHD is also known as coronary heart disease.)

3.1 Dietary and Lifestyle Factors that Affect the Risk of IHD

The components of the diet and of other aspects of lifestyle that are of greatest importance in increasing the risk of IHD are as follows:

• Saturated fatty acids; For the major food sources of this fat and the others listed here and below, see section 3.4 of Chapter 12.
• Trans-fatty acids
• Smoking; This is a major risk factor that doubles the risk of IHD.
• Hypertension; This is a condition strongly related to lifestyle that, like smoking, doubles the risk of IHD.

Dietary and other lifestyle factors of greatest importance in preventing IHD are as follows:

• Polyunsaturated fatty acids (PUFA); These fats should be used to replace saturated fats.
• Omega-3 fatty acids; These are one type of PUFA.
• Monounsaturated fatty acids (MUFA); These fats are another replacement for saturated fats.
• Fruit, vegetables, nuts, and whole grains; Much evidence has accumulated showing that a generous intake of these foods is associated with a significantly reduced risk of IHD (Mozaffarian et al., 2011). The key active ingredients are probably the variety of micronutrients, antioxidants, fibre, and potassium that these food items contain. One class of substance that has been much studied in recent years is phytochemicals, which are non-vitamin organic substances in plant foods. There are thousands of different phytochemicals.
• Exercise; Aerobic exercise is strongly protective against risk of IHD. A reasonable amount is around 30 minutes of vigorous walking on most days of the week. Its impact on risk of IHD is similar to that of smoking, hypertension, and high blood cholesterol but in the preventative rather than causative direction.

An important mechanism by which the above dietary and other lifestyle factors either increase or decrease the risk of IHD is their effect on blood lipid levels. In addition, these lifestyle factors have multiple other effects, including their impact on blood pressure and body weight.

Low to moderate alcohol consumption decreases the risk of IHD, regardless of the source (wine, beer, or spirits). This subject is discussed more fully later in this chapter. A maximum of one alcoholic drink per day for women and 2 drinks per day for men is recommended.

Drinking 3 or 4 cups of coffee per day appears to have a negligible effect on the risk of CVD (Sofi et al., 2007). By contrast, there is fairly strong evidence that 3 or more cups per day of black tea are modestly protective against IHD (Gardner et al., 2007).
3.2 Dietary Patterns and IHD

It is important for nutritionists and dietitians to be aware of the relationship between the individual components of the diet and their effect on risk of IHD. However, recent trends have placed increasing focus on dietary patterns. This was shown most clearly in a recent analysis of several dozen cohort studies; these were studies in which large numbers of healthy subjects had their diets recorded and were then followed for a number of years until many of them developed IHD. The investigators looked at the relationship between, on the one hand, a wide array of dietary components (saturated fat, fibre, etc.), foods (meat, fish, etc.), and dietary patterns and, on the other hand, risk of IHD (Mente et al., 2009). The strongest associations were found for dietary patterns. In particular, two dietary patterns stood out – the “Mediterranean” diet and the “Western” diet.

The Mediterranean diet (Sofi, 2009) varies between different countries located around the Mediterranean but typically has a generous content of vegetables, fruit, legumes, wholegrain cereals, poultry, fish, nuts, cheese or yogurt, and MUFA (usually from olive oil). It is also low in red meat and saturated fat. The diet often includes wine. In contrast, the Western diet has a high content of processed meat, red meat, butter, high-fat dairy products, eggs, and refined cereals. The Mediterranean diet was associated with a 37% reduction in risk of IHD, whereas the Western diet was associated with a 33% increase in risk.

3.3 How Much Do Diet and Lifestyle Affect the Risk of IHD and Stroke?

The various lifestyle factors that increase the risk of IHD are cumulative. Thus a person who leads an unhealthy lifestyle in several different ways has a greatly increased risk of IHD compared with a person who leads a generally healthy lifestyle. This was convincingly demonstrated in the Nurses’ Health Study (Stampfer et al., 2000). This was a cohort study of 84,000 female American nurses who were aged 34 to 59 years at the start of the study. The researchers analyzed the relationship between lifestyle and risk of IHD over 14 years. They identified the nurses who led a low-risk lifestyle based on smoking, BMI, exercise, and seven dietary variables. By this means they identified the 3% of nurses who were at the lowest risk. These nurses had six times less risk of IHD than the others.

In another report from the Nurses’ Health Study, this time with 24 years of follow-up, the investigators looked at the relationship between lifestyle and risk of death from CVD. They focused on the same risk factors as in the previous study – smoking, a BMI over 25, lack of exercise, and eating a poor diet. In this analysis they examined the relationship between the number of risk factors in each nurse’s life and her risk of death from CVD. In comparison to nurses whose lifestyle contained no risk factors, risk steadily increased with the number of risk factors: it was 1.4, 2.4, 4.0, and 6.9 times higher with 1, 2, 3, or 4 risk factors, respectively (van Dam et al., 2008).

Lastly, mention can be made of a particularly informative study from Poland. As a result of the severe economic and political crisis during the 1980s and into the 1990s, there was a sharp decrease in availability of animal products. This meant that people had much less saturated fat in their diets. This was followed by an astonishing 40% drop in mortality from CVD during the period from 1990 to 2002 (Zatonski & Willett, 2005). Other contributing factors were an increase in consumption of fruit and vegetables and a decrease in smoking.

In addition to the three studies described above, many others have been reported over the years. This large body of research convincingly demonstrates the potential for lifestyle change to prevent most cases of CVD.

4. THE PREVENTION OF TYPE 2 DIABETES

In Chapter 12, we presented information on the global distribution of DM and the key features of the different types of DM. Here we focus on the prevention of type 2 DM.

If one disease is closely linked to overnutrition, it is type 2 DM. The presence of obesity has been repeatedly shown to cause a huge increase in risk of type 2 DM. For example, data from the Nurses’ Health Study revealed that the risk of DM is 20-fold greater for obese women (BMI 30 to 35) as compared with slim women (BMI less than 23) (Hu et al., 2001). Even being at the high end of normal may carry an elevated risk: women with a BMI of 23 to 25 are 2.7 times more likely to develop DM than those with a BMI less than 23 (Hu et al., 2001).
An epidemic of obesity has swept the world since the 1980s, and it is associated with a parallel rise in the prevalence of type 2 DM (Mokdad et al., 2001). This problem is now affecting younger age groups. The former name of type 2 diabetes was adult-onset diabetes. Contrary to what this name implies, the disease is now occurring with increasing frequency in teenagers. It is therefore a safe bet that the prevalence of DM around the world will continue its upward trajectory for the next several decades.

Some evidence suggests that the distribution of body fat may be a more reliable predictor than BMI of the risk of developing DM. Several studies indicate that a large waist circumference or a high waist-to-hip ratio (i.e., an “apple” shape) is an important risk factor for DM (Chan et al., 1994; Boyko et al., 2000). Waist circumference is generally considered a more useful parameter than waist-to-hip ratio, because it is easier to measure and has good predictive ability.

Physical activity has repeatedly been shown to be protective against DM (Hu et al., 2001). DM therefore resembles several other conditions, such as IHD, hypertension, and colon cancer, in that physical activity is protective while risk is increased by obesity.

Much research has been conducted into the relationship between diet and DM. The strongest and most consistent relationship has been observed for intake of dietary fibre. The research has been of two major types – epidemiology and experimental studies. For reasons that are unclear, the two types of study have produced inconsistent findings (Steyn et al., 2004). Epidemiological research, namely large cohort studies, has shown that cereal fibre (which is rich in insoluble fibre) has a much stronger protective association with DM than does soluble fibre. This type of research reveals only that cereal fibre is associated with reduced risk, not that the fibre is actually protective. The true protective factor might be other substances present in foods rich in cereal fibre (i.e., whole grains). Experimental studies tell a different story: giving people extra amounts of soluble fibre (also called viscous fibre) improves glycaemic control, but insoluble fibre has a much weaker effect. This benefit is seen for supplements of both soluble fibre and for foods rich in this type of fibre, and it is seen in both healthy people and those with type 2 DM. Foods rich in soluble fibre include fruit, oats, dried beans, and legumes.

So should nutritionists recommend an increase in cereal fibre or of foods rich in soluble fibre as one way to help lower the risk of DM? Fortunately, there is no need to decide which type of evidence is most believable. The message from this chapter, which will be summarized later, is that the diet should be plentiful in sources of both types of fibre.

Another aspect of diets linked to risk of DM is glycaemic index (GI): foods with a high GI appear to increase the risk (Steyn et al., 2004). Supporting evidence has come from both epidemiology and experimental studies. Many experts have incorporated detailed advice on GI into dietary recommendations. However, many others, including this author, have chosen to disregard GI because the resulting dietary advice can be confusing but without adding much useful information.

Later in this chapter, we turn our attention to intervention programmes that have succeeded in preventing DM.

5. THE CHALLENGE OF OBESITY

As Shakespeare observed, “They are as sick that surfeit with too much as they that starve with nothing” (Merchant of Venice, Act I, scene 2). Overweight and obesity are important risk factors for most of the disorders discussed in this chapter (and for several others not discussed here). Indeed, there is a strong interrelationship between many of these disorders and risk factors. It has been observed many times that several of the risk factors for these conditions cluster together (i.e., a person who has one of these risk factors has a high chance of having others). The major risk factors that are closely associated with each other are: a large waist circumference, a raised blood level of glucose and triglyceride (TG), elevated blood pressure, and a low blood level of HDL-C (Gupta & Gupta, 2010). This group of risk factors is known as the metabolic syndrome. Not surprisingly, its presence denotes an especially high risk of CVD and type 2 DM.

5.1 The Causes of Obesity

Obesity is a completely unnatural human condition. Dozens of studies from around the world have convincingly shown that obesity is absent when people eat the traditional diet for their region. The disorder appeared when people began to adopt a more modern, Westernized lifestyle. We see something similar with
animals. In the wild they do not overeat and become obese; deer do not overeat vegetation, and lions do not overeat their prey.

So why do so many humans become obese? The epidemic of obesity can be completely explained in terms of energy balance. If a woman gains 454 grams (one pound) of body fat, this came about because she consumed 3500 kcal of food energy in excess of the quantity that she metabolically converted into heat energy. The real question, therefore, is the following: Why is much of the world’s population eating more food energy than they burn up? Decades of research have given us a reasonably good answer to this question. Here we focus on the major drivers of the obesity epidemic.

A major factor leading to obesity is reduced physical activity. This occurs as a result of the combination of urbanization and labour-saving machinery. A few decades ago, the majority of people in developing countries lived in villages and engaged in agricultural work or other occupations that require much physical labour. Over recent decades, many tens of millions have relocated to cities. Most jobs today require far less expenditure of energy. At the same time, thanks to the availability of cars and buses, people today typically walk much less than people used to.

Another major cause of obesity is the widespread availability of highly palatable, energy-dense food (i.e., high quantity of kcal per gram). A large amount of accumulated evidence demonstrates how such food leads to excess intake of food energy – in other words, overnutrition. Such foods have four key features:

• a high fat content,
• a high refined sugar content,
• a low fibre content, and
• a high energy density.

These features of the modern, Western diet should not be viewed singly: they act synergistically.

Let us start with dietary fat. Many studies using experimental animals have revealed that they gain body fat when fed a high-fat diet. Although some conflicting observations have been reported, the majority of human studies indicate that a high-fat diet induces excessive energy intake and hence weight gain (Hooper et al., 2012). This has been repeatedly shown in both epidemiological and experimental investigations. One study that illustrates this was the Women’s Health Initiative Dietary Modification Trial, for which 49,000 post-menopausal women were recruited. The study’s aim was to investigate whether a low-fat diet reduces the risk of cancer. Accordingly, half the women were instructed to lower their intake of fat, but were not advised to lose weight or to take exercise. The investigators discovered that when women lowered their fat intake by 11% (e.g., from 40% of energy to 29%), their weight decreased over the following year by about 1.4 kg (Howard et al., 2006). To sum it up: “fat on the lips becomes fat on the hips.”

The next villain in the obesity epidemic is sugar. In particular, sugar-sweetened beverages have a similar effect on energy balance as does dietary fat: consuming these drinks leads to spontaneous overconsumption of food energy (Te Morenga et al., 2012; Malik et al., 2013). Several obesity experts have suggested that a major cause of the obesity epidemic among American children and teenagers over the past 30 years is the greatly increased consumption of soft drinks (Malik et al., 2013). With respect to weight control fruit juices, as far as is known, have no advantage over soft drinks.

Another important dietary component with respect to obesity is fibre. Fibre has the opposite action in the body of sugar and fat; the presence of fibre in foods tends to induce satiation (a feeling of fullness), thereby bringing about a halt to eating. This can be illustrated by comparing a slice of whole wheat bread, a slice of white bread, and 170 mL of cola drink (about half a tin). They each have 170 kcal. Compared with whole wheat bread, the white bread has only half as much fibre, and cola is devoid of fibre altogether. This difference is clear when these foods are eaten: white bread can be eaten more quickly than whole wheat bread and produces less satiation. The cola can be consumed even more quickly and produces minimal satiation.

The role of fibre in retarding the development of obesity is supported by strong epidemiologic evidence: numerous studies have reported that intake of dietary fibre is inversely associated with body weight and body fat (Slavin, 2005).

Detailed comparisons have been made between the satiating effects of the major components of food. In general, fat has the least satiating action, next is carbohydrate, then protein, while fibre has the most (Holt et al., 1995).
An important factor that determines the satiating ability of a particular food is its energy density (Drewnowski, 1998). Foods with more concentrated energy (more kcal per gram) have less satiating power (i.e., little appetite satisfaction relative to energy consumed), and they are therefore more likely to lead to overconsumption of food energy. This may be a major reason why food fat causes weight gain: because fat has more than twice as much energy per gram as either protein or carbohydrates, fat-rich foods tend to be energy dense. Conversely, foods with a high water content have a low energy density and can therefore satiate the appetite before much food energy has been consumed. Many types of fruit and vegetables, such as apples, melon, carrots, and cabbage, have a high water content and are therefore particularly good at satisfying the appetite.

We can summarize as follows: Doughnuts and biscuits (cookies) are a mixture of fat, sugar, and refined flour, with a minimal content of water and fibre. They are the type of food that readily causes people to overeat and become overweight. In stark contrast, no one ever became overweight by eating too many carrots or by drinking too much tomato soup!

One more factor deserves mention in a discussion of the causes of obesity is portion sizes. These have been steadily expanding for the past 40 years. For example, plates in restaurants are significantly larger now than they were a few decades ago. In the case of bottle sizes for cola drinks, these are now three or four times larger. These observations are based mainly on studies in the United States. But trends that start in that country frequently spread to many other countries. This is potentially important because evidence shows that when people have more food placed in front of them, they eat more. This problem appears to be additive when combined with increased energy density (Rolls et al., 2006).

An accepted wisdom concerning obesity is that most people who try to lose weight fail, and of those that do lose weight, most regain it. By comparison, avoiding obesity in the first place is a much easier goal to accomplish. As the saying goes, an ounce of prevention is worth a pound of cure. Clearly, in the case of obesity, this is especially true. Later in this chapter, attention is turned to intervention programmes that aim to translate these ideas into practice.

5.2  The Treatment of Obesity

As mentioned above, attempts to lose weight (i.e., body fat) usually achieve little success. This has led to the creation of an enormous weight-loss industry. There are huge numbers of books as well as dietary supplements that promise to “shrink the waistline.” Alas, the majority of treatments, especially those that offer “quick and easy” weight loss, are worthless. Indeed, weight-loss treatments are one of the biggest forms of health fraud. This topic is discussed in Chapter 26.

It is important that people wishing to lose weight have realistic goals. An appropriate goal is to lose between 200 and 900 grams per week, or 10% of body weight over 6 months. Setting more ambitious goals is a recipe for disappointment. Moreover, rapid weight loss increases the odds of later regaining the weight. Many overweight people dream of achieving a shape that requires losing 30% of their weight. When they fail to achieve this, they feel they have failed. In reality, losing 10% of body weight is a success because it results in significant improvement to long-term health, such as a decrease in blood pressure or blood cholesterol, or an improvement in ability to walk quickly.

The first step in losing weight is the adoption of an energy-reduced diet. An appropriate target is to cut energy intake by 500 to 1000 kcal per day.

It is of prime importance to recognize the major causes of obesity and put these into reverse. In other words, a person should follow a healthy lifestyle that includes a diet that has a generous content of fibre-rich foods, is moderate in fat, is low in sugar, and has a low energy density. Exercise is especially important. There is much evidence that achieving weight loss – and long-term avoidance of weight regain – requires around 60 or 90 minutes of exercise every day, such as walking at a brisk pace. If the intensity is greater, as in the case of jogging for example, then the time required is reduced to 30 to 45 minutes per day.

The National Weight Control Registry, based in the United States, collects information on more than 4000 adults who have lost at least 13.6 kg and kept it off for at least a year (Wing & Phelan, 2005). The members have lost an average of 33 kg and have maintained the minimum weight loss (13.6 kg) for an average of more than 5 years. These people therefore represent the small minority who are successful at both losing weight.
and at keeping it off. What is their secret? Members report that engaging in high levels of physical activity (approximately 1 hour per day), eating a low-calorie, low-fat diet, eating breakfast regularly, self-monitoring weight, and maintaining a consistent eating pattern across weekdays and weekends. Moreover, weight loss maintenance may get easier over time; after individuals have successfully maintained their weight loss for 2 to 5 years, the chance of longer-term success greatly increases.

Here are additional rules that are helpful for people trying to lose weight:

1. Eat small portions.
2. Eat breakfast every day.
3. If a person wishes to have sweet-tasting beverages, then replace sugar with synthetic sweeteners.
4. Avoid buying foods that encourage overeating, and don’t have the “wrong” foods easily accessible. If you can’t resist chocolate, then keep chocolate out of easy reach.
5. Stay away from buffets or other locations where overeating is made easy.
6. Try to identify factors that trigger overeating. For example, many people react to stress by overeating. Reducing stress is one example of changing behaviour so that overeating is avoided.
7. Buy a pedometer. These devices count the number of steps walked. An appropriate goal is 10,000 steps per day.
8. Join a group that actively supports weight loss, increased fitness, and healthful eating. This could be, for example, a commercial organization or a group of friends.
9. And perhaps most important of all: be determined!

6. PROGRAMMES FOR THE PREVENTION OF CHRONIC DISEASES OF LIFESTYLE

We can summarize a sensible approach to CDL as follows: Better to build a fence at the top of the cliff than park an ambulance at the bottom.

A number of programmes have been developed for the prevention of CDL. This is a significant subject that we examine only briefly here. In Chapter 15 we consider this from the perspective of nutrition education. In this section we look at several programmes that have worked toward preventing CDL.

6.1 Obesity

In an earlier section of this chapter we discussed the major causes of obesity. These help us understand how obesity can be prevented. But, unfortunately, we are now confronted by a major obstacle: as various countries adopt an increasingly Westernized lifestyle and move further along in the nutrition transition, their populations find themselves living in a society that seems as if it had been designed to make them obese. Consider the following:

- Most people clearly prefer fattening foods over traditional foods. Major reasons for this include taste and image. This is not an accident: the modern food industry has carefully designed its products to make them as appealing as possible. As a result, everyone living in locations where modern foods are sold is constantly exposed to fattening foods. For that reason, most people can only avoid becoming overweight by exerting much self-control.
- Information given in Chapter 19 shows that a healthy diet is significantly more expensive than a diet that is unhealthy and fattening. This means that the cost of different types of food acts as a driver to pressure people – especially poor people – to eat fattening food.
- When children are at school, they generally have easy access to fattening food, either in the school itself or within the distance of a short walk.
- Education directed at children regarding healthy eating is usually massively outweighed by advertising for unhealthy foods.
A combination of computers and TV has seduced millions of children away from physical activities, such as football.

These factors compel us to conclude that the basic cause of obesity is that the environment in which we live is “obesogenic.”

How should a nutritionist confront this reality? The starting point for an anti-obesity strategy is to recognize that because many factors work together to cause obesity, the goal of reducing obesity therefore requires a multicomponent counter-attack. This was recognized in a 2007 report by senior scientists working for the UK government (Foresight, 2007):

The obesity epidemic cannot be prevented by individual action alone and demands a societal approach. Tackling obesity requires far greater change than anything tried so far, and at multiple levels: personal, family, community and national. Preventing obesity is a societal challenge, similar to climate change. It requires partnership between government, science, business and civil society.

Several important aspects of an anti-obesity strategy are beyond the work of a community nutritionist and require government action. These aspects are discussed in Chapter 19. But it is entirely possible for a community nutritionist to carry out a community-based programme. Unfortunately, few such programmes have been carried out with the aim of countering obesity. Here we look at one of the rare successful examples.

Starting in 1992, children in schools in two towns in France received nutrition education (Romon et al., 2008). This expanded somewhat after 1997 to the adult population of the towns. From 1999 on, there was even wider community activity in support of more physical activity and a healthier lifestyle. At the same time, there was much media interest. The impact of the intervention was assessed in 2004 by measuring the BMI of children aged 5 to 12 years. These data were compared with two other towns in which no intervention was done. The intervention children had a lower BMI: 15.7 versus 16.5. The proportion of children who were overweight or obese was also reduced: 7.4% (intervention) versus 19.4% (non-intervention) for boys, and 10.4% versus 16.0% for girls. This is a remarkable degree of success.

6.2 School Interventions

Many interventions have been conducted in schools with the aim of improving diet and other aspects of lifestyle. A review was published that covered 85 school-based interventions that included a nutrition component (Steyn et al., 2009a). Key factors generally associated with improved behaviour appeared to be

- a nutrition-based curriculum offered at the school by trained teachers,
- interventions that included a physical activity programme or component,
- a parental/family component,
- a grounding in a firm theory of behaviour (such as stages of change), and
- a food service component.

6.3 Interventions at Worksites

Another approach to the prevention of CDL has been to have interventions for employees at their worksites. A review of such projects reported significant success (Carnethon et al., 2009). Indeed, this can actually be cost-effective from the perspective of the employer, in terms of reduced sickness and improved efficiency. The authors estimated that each dollar spent on the programme generates between $3 and $15 in economic benefits. This may be especially relevant in developing countries where productivity is often poor because of malnutrition.

6.4 Community Programmes

Many community programmes have been carried out in Western countries with the goal of preventing CVD. A systematic review was performed in which thirty-six programmes were assessed, each of which targeted risk factors for CVD across an entire community (Pennant et al., 2010). Every programme used mass media
(radio, TV, print media) to deliver their message. Other commonly used interventions included screening for risk factors, counselling (either individually or for groups of people), and environmental changes. Seven of the studies reported changes in CVD mortality; while the trends were all favourable, only one study achieved a statistically significant reduction in risk of death from CVD. Twenty-two of the studies reported changes in terms of risk factors. There were small favourable trends for blood pressure, blood cholesterol, and smoking; for example, systolic blood pressure on average decreased by 2.9 mmHg, and smoking prevalence decreased by 1.7%. The researchers estimated the effect of these changes in risk factors on the 10-year risk of CVD: the risk decreased by approximately 9% compared to the baseline level of risk (i.e., approximately one case in every eleven would be prevented). This means that one case of CVD would be prevented for every 154 subjects that were exposed to the intervention for 10 years.

6.5 Preventing CDL by Changing the Environment

The point was made above that the environment in which we live may be obesogenic. In a broader sense, the same is generally true for CDL: it is the environment that is the real cause of CDL. For this reason, a truly effective prevention strategy needs to tackle CDL on a broad front. In addition, the proposed strategy will need active government support. The following are two examples of this strategy in action.

6.5.1 Finland

In the 1960s, Finland had the unenviable distinction of having the world’s highest rates of IHD, especially among men. In response, the North Karelia Project was launched in 1972 (Puska, undated), a preventive intervention designed to reduce the risk factors in the population of the Province of North Karelia. Emphasis was placed on changing diets and reducing smoking. Comprehensive activities were used, involving health and other services, schools, innovative media campaigns, local media, supermarkets, the food industry, and various other organizations. After a few years, these interventions were extended to the rest of Finland. Over time, important improvements in lifestyle occurred, such as a major decrease in smoking rates (for men), and people switching from butter to vegetable oils. One outcome was a reduction of about 17% in the mean serum cholesterol level of the population. Elevated blood pressures were brought under control. Over the 25 years from 1970 to 1995, mortality rates for men aged 35 to 64 fell by a remarkable 73% for IHD, 71% for lung cancer, and 49% for all-cause mortality.

6.5.2 Mauritius

One of the few examples of a national intervention programme in a developing country took place in Mauritius. This island nation in the Indian Ocean experienced rapid industrialization and general improvement in living standards during the 1970s and 1980s. But, as in many other developing countries, this was followed by an epidemic of CVD and DM. In 1987, the government of Mauritius responded by instituting a national intervention programme aimed at the prevention of CDL (Dowse et al., 1995). The goal was to reduce levels of risk factors related to CDL, including glucose intolerance, hypertension, hyperlipidaemia, obesity, cigarette smoking, alcohol misuse, and physical inactivity. Interventions included extensive use of the mass media, fiscal and legislative measures, and widespread community, school, and workplace health education activities. These components were intended to promote healthy nutrition and increased amounts of exercise and to reduce alcohol intake. There was also a comprehensive antitobacco campaign that used mass media, advertising bans, and increased taxation.

A survey conducted in 1992, 5 years after the programme had been implemented, revealed much success, namely reductions in population blood pressure and blood lipid concentrations, increased amounts of leisure exercise, and decreased smoking and alcohol consumption. The dramatic fall in blood cholesterol levels was probably mainly due to a large decrease in the saturated fat content of cooking oil, achieved by switching from palm oil to soya bean oil. There were, however, some disappointments: the prevalence of obesity and DM both increased.
6.6 Diabetes
Several randomized control trials have been carried out to determine whether a lifestyle approach, typically involving improved diet, weight loss, and exercise, can arrest the development of type 2 DM. These trials had substantial sample sizes and periods of intervention (Gillies et al., 2007; Steyn et al., 2009b). The subjects in these studies had impaired glucose tolerance and were therefore at high risk of DM. The trials demonstrated that a lifestyle intervention reduces by 50% the number of subjects who develop DM over the next few years.

This and much other evidence clearly demonstrate that type 2 DM is a preventable disease. This applies to the general population; in other words, most cases of DM can be prevented by a healthy lifestyle. Prevention programmes should therefore be directed to not only individuals at high risk, but also to families, workplaces, schools, and communities (Bazzano et al., 2005).

6.7 Comment
The most successful campaigns for the prevention of CDL are those that have made serious and wide-ranging efforts to change the environment that causes CDL. Such a strategy needs not only broad support from across the community, but also active government support. The campaigns carried out in Finland and Mauritius were excellent models of this. In Chapter 19 we discuss this in more detail.

Many programmes for the prevention of CDL do not require government support and can be set up and implemented within communities. These can be done in specific locations, such as in schools or worksites, or across an entire community. The WHO published a systematic review of the evidence concerning the effectiveness of diet and physical activity interventions to prevent chronic CDL (WHO, 2009b). The types of interventions considered were those targeting schools, worksites, and primary health care. The authors concluded (page 1):

Multi-component interventions that are adapted to the local context were found to be the most successful. Interventions that used the existing social structures of a community, such as schools or the weekly meetings of older adults, reduced barriers to implementation. Effective interventions invariably involved participants in the planning and implementation stages, such as involving the workers themselves in workplace interventions, and community leaders in community and religion-related programmes.

Another form of intervention is to target those at high risk of a particular chronic disease, as with the interventions designed to prevent type 2 DM. This strategy can be highly effective because people in the target group are aware of their health status and are therefore more likely to be willing to make lifestyle changes than are people at lower risk of disease. This means that a community nutritionist will likely achieve much more – in terms of amount of disease prevented – by focusing on high-risk subjects than by working across an entire community. However, there is a negative side to this strategy: most cases of CDL occur in people who are not at a particularly high risk. Therefore, to be really effective, it is the entire community that needs to be targeted. Moreover, because CDL develops over many years, starting in childhood, it makes good sense to encourage healthy lifestyles in all age groups.

7. THE CAUSES OF CHRONIC DISEASES OF LIFESTYLE
In the previous chapter we examined the major dietary factors related to elevated blood cholesterol and hypertension, while in this chapter we have explored the causes of cancer, IHD (and more generally of CVD), type 2 DM, and obesity. Taken as a whole, this evidence identifies the major dietary factors that cause CDL. This same information tells us how to prevent CDL. In this section we now summarize the relative importance of each of these factors. Based on that assessment we can formulate overall dietary advice.

7.1 Identifying the Major Causes of Disease
Table 13.1 presents information on the major causes of death and of lost DALYs (disability-adjusted life years). DALYs lost indicate the burden of disease, as discussed in Section 1. Information is given only for middle-income and low-income countries. The actual WHO (2009a) report also presents data for high-income countries.
Table 13.1: Major causes of death and DALYs lost in middle- and low-income countries (as percentages of total)

<table>
<thead>
<tr>
<th>Causes of death*</th>
<th>Causes of DALYs lost</th>
<th>Causes of death</th>
<th>Causes of DALYs lost</th>
</tr>
</thead>
<tbody>
<tr>
<td>High blood pressure</td>
<td>17.2</td>
<td>5.4</td>
<td>7.5</td>
</tr>
<tr>
<td>Tobacco use</td>
<td>10.8</td>
<td>5.4</td>
<td>3.9</td>
</tr>
<tr>
<td>Overweight and obesity</td>
<td>6.7</td>
<td>3.6</td>
<td></td>
</tr>
<tr>
<td>Physical inactivity</td>
<td>6.6</td>
<td>2.7</td>
<td>3.8</td>
</tr>
<tr>
<td>Alcohol use</td>
<td>6.4</td>
<td>7.6</td>
<td>2.1</td>
</tr>
<tr>
<td>High blood glucose</td>
<td>6.3</td>
<td>3.4</td>
<td>4.9</td>
</tr>
<tr>
<td>High cholesterol</td>
<td>5.2</td>
<td>2.5</td>
<td>3.4</td>
</tr>
<tr>
<td>Low fruit and vegetable intake</td>
<td>3.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indoor smoke from solid fuels</td>
<td>2.8</td>
<td>4.8</td>
<td>4.0</td>
</tr>
<tr>
<td>Urban outdoor air pollution</td>
<td>2.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Childhood underweight</td>
<td></td>
<td>7.8</td>
<td>9.9</td>
</tr>
<tr>
<td>Unsafe sex</td>
<td></td>
<td>3.0</td>
<td>6.6</td>
</tr>
<tr>
<td>Unsafe water, sanitation, hygiene</td>
<td></td>
<td>2.0</td>
<td>6.1</td>
</tr>
<tr>
<td>Suboptimal breast-feeding</td>
<td></td>
<td>3.7</td>
<td>4.1</td>
</tr>
<tr>
<td>Vitamin A deficiency</td>
<td></td>
<td></td>
<td>2.4</td>
</tr>
<tr>
<td>Zinc deficiency</td>
<td></td>
<td></td>
<td>1.7</td>
</tr>
</tbody>
</table>

* Only the ten leading causes of death or DALYs lost are shown for each column. Countries are grouped by gross national income per capita per year: low income is less than US$ 825; middle income is US$ 825 to 10,066.

Source: WHO, 2009a

The data in Table 13.1 reveal the relative importance of various factors. There are very different patterns in middle-income versus low-income countries. In middle-income countries factors closely associated with CDL account for the eight leading causes of death as well as seven of the eight leading causes of DALYs lost. Of particular note, high blood pressure and tobacco use together cause 28% of all deaths in middle-income countries. These factors are of much less importance in low-income countries, where several factors closely associated with poverty are important causes of health problems. These include (1) unsafe water, sanitation, and hygiene, (2) indoor smoke from solid fuels, and (3) certain nutritional problems that mainly affect infants and children, including suboptimal breast-feeding, childhood underweight, and deficiencies of vitamin A and zinc. In total these factors are responsible for 22.4% of deaths and 28.4% of DALYs lost in low-income countries.

7.2 Factors that Cause or Prevent Disease
We now look at the role of specific factors that explain the connections between lifestyle and disease.

7.2.1 Tobacco use and physical inactivity
Smoking is a major cause of chronic respiratory disease, CVD (both IHD and stroke), and several types of
cancer. This explains why tobacco use is one of the leading causes of both death and lost DALYs in middle-income countries, though it plays a much lesser role in low-income countries (see Table 13.1).

Physical inactivity is also of major importance in several diseases. Exercise has a strong protective benefit against several disorders, most notably CVD, DM, obesity, and some types of cancer. A general recommendation for health is 30 minutes of exercise on most days of the week. This needs to be moderately vigorous, such as brisk walking. This level of exercise will achieve most of the benefits of exercise. However, much evidence informs us that more is better: both higher intensity (i.e., vigorous exercise, such as jogging) and more time spent exercising (say, one hour per day).

7.2.2 Diet: seeing the big picture
Diet plays a major role in CDL. But how do we make sense of so much information? There are two concepts that allow much complex information to be seen in simple terms, which makes it easy to see the big picture rather than getting lost in the details.

1. A healthy diet should have low energy density, as measured by kcal per gram. This is particularly important to help with avoiding excess energy intake and hence obesity, i.e., overnutrition. In practice, this means that much of the diet should consist of food with a high content of water and fibre, and a low content of fat and sugar.

2. A healthy diet should have a high nutrient density, as measured by its content of nutrients relative to energy. Fat and sugar add energy to the diet but do not add micronutrients. For this reason, foods rich in fat and sugar have a low nutrient density while fruit and vegetables have a high nutrient density.

It must be noted that despite a great many epidemiological and experimental studies, we still have little direct evidence linking the total amount of fat in the diet to CVD, cancer, or other diseases. The major rationale for reducing the amount of fat (where the diet content is high) is because of its contribution to obesity. But with sugar, especially sugar-sweetened beverages, the evidence is now quite solid. These foods are strongly linked to excessive weight gain as was mentioned earlier. They also increase the risk of both DM and IHD (Malik et al., 2010; de Koning et al., 2011, 2012; Fung et al., 2009).

A practical definition of junk food is food with a high energy density and a low nutrient density. Examples are soft drinks, cookies, French fries, and white bread with margarine or butter. Healthy foods are the opposite: they have a low energy density and a high nutrient density.

Based on the above two concepts, a healthy diet should include generous amounts of wholegrain cereals, beans (or other legumes/pulses), fruit, and vegetables, and have a low content of fatty foods, sugar, and refined cereals. Extending this approach to milk and meat, we see that low-fat milk is preferred over full-fat milk and lean meat over fat-rich meat. The type of fats to reduce consumption of are those found in animal products, tropical oils (palm oil and coconut oil), and hard margarine. Unsaturated fats are important for health; good sources include vegetable oils, soft margarine, and fish.

Where does meat fit into this dietary pattern? Lean meat can make a valuable contribution to the intake of protein and several micronutrients, particularly zinc, iron, and vitamin B₁₂ (Zanovec et al., 2010). This can be especially useful for particular population groups: children in the case of protein and zinc, and premenopausal women for iron. However, a well-designed vegetarian diet can be nutritious and lead to excellent health.

For older adults, meat can have a more negative than positive effect on health. A major study, conducted in the United States, of men and women aged more than 50 years reported that those who ate more red meat (i.e., beef and pork) and processed meat (such as bacon, ham, sausages, and salami) had a higher risk of death (Sinha et al., 2009). People in the top 20% in terms of meat consumption had about a 20% to 30% increased risk of deaths over the following 10 years, in comparison with those in the bottom 20% of meat consumption. The extra deaths were divided between CVD and cancer. (Earlier in this chapter we mentioned that eating meat is a risk factor for colorectal cancer.) The study also observed that chicken, turkey, and fish were not associated with an increased risk of death.

As pointed out earlier, fish, especially fatty fish, is protective against IHD. It follows, therefore, that for people who wish to eat animal products, fish is the best choice. Chicken would be the second choice. There is also a serious environmental aspect to the issue of consuming meat, a topic that is addressed in Chapter 27.
Simply put, meat production plays an important role in both the destruction of rainforests and climate change. For reasons of both health and protecting the environment, it therefore makes good sense if less beef and pork were eaten and more legumes eaten instead. Another important factor to consider is that world fish stocks are being rapidly depleted. Fish from the sea may therefore be in short supply in future years. However, fish farming seems to hold much promise.

With respect to vegetables, fresh ones are generally preferable. However, they are not always available. In that case, frozen vegetables are a good choice because they are quickly frozen and therefore usually contain the same amount of vitamins and minerals as fresh vegetables. Canned vegetables and fruit can also be consumed; however, some vitamins may be lost as a result of the high temperatures involved in the canning process.

If these simple rules listed above are followed, then we are already more than half way to formulating a diet that will prevent CDL.

7.2.3 Sodium
The intake of sodium in most countries is excessive, typically in the range 3000 to 4000 mg per day (equivalent to about 8 to 10 grams of salt per day) per person. Both developing countries and Westernized countries fall into this intake range (Brown et al., 2009). Evidence referred to in this chapter and Chapter 12 shows that a high intake of salt poses a substantial risk of hypertension and CVD, and is also linked to stomach cancer.

A reasonable goal is to reduce salt intake to no more than 6 grams (roughly 2300 mg sodium) per day. A lower amount – 1500 mg sodium – is preferable. However, achieving this goal at a societal level requires the collaboration of the food industry. A sensible strategy would be the implementation of government policy requiring that the salt content of processed foods be cut by at least half (see Chapter 19).

7.2.4 Vitamin D
Humans get vitamin D from their diet and from dietary supplements, but the most important source is skin synthesis upon exposure to sunlight, specifically ultraviolet B radiation (UVB) (Holick, 2007; Tavera-Mendoza & White, 2007). A common misconception is that vitamin D deficiency is only a problem for people living at latitudes distant from the equator, places where average levels of sunshine are low. However, there may be a high prevalence of vitamin D deficiency in many developing countries even when they are located in zones that have sufficient sunlight for vitamin D synthesis for most if not all of the year (Arabi et al., 2010). Indeed, a number of studies have reported widespread prevalence of low blood vitamin D levels in people living in Iran, Jordan, and India, countries that have bright sunshine for much of the year (Hashemipour et al., 2004; Arya et al., 2004; Mishal, 2001; Harinarayan, 2005). Vitamin D deficiency is also reported to be highly prevalent in China, sub-Saharan Africa, and Latin America (Arabi et al., 2010). A poor intake of the vitamin is most common in elderly people, neonates, preschool children, people with dark skin, and those who expose little skin to the sun (usually women).

An impressive body of evidence has emerged in recent years suggesting that vitamin D has an important protective benefit against several common chronic health conditions. Randomized controlled trials have reported that in older adults, supplemental vitamin D is protective against both falls (Bischoff-Ferrari et al., 2009a) and fractures (Bischoff-Ferrari et al., 2009b). In the case of fractures, the presumed mechanism is taking vitamin D in tandem with calcium to help prevent osteoporosis. An especially important development in recent years has been findings indicating that vitamin D may have a strong protective association with the risk of colon cancer. This was discussed earlier in this chapter. The evidence suggests that vitamin D supplements have the potential to lower the risk of colon cancer in people who have poor exposure to the sun (Scragg, 2011). Other evidence suggests that vitamin D helps reduce the risk of cardiovascular disease, DM, total mortality, and also depression (Chowdhury et al., 2014; Lavie et al., 2011; Scragg, 2011). Low levels of vitamin D have also been linked to faster cognitive decline in older adults (Llewellyn et al., 2010). Pregnancy is another stage in life when low levels of vitamin D are harmful (see Chapter 5).

The ideal dose for prevention of vitamin D deficiency is much higher than the Dietary Reference Intake (DRI), which is currently 15 µg (micrograms) or 600 IU per day for ages up to 70 and 20 µg or 800 IU per day for ages over 70. While we still need to see the findings from long-term clinical trials, accumulating evidence
suggests that a higher vitamin D intake is more effective for the prevention of several diseases, including cancer as well as bone disorders. For this reason, a supplemental dose of 20 to 25 µg (or 800 to 1000 IU) per day is indicated for those whose vitamin D status is likely to be suboptimal. This is most common in such groups as elderly people, people with dark skin, and those who expose little skin to the sun (Giovannucci et al, 2006; Johnson & Kimlin, 2006).

### 7.2.5 Alcohol

Table 13.1 shows that in middle-income countries, alcohol is responsible for a vast amount of death and disability: it is one of the leading causes of death and is the leading cause of lost DALYs. However, it is much less of a problem in low-income countries.

In this discussion we refer to alcoholic “drinks.” A drink contains approximately 12 grams of alcohol, though the definition varies somewhat between countries. This quantity of alcohol is approximately the amount in 350 mL (12 oz.) of regular beer, 120 mL (4 oz.) of wine, or 30 to 35 mL (1.0 to 1.2 oz.) of whisky or other spirits.

The relationship between alcohol and health has been reviewed by Temple (2012). Alcohol can lead to much harm, mainly due to drunkenness and chronic alcohol abuse. This plays a major role in accidents (especially traffic accidents), violence, and suicide. Years of alcohol abuse eventually leads to chronic health and nutritional problems, including liver disease. Drinking during pregnancy is especially harmful and can cause foetal alcohol syndrome (FAS) (see Chapter 5). Alcohol also increases the risk of several types of cancer. Four drinks per day increases overall cancer risk by about 22%, as discussed earlier in this chapter. This level of intake also increases the risk for hypertension, stroke, some forms of heart disease, poor erectile function (impotence), and impaired cognitive function (brain damage). As intake rises, so does risk.

Much evidence has accumulated demonstrating that a moderate intake of alcohol – around 0.5 to 1 drink per day for a woman or 1 to 2 per day for a man – is protective against IHD. Risk may be decreased by as much as 20% to 40%. This protective effect is linked to alcohol itself; there is no good evidence that one type of alcohol, such as red wine, is of greater benefit. Moderate levels of alcohol consumption also seem to be protective against several other conditions, including hypertension, DM, and the decline in cognitive ability with aging.

The benefits of alcohol are most apparent in middle-aged and elderly people. This is because alcohol reduces the risk of IHD and stroke, two of the leading causes of death after age 50. The net effect of alcohol on total mortality is a J-shaped curve with minimum mortality associated with a moderate intake of alcohol but with a rising curve as consumption increases (Lee et al. 2009). But for people under the age of 40, especially men, alcohol at any level increases the risk of death because of its close association with accidents and violence.

Most of the harmful effects of alcohol can be avoided by drinking only in moderation. It is also important to avoid binge drinking (drinking a large quantity of alcohol in a single drinking session), or drinking when driving. The consumption of alcohol is best avoided for persons with a family history of alcoholism, hypertriglyceridaemia, pancreatitis, liver disease, heart failure, or uncontrolled hypertension, or who are taking certain medications (Pearson, 1997). However, for people in middle age and above who can drink sensibly, alcohol can be of considerable benefit. Like so much else in life, it’s a matter of balance.

### 7.3 What Is the Best Diet?

The diet advice given above has been summarized into an easy-to-use food guide, namely the Traffic Lights Food Guide. This is described in Section 3 of Chapter 14.

### 7.4 Dietary Supplements

One other question is whether dietary supplements should be recommended, a topic explored in some detail in Chapter 9. Supplements are of little or no value for the majority of people eating a nutritious diet (Fortmann et al., 2013; Guallar et al., 2013). However, there are some specific groups for whom a supplement is advised. These include the following:
• Vitamin D supplements may be of value for the many people who are lacking the vitamin (discussed earlier in this chapter).
• People with other specific deficiencies, such as iron or iodine, also require supplements.
• Supplements of particular micronutrients may be needed during pregnancy (see Chapter 5). Folic acid is particularly important for women who are pregnant or who may become pregnant.
• People with various infections may also need particular micronutrients (see Chapter 9).

Dietary supplements have turned into a big industry. Alas, a great deal of the marketing is dishonest, a subject explored in Chapter 26.

DISCUSSION QUESTIONS AND EXERCISES
1. The minister of health of your country is alarmed over the rising levels of overweight in schoolchildren. She therefore asks all community nutritionists to visit schools and give talks about this problem and about how children can change their diet. Comment on how effective this strategy is likely to be.
2. In this chapter we referred to interventions that have successfully prevented type 2 diabetes in around half of people at high risk of developing the disease. Do you consider this an appropriate strategy to reduce the prevalence of diabetes in the population of your country?
3. Look at the data in Table 13.1. What are the major causes of death in your country? How does this distribution of causes compare to the data in the table?
4. Based on observed or expected changes in diet and other aspects of lifestyle in your country, which diseases do you expect to become more or less important as causes of death over the next 10 years? Explain your reasoning.
5. How common is excessive alcohol consumption in your country?
6. What commercial organizations that help people to lose excess weight are active in your country? What methods do they use? Do you believe they achieve much success?
7. What are the major types of fats and oils used in food preparation in your country? Are there better choices available for helping to prevent IHD? What could be done to encourage people to use the healthier fats and oils?
8. Consider the health intervention programmes conducted in France (for the prevention of obesity) and Mauritius (for the prevention of CDL). Do you think there would be support for launching similar programmes in your country? Discuss what modified versions of these programmes might receive support from those with power to make decisions.
9. Describe four lifestyle-related risk factors for each of the following types of cancer: breast (post-menopausal), colorectal, and stomach.

REFERENCES


**ADDITIONAL RESOURCES**


