

5.5 Recommendations for preventing cancer

5.5.1 *Background*

Cancer is caused by a variety of identified and unidentified factors. The most important established cause of cancer is tobacco smoking. Other important determinants of cancer risk include diet, alcohol and physical activity, infections, hormonal factors and radiation. The relative importance of cancers as a cause of death is increasing, mostly because of the increasing proportion of people who are old, and also in part because of reductions in mortality from some other causes, especially infectious diseases. The incidence of cancers of the lung, colon and rectum, breast and prostate generally increases in parallel with economic development, while the incidence of stomach cancer usually declines with development.

5.5.2 *Trends*

Cancer is now a major cause of mortality throughout the world and, in the developed world, is generally exceeded only by cardiovascular diseases. An estimated 10 million new cases and over 6 million deaths from cancer occurred in 2000 (1). As developing countries become urbanized, patterns of cancer, including those most strongly associated with diet, tend to shift towards those of economically developed countries. Between 2000 and 2020, the total number of cases of cancer in the developing world is predicted to increase by 73% and, in the developed world, to increase by 29%, largely as a result of an increase in the number of old people (1).

5.5.3 *Diet, physical activity and cancer*

Dietary factors are estimated to account for approximately 30% of cancers in industrialized countries (2), making diet second only to tobacco as a theoretically preventable cause of cancer. This proportion is thought to be about 20% in developing countries (3), but may grow with dietary change, particularly if the importance of other causes, especially infections, declines. Cancer rates change as populations move between countries and adopt different dietary (and other) behaviours, further implicating dietary factors in the etiology of cancer.

Body weight and physical inactivity together are estimated to account for approximately one-fifth to one-third of several of the most common cancers, specifically cancers of the breast (postmenopausal), colon, endometrium, kidney and oesophagus (adenocarcinoma) (4).

5.5.4 *Strength of evidence*

Research to date has uncovered few definite relationships between diet and cancer risk. Dietary factors for which there is convincing evidence for an increase in risk are overweight and obesity, and a high consumption of alcoholic beverages, aflatoxins, and some forms of salting and fermenting

fish. There is also convincing evidence to indicate that physical activity decreases the risk of colon cancer. Factors which probably increase risk include high dietary intake of preserved meats, salt-preserved foods and salt, and very hot (thermally) drinks and food. Probable protective factors are consumption of fruits and vegetables, and physical activity (for breast cancer). After tobacco, overweight and obesity appear to be the most important known avoidable causes of cancer.

The role of diet in the etiology of the major cancers

Cancers of the oral cavity, pharynx and oesophagus. In developed countries the main risk factors for cancers of the oral cavity, pharynx and oesophagus are alcohol and tobacco, and up to 75% of such cancers are attributable to these two lifestyle factors (5). Overweight and obesity are established risk factors specifically for adenocarcinoma (but not squamous cell carcinoma) of the oesophagus (6–8). In developing countries, around 60% of cancers of the oral cavity, pharynx and oesophagus are thought to be a result of micronutrient deficiencies related to a restricted diet that is low in fruits and vegetables and animal products (5, 9). The relative roles of various micronutrients are not yet clear (5, 9). There is also consistent evidence that consuming drinks and foods at a very high temperature increases the risk for these cancers (10). Nasopharyngeal cancer is particularly common in South-East Asia (11), and has been clearly associated with a high intake of Chinese-style salted fish, especially during early childhood (12, 13), as well as with infection with the Epstein-Barr virus (2).

Stomach cancer. Until about 20 years ago stomach cancer was the most common cancer in the world, but mortality rates have been falling in all industrialized countries (14) and stomach cancer is currently much more common in Asia than in North America or Europe (11). Infection with the bacterium *Helicobacter pylori* is an established risk factor, but not a sufficient cause, for the development of stomach cancer (15). Diet is thought to be important in the etiology of this disease; substantial evidence suggests that risk is increased by high intakes of some traditionally preserved salted foods, especially meats and pickles, and with salt per se, and that risk is decreased by high intakes of fruits and vegetables (16), perhaps because of their vitamin C content. Further prospective data are needed, in particular to examine whether some of the dietary associations may be partly confounded by *Helicobacter pylori* infection and whether dietary factors may modify the association of *Helicobacter pylori* with risk.

Colorectal cancer. Colorectal cancer incidence rates are approximately ten-fold higher in developed than in developing countries (11), and it has been suggested that diet-related factors may account for up to 80% of the differences in rates between countries (17). The best established diet-

related risk factor is overweight/obesity (8) and physical activity has been consistently associated with a reduced risk of colon cancer (but not of rectal cancer) (8, 18). These factors together, however, do not explain the large variation between populations in colorectal cancer rates. There is almost universal agreement that some aspects of the “westernized” diet are a major determinant of risk; for instance, there is some evidence that risk is increased by high intakes of meat and fat, and that risk is decreased by high intakes of fruits and vegetables, dietary fibre, folate and calcium, but none of these hypotheses has been firmly established.

International correlation studies have shown a strong association between per capita consumption of meat and colorectal cancer mortality (19), and a recent systematic review concluded that preserved meat is associated with an increased risk for colorectal cancer but that fresh meat is not (20). However, most studies have not observed positive associations with poultry or fish (9). Overall, the evidence suggests that high consumption of preserved and red meat probably increases the risk for colorectal cancer.

As with meat, international correlation studies show a strong association between per capita consumption of fat and colorectal cancer mortality (19). However, the results of observational studies of fat and colorectal cancer have, overall, not been supportive of an association with fat intake (9, 21).

Many case-control studies have observed a weak association between the risk of colorectal cancer and high consumption of fruits and vegetables and/or dietary fibre (22, 23), but the results of recent large prospective studies have been inconsistent (24–26). Furthermore, results from randomized controlled trials have not shown that intervention over a 3–4 year period with supplemental fibre or a diet low in fat and high in fibre and fruits and vegetables can reduce the recurrence of colorectal adenomas (27–29). It is possible that some of the inconsistencies are a result of differences between studies in the types of fibre eaten and in the methods for classifying fibre in food tables, or that the association with fruits and vegetables arises principally from an increase in risk at very low levels of consumption (30). On balance, the evidence that is currently available suggests that intake of fruits and vegetables probably reduces the risk for colorectal cancer.

Recent studies have suggested that vitamins and minerals might influence the risk for colorectal cancer. Some prospective studies have suggested that a high intake of folate from diet or vitamin supplements is associated with a reduced risk for colon cancer (31–33). Another promising hypothesis is that relatively high intakes of calcium may reduce the risk for colorectal cancer; several observational studies have supported this hypothesis (9, 34), and two trials have indicated that supplemental calcium may have a modest protective effect on the recurrence of colorectal adenomas (29, 35).

Liver cancer. Approximately 75% of cases of liver cancer occur in developing countries, and liver cancer rates vary over 20-fold between countries, being much higher in sub-Saharan Africa and South-East Asia than in North America and Europe (11). The major risk factor for hepatocellular carcinoma, the main type of liver cancer, is chronic infection with hepatitis B, and to a lesser extent, hepatitis C virus (36). Ingestion of foods contaminated with the mycotoxin, aflatoxin is an important risk factor among people in developing countries, together with active hepatitis virus infection (13, 37). Excessive alcohol consumption is the main diet-related risk factor for liver cancer in industrialized countries, probably via the development of cirrhosis and alcoholic hepatitis (5).

Pancreatic cancer. Cancer of the pancreas is more common in industrialized countries than in developing countries (11, 38). Overweight and obesity possibly increase the risk (9, 39). Some studies have suggested that risk is increased by high intakes of meat, and reduced by high intakes of vegetables, but these data are not consistent (9).

Lung cancer. Lung cancer is the most common cancer in the world (11). Heavy smoking increases the risk by around 30-fold, and smoking causes over 80% of lung cancers in developed countries (5). Numerous observational studies have found that lung cancer patients typically report a lower intake of fruits, vegetables and related nutrients (such as β -carotene) than controls (9, 34). The only one of these factors to have been tested in controlled trials, namely β -carotene, has, however, failed to produce any benefit when given as a supplement for up to 12 years (40–42). The possible effect of diet on lung cancer risk remains controversial, and the apparent protective effect of fruits and vegetables may be largely the result of residual confounding by smoking, since smokers generally consume less fruit and vegetables than non-smokers. In public health terms, the overriding priority for preventing lung cancer is to reduce the prevalence of smoking.

Breast cancer. Breast cancer is the second most common cancer in the world and the most common cancer among women. Incidence rates are about five times higher in industrialized countries than in less developed countries and Japan (11). Much of this international variation is a result of differences in established reproductive risk factors such as age at menarche, parity and age at births, and breastfeeding (43, 44), but differences in dietary habits and physical activity may also contribute. In fact, age at menarche is partly determined by dietary factors, in that restricted dietary intake during childhood and adolescence leads to delayed menarche. Adult height, also, is weakly positively associated with risk, and is partly determined by dietary factors during childhood and adolescence (43). Estradiol and perhaps other hormones play a key

role in the etiology of breast cancer (43), and it is possible that any further dietary effects on risk are mediated by hormonal mechanisms.

The only dietary factors which have been shown to increase the risk for breast cancer are obesity and alcohol. Obesity increases breast cancer risk in postmenopausal women by around 50%, probably by increasing serum concentrations of free estradiol (43). Obesity does not increase risk among premenopausal women, but obesity in premenopausal women is likely to lead to obesity throughout life and therefore to an eventual increase in breast cancer risk. For alcohol, there is now a large body of data from well-designed studies which consistently shows a small increase in risk with increasing consumption, with about a 10% increase in risk for an average of one alcoholic drink every day (45). The mechanism for this association is not known, but may involve increases in estrogen levels (46).

The results of studies of other dietary factors including fat, meat, dairy products, fruits and vegetables, fibre and phyto-estrogens are inconclusive (9, 34, 47, 48).

Endometrial cancer. Endometrial cancer risk is about three-fold higher in obese women than in lean women (8, 49), probably because of the effects of obesity on hormone levels (50). Some case-control studies have suggested that diets high in fruits and vegetables may reduce risk and that diets high in saturated or total fat may increase risk, but the amount of available data is limited (9).

Prostate cancer. Prostate cancer incidence rates are strongly affected by diagnostic practices and therefore difficult to interpret, but mortality rates show that death from prostate cancer is about 10 times more common in North America and Europe than in Asia (11).

Little is known about the etiology of prostate cancer, although ecological studies suggest that it is positively associated with a “westernized” diet (19). The data from prospective studies have not established causal or protective associations for specific nutrients or dietary factors (9, 34). Diets high in red meat, dairy products and animal fat have frequently been implicated in the development of prostate cancer, although the data are not entirely consistent (9, 51–53). Randomized controlled trials have provided substantial, consistent evidence that supplements of β -carotene do not alter the risk for prostate cancer (40, 41, 54) but have suggested that vitamin E (54) and selenium (55) might have a protective effect. Lycopene, primarily from tomatoes, has been associated with a reduced risk in some observational studies, but the data are not consistent (56). Hormones control the growth of the prostate, and diet might influence prostate cancer risk by affecting hormone levels.

Kidney cancer. Overweight and obesity are established risk factors for cancer of the kidney, and may account for up to 30% of kidney cancers in both men and women (57).

Table 11 provides a summary of strength of evidence with regard to the role of various risk factors in the development of cancer.

Table 11

Summary of strength of evidence on lifestyle factors and the risk of developing cancer

Evidence	Decreased risk	Increased risk
Convincing ^a	Physical activity (colon)	Overweight and obesity (oesophagus, colorectum, breast in postmenopausal women, endometrium, kidney) Alcohol (oral cavity, pharynx, larynx, oesophagus, liver, breast) Aflatoxin (liver)
Probable ^a	Fruits and vegetables (oral cavity, oesophagus, stomach, colorectum ^b) Physical activity (breast)	Chinese-style salted fish (nasopharynx) Preserved meat (colorectum) Salt-preserved foods and salt (stomach) Very hot (thermally) drinks and food (oral cavity, pharynx, oesophagus)
Possible/ insufficient	Fibre Soya Fish n-3 Fatty acids Carotenoids Vitamins B ₂ , B ₆ , folate, B ₁₂ , C, D, E Calcium, zinc and selenium Non-nutrient plant constituents (e.g. allium compounds, flavonoids, isoflavones, lignans)	Animal fats Heterocyclic amines Polycyclic aromatic hydrocarbons Nitrosamines

^a The "convincing" and "probable" categories in this report correspond to the "sufficient" category of the IARC report on weight control and physical activity (4) in terms of the public health and policy implications.

^b For colorectal cancer, a protective effect of fruit and vegetable intake has been suggested by many case-control studies but this has not been supported by results of several large prospective studies, suggesting that if a benefit does exist it is likely to be modest.

The Consultation recognized the problems posed by the lack of data on diet and cancer from the developing world. There are very limited data from Africa, Asia and Latin America, yet these regions represent two-thirds or more of the world population. There is thus an urgent need for epidemiological research on diet and cancer in these regions. The need to evaluate the role of food processing methods, traditional and industrial, was also identified. Microbiological and chemical food contaminants may also contribute to carcinogenicity of diets.

The nutrition transition is accompanied by changes in prevalence of specific cancers. For some cancers, such as stomach cancer, this may be beneficial while for others, such as colorectal and breast cancers, the changes are adverse.

5.5.5 *Disease-specific recommendations*

The main recommendations for reducing the risk of developing cancer are as follows:

- Maintain weight (among adults) such that BMI is in the range of 18.5–24.9 kg/m² and avoid weight gain (> 5 kg) during adult life (58).
- Maintain regular physical activity. The primary goal should be to perform physical activity on most days of the week; 60 minutes per day of moderate-intensity activity, such as walking, may be needed to maintain healthy body weight in otherwise sedentary people. More vigorous activity, such as fast walking, may give some additional benefits for cancer prevention (4).
- Consumption of alcoholic beverages is not recommended: if consumed, do not exceed two units¹ per day.
- Chinese-style fermented salted fish should only be consumed in moderation, especially during childhood. Overall consumption of salt-preserved foods and salt should be moderate.
- Minimize exposure to aflatoxin in foods.
- Have a diet which includes at least 400 g per day of total fruits and vegetables.
- Those who are not vegetarian are advised to moderate consumption of preserved meat (e.g. sausages, salami, bacon, ham).²
- Do not consume foods or drinks when they are at a very hot (scalding hot) temperature.

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¹ One unit is equivalent to approximately 10 g of alcohol and is provided by one glass of beer, wine or spirits.

² Poultry and fish (except Chinese-style salted fish) have been studied and found not to be associated with increased risk for cancer.

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