Nutritional aspects of the development of cancer

Wynnie Chan

Cancer is the second most common cause of death after coronary heart disease in the UK. The latest government White Paper, Saving Lives: Our Healthier Nation (Department of Health, 1999) lists cancer as one of the four key areas being targeted for action.

1. Cancer: to reduce death rates in the under 75s by at least a fifth.
2. Coronary heart disease and stroke: to reduce death rates in the under-75s by at least two fifths.
3. Accidents: to reduce death by at least a fifth and serious injury by at least a tenth.
4. Mental illness: to reduce death rate from suicide and undetermined injury by at least a fifth.

The incidence of several types of cancer has been linked to a number of dietary and nutritional factors, and poor diet has been estimated to account for about a quarter of all cancer deaths in this country (Department of Health, 1999). Diet, however, is only one of a number of environmental and lifestyle factors that are associated with an increased risk of cancer such as smoking, alcohol, exposure to a variety of factors such as chemicals, sunlight, radiation, air and water pollutants, and viral infections.

Cancer describes a wide variety of malignant tumours (Department of Health, 1999) and can occur when the normal and replacement process of cells goes out of control and results in abnormal cells being produced.

The Committee on Medical Aspects of Food and Nutrition Policy (COMA) (1998) report, Nutritional Aspects of the Development of Cancer, followed the World Cancer Research Fund’s (WCRF) (1997) report, Food, Nutrition and the Prevention of Cancer: A Global Report. The COMA report concentrated on defining the nature of possible links between nutritional factors and cancer in the UK compared with the more global perspective from the WCRF. Associations between diet and cancer are more difficult to detect than for, say, smoking, which is much more quantifiable. This is why COMA did not attempt to estimate the relative contributions of diet to cancer in the UK. They recognised that the body of evidence from epidemiological studies and actual or possible mechanisms in humans was so complex that
causal inferences could not be ascribed to observed associations.

Diet in relation to specific cancers

Breast cancer
This is the most common cancer in women in the UK and affects over 30,000 women each year.

Non-dietary risk factors include:
- family history of the disease;
- early menarche;
- late age at menopause;
- age at first birth;
- low parity; and
- hormone replacement therapy (after the menopause, higher levels of circulating oestrogens are associated with the risk of developing breast cancer).

In terms of dietary risk factors, COMA concluded that:
(1) There is moderately consistent evidence that higher meat intake, particularly of red or fried and browned meat, is associated with a higher risk of breast cancer. The possible causes include either:
  - The formation of heterocyclic amines when meat is browned. Animal studies have shown that these heterocyclic amines cause mammary tumours once they have been absorbed through the gut.
  - N-nitrosocompounds are formed in the colon after eating meat. Rat studies have shown that N-nitrosocompounds can cause mammary cancers.

(2) There is inconsistent evidence for an association between higher total fat and saturated fat and breast cancer.

(3) There is strong evidence that obesity particularly around the excess body weight around the waist is associated with an increase in risk of post-menopausal breast cancer.

(4) High consumption of fruit and vegetables is associated with a lower risk of breast cancer.

Colorectal cancer
Colorectal cancer is the second most common cancer in Western societies affecting up to 6 per cent of men and women by the age of 75 (Department of Health, 1998). There is a strong positive association between body mass index and risk of colon cancer in men, the effect being less pronounced in women.

In terms of dietary risk factors, COMA concluded that:
(1) There is moderately consistent evidence that diets with more vegetables and less red and processed meats are associated with a reduced risk of colorectal cancer. Possible components within meats and other protein foods suggested as being involved in colorectal carcinogenesis include ammonia and N-nitrosocompounds, heterocyclic aromatic amines (from cooked meats).

(2) There is moderately consistent evidence that higher vegetable intakes are associated with lower risk of colorectal cancer.

(3) There is inconsistent evidence about the effect of fruits, vitamins A, C and E, and β-carotene on colorectal cancer.

(4) It is thought that high fibre intakes may play a role in the reduction of risk; suggested mechanisms include colon fermentation and an increase in stool weight.

Lung cancer
Cigarette smoking is the most important cause of lung cancer. It is estimated that in Europe about 90 per cent of the cases of lung cancer in men and 70-80 per cent in women are caused by smoking.

In terms of dietary risk factors, COMA concluded that:
(1) There is weakly consistent evidence for an association between higher total meat consumption and increased risk of lung cancer.

(2) There is moderately consistent evidence that higher fruit consumption and weakly consistent evidence that higher vegetable consumption are associated with a lower risk of lung cancer. The possible protective effect is via the antioxidative capacity of fruit and vegetables which protects against free radical induced damage to DNA. It is unlikely that β-carotene or β-tocopherol are involved as mediators of any effect.

(3) The strongly consistent negative association between serum β-carotene and lung cancer has not been demonstrated as being causative by intervention trials.
Prostate cancer
In the UK, prostate cancer is the third most common cancer in men.
In terms of dietary risk factors, COMA concluded that:
(1) There is moderately consistent evidence that higher red meat consumption is associated with increased risk of prostate cancer.
(2) There is moderately consistent evidence that higher total meat and fat consumption are associated with an increased risk of prostate cancer.
(3) There is moderately consistent evidence that higher vegetable consumption, especially raw and salad vegetables, is associated with reduced risk of prostate cancer.

Bladder cancer
Cigarette smoking is the major risk factor for bladder cancer in the UK.
In terms of dietary risk factors, COMA concluded from limited data that there is moderately consistent evidence fruit and vegetables consumption is inversely related to the risk of bladder cancer.

Gastric cancer
The major cause of gastric cancer is infection with Helicobacter pylori. Cigarette smoking is also a risk factor.
In terms of dietary risk factors, COMA concluded that:
(1) There is moderately consistent evidence that diets rich in salted meats and fish, salted and pickled vegetables are associated with an increased risk of gastric cancer.
(2) It is suggested that chronic injury and repair, which are thought to be the precursor of gastric carcinogenesis, are initiated by high salt intakes.
(3) There is moderately consistent evidence that higher intakes of fruits and vegetables are associated with a lower risk of gastric cancer.
(4) There is strongly consistent evidence that higher vitamin C intakes and moderately consistent evidence that higher carotenoid intakes are associated with a lower risk of gastric cancer.

Cervical and ovarian cancers
In terms of dietary risk factors, COMA concluded from limited evidence that:
(1) There is strongly consistent (limited) evidence that higher fruits and vegetables intakes are associated with reduced risk of cervical cancer.

Endometrial cancer
Higher body weight and higher body mass index are associated with a higher risk of endometrial cancer. It is postulated that longer lifetime exposure to circulating oestrogens is the mechanism via which these effects could be explained.
COMA concluded that there is no evidence of any links between specific dietary factors and endometrial cancer.

Pancreatic cancer
Cigarette smoking is the major risk factor for pancreatic cancer.
In terms of dietary risk factors, COMA concluded that:
(1) There is moderately consistent evidence that higher total and red meat consumption is associated with an increase risk of pancreatic cancer.
(2) There is moderately consistent evidence that high levels of coffee consumption are associated with an increased risk of pancreatic cancer.
(3) There is moderately consistent evidence that higher fruits and vegetables intakes are associated with a lower risk of pancreatic cancer.
(4) There is moderately consistent evidence that higher vitamin C intakes are associated with a lower risk of pancreatic cancer.
(5) There is moderately consistent evidence that higher fibre intakes are associated with a lower risk of pancreatic cancer.

Oesophageal cancer
Alcohol and tobacco consumption are directly linked with risk of oesophageal cancer.
In terms of dietary risk factors, COMA concluded that:
(1) From case control studies, there is strongly consistent evidence that higher fruits and vegetables intakes are associated with a lower risk of oesophageal cancer.
(2) There is evidence that higher antioxidant nutrient intakes are associated with a lower risk of oesophageal cancer but results from intervention trials of
micronutrient supplementation have not demonstrated a reduction in risk. 
(3) There is inconsistent evidence that meat consumption is associated with a risk of oesophageal cancer.

**Laryngeal cancer**
Cigarette smoking and alcohol consumption are the major risk factors for laryngeal cancer.

In terms of dietary risk factors, COMA concluded from limited evidence that there is moderately consistent evidence that higher intakes of fruits are associated with a reduced risk of laryngeal cancer.

**Oral and pharyngeal cancer**
Cigarette smoking and alcohol consumption are the major risk factors for oral and pharyngeal cancer.

In terms of dietary risk factors, COMA concluded that there is weakly consistent evidence that higher intakes of fruits are associated with a reduced risk of oral and pharyngeal cancer.

**Testicular cancer and melanoma**
COMA concluded that there is insufficient evidence relating dietary factors to testicular cancer and melanoma.

**Practical dietary advice – Government recommendations**
Because the body of evidence is complex, the conclusions reached by COMA are cautious. However, specific practical dietary recommendations have been made by the working group which include:
(1) An increase in fruit and vegetable consumption in the UK.
(2) For adults, an individual’s consumption of red and processed meat should not rise and that higher consumers should consider a reduction. As a guide, the current average intake of red and processed meat is 90g per day cooked weight (i.e. eight to ten portions per week). Intakes of above 140g per day cooked weight are considered to represent consumers in the upper range of the intakes distribution (i.e. 12-15 portions per week).
(3) The recommendations on red and processed meat should be followed in the context of a balanced diet rich in cereals, fruits and vegetables.
(4) A healthy body weight should be maintained, in the body mass index range of 20-25. To prevent weight gain with age, regular physical activity and eating appropriate amounts of foods should be encouraged.
(5) An increase in intake of non-starch polysaccharides from a variety of food sources.

In addition, COMA recommends:
(1) The avoidance of β-carotene supplements as a means of protecting against cancer.
(2) The need to exercise caution in the use of high doses of purified supplements of other micronutrients as they cannot be assumed to be without risk.

**References**