

Cancer Prevention and Your Food

Since the early 1990s, the rate of new cancer cases and the overall cancer death rate have been declining in the United States. However, cancer remains the second leading cause of death (heart disease is first) in this country, claiming the lives of more than 500,000 Americans each year. The annual death toll from cancer exceeds the total number of people who have died from AIDS in the United States since the AIDS epidemic began in the early 1980's. For unknown reasons, Maryland has one of the highest cancer death rates in the country.

What is Cancer?

Cancer is a group of diseases characterized by abnormal cells that have two major features: (1) the cells divide uncontrollably instead of in a regular, orderly fashion; and (2) the cells can metastasize, meaning they can spread to other parts of the body. The uncontrolled spread of cancerous cells can lead to death.

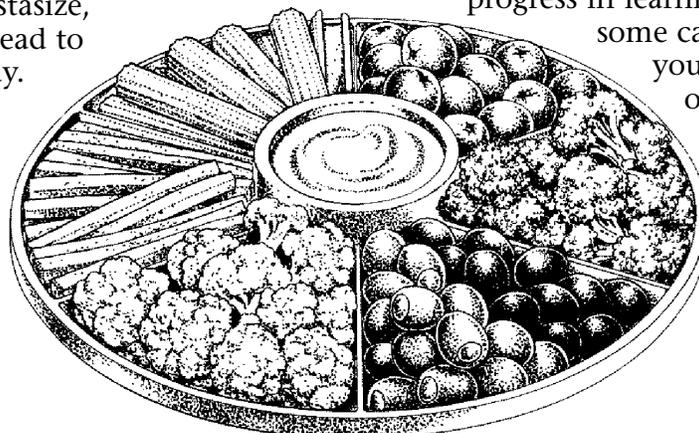
Researchers believe that some types of cancer, such as colon and breast cancers, run in some

families. Scientists have discovered a gene that appears to be responsible for about half the cases of breast cancer that are inherited. However, the development of cancer probably results from complex interactions involving genetic, environmental, and lifestyle factors.

Doctors have made considerable progress in developing medicines and therapies to treat this complex disease. As a result, many cancer patients are living long and productive lives. Some types of cancer can be virtually cured, especially when detected early.

The Link Between Diet and the Stages of Cancer

Although the exact causes of cancer remain a mystery, researchers have made progress in learning how to prevent some cancers. For example, you can reduce your risk of lung cancer by not smoking and decrease your risk of skin cancer by avoiding prolonged exposure to sunlight. Exercising regularly



may protect you from certain types of cancer, such as colon cancer.

There is also much scientific evidence supporting a link between diet and cancer, and this body of knowledge is growing.

For example, researchers have found that a diet high in fat is associated with an increased risk of some cancers, and a diet rich in fruits, vegetables, and other high-fiber foods is associated with a decreased incidence of cancer. Eating a well-balanced diet helps the immune system function properly which also lowers cancer risk. Although the precise relationship between diet and cancer is not understood, some experts estimate that more than one-third of all cancers may be related to what we eat.

Researchers believe that cancer develops through a series of stages, which includes "initiation" and "promotion." Diet can affect cancer development at many stages.

During the initiation step, cells are exposed to a hazardous substance, such as cigarette smoke, x-rays, or chemical pollutants. These "initiators" can damage the genetic material in cells, making otherwise normal, healthy cells susceptible to becoming cancer cells.

This only happens, however, if the cells also are exposed to a "promoter." A promoter transforms a cell exposed to an initiator into a cancerous cell.

Certain nutrients in food, such as vitamin C and beta-carotene, may protect cells from damage caused by initiators. On the other hand, fat and alcohol in the diet may function as promoters, causing cells exposed to initiators to develop into a cancerous tumor. An excess of calories, leading to obesity, also can serve as a cancer promoter. However, a diet low in fat and alcohol may prevent cells from becoming cancerous even if the cells have been exposed to an initiator.

The food choices you make, therefore, are important in helping to reduce cancer risk. Eating a well-balanced diet provides nutrients that may slow or prevent the initiation and promotion of cancer. The following sections

discuss specific food choices that can help protect you from cancer.

Cancer-Fighting Foods

Fruits and Vegetables

Hundreds of scientific studies on worldwide populations show that diets with plenty of fruits and vegetables lead to a low incidence of many types of cancer. Fruits and vegetables are rich in nutrients and other compounds that help protect against cancer. They also are low in fat and, like all plant products, contain no cholesterol.

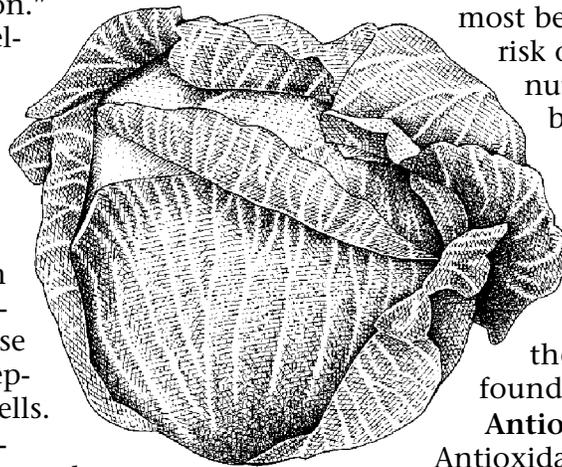
Although fresh, frozen, and canned fruits and vegetables are all beneficial, research suggests that raw fresh fruits and vegetables, especially green and dark yellow vegetables and those in the cabbage family, are the most beneficial in reducing the risk of cancer. Freezing preserves nutrients better than canning, but all forms of fruits and vegetables lose nutrients during prolonged storage and if they are overcooked.

The following paragraphs discuss some of the protective nutrients found in fruits and vegetables.

Antioxidant nutrients.

Antioxidants protect the body from adverse biological reactions involving oxygen. This may sound strange, because we know that oxygen is necessary for the body to function; without oxygen, our cells die within minutes. A great irony of nature is that the body's natural metabolism involving oxygen also produces a host of toxic compounds called "free radicals." These compounds can harm body cells by altering molecules of protein and fat, and by damaging DNA, the cell's genetic material. Antioxidants counteract, or neutralize, the harmful effects of free radicals.

Among the antioxidants being studied for their ability to fight cancer, as well as other chronic diseases, are carotenoids, vitamin C, vitamin E, and polyphenols. With the exception of vitamin E, these antioxidants are widely distributed in fruits and vegetables.



Beta-carotene is probably the most familiar carotenoid, but it is only one of several hundred different carotenoids that exist in nature. Orange and yellow fruits and vegetables, as well as green leafy vegetables, are rich sources of carotenoids.

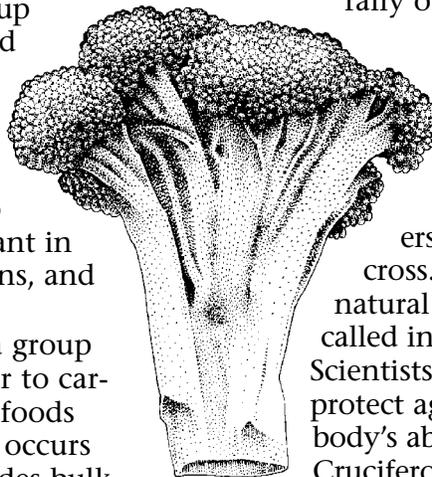
It is not clear which specific carotenoids are most important in reducing the cancer risk. Previously, scientists believed that beta-carotene had important cancer prevention properties. In several recent studies, however, beta-carotene supplements did not lower the risk of cancer, and actually seemed to increase it.

Citrus fruits, strawberries, green peppers, tomatoes, and kiwi are examples of foods high in vitamin C. Good sources of vitamin E include nuts and seeds, wheat germ, and vegetable oils.

Polyphenols are a diverse group of compounds widely distributed in the plant kingdom. One group of polyphenols, called flavonoids, appear to be beneficial in lowering the risk of certain cancers. Flavonoids, also called bioflavonoids, are abundant in grapes, apples, berries, tea, onions, and citrus fruits.

Fiber. Fiber, or roughage, is a group of substances chemically similar to carbohydrates. It is only found in foods derived from plants, and never occurs in animal products. Fiber provides bulk in the diet, so foods rich in fiber fill you up without contributing excessive calories. A diet high in fiber may help prevent colon cancer and other types of cancer.

Most health agencies recommend that adult Americans consume 20-35 grams of fiber daily. This is not difficult to do if you eat an average of five servings of fruits and vegetables a day, and regularly include whole grain breads, cereals, and legumes in your diet. Some excellent sources of fiber are kidney beans, bran-rich breakfast cereals, baked potatoes with skin, apples, oranges, pears, spinach, oatmeal, and popcorn. The dietary fiber content of packaged foods is listed on the food label. A product that contains 20 percent or more of the Percent Daily Value of fiber (or at least 5 grams) per serving is an excellent source.



Folic acid. Several studies have suggested that folic acid, also called folate, may reduce the risk of colon and rectal cancer. In one study involving more than 25,000 adults, those who ate diets high in folate had fewer pre-cancerous polyps, which are associated with the eventual development of colorectal cancer. This benefit of folate did not occur among people who consumed more than two alcoholic drinks per day. There is also accumulating evidence that folate may lower the risk of pancreatic cancer and perhaps breast cancer. Good sources of folate are dark green leafy vegetables, legumes, citrus fruits and juices, and fortified breakfast cereals and grain products. Dietary supplements are a good way of obtaining this vitamin, since the folic acid in supplements is better absorbed by the body than the folate naturally occurring in foods.

Other beneficial components.

Vegetables belonging to the cabbage family are called cruciferous vegetables. These vegetables derive their name from the plants' tiny flowers, which form the shape of a cross. Cruciferous vegetables contain natural cancer-fighting compounds called indoles and isothiocyanates. Scientists believe these compounds may protect against cancer by enhancing the body's ability to detoxify carcinogens. Cruciferous vegetables also contain calcium, a mineral that studies suggest may be helpful in preventing colon cancer. Vegetables in the cruciferous family include green and red cabbage, broccoli, brussels sprouts, cauliflower, collards, kale, bok choy, kohlrabi, mustard greens, turnip greens, and radishes.

Cereal Grains, Nuts, and Legumes

Wheat, barley, oats, rye, and rice are cereal grains; almonds, pecans, pistachios, and walnuts are examples of nuts. Legumes include lentils, peas, soybeans, chick peas, lima beans, and, despite their name, peanuts. All these foods contribute fiber to the diet.

Beans and legumes, as well as fortified breakfast cereals and grain products, also are good sources of folic acid. In addition, grains, nuts, and legumes contain phytates,

Relationships Between Food, Nutrition, and Physical Activity, and the Prevention of Cancer

Diet and Lifestyle Factors	Type of Cancer												
	Mouth, pharynx	Naso-pharynx	Larynx	Esophagus	Lung	Stomach	Pancreas	Liver	Colon, rectum	Breast	Endometrium	Kidney	Bladder
Vegetables	○		⊖	○	○	○			○	⊖			⊖
Fruits	○		⊖	○	○	○				⊖			⊖
Carotenoids in foods					⊖								
Vitamin C in foods						⊖							
Physical activity									○				
Alcohol	●		●	●				●	◐	◐			
Salt (salted fish)		●						◐					
Meat									◐				
Obesity										◐	●	◐	

○ convincing evidence for decreasing risk
 ⊖ probably decreases risk
 ◐ probably increases risk
 ● convincing evidence for increasing risk

(Source: Food, Nutrition and the Prevention of Cancer: A Global Perspective. World Cancer Research Fund/American Institute for Cancer Research. 1997.)

compounds that have the ability to chemically bind minerals, especially iron. This can be advantageous because excessive iron stores in the body are related to an increased risk of cancer. On the other hand, iron is also an essential nutrient required for healthy blood cells. People at risk for iron deficiency, such as many young women, need to consume adequate amounts of iron, and should avoid the excessive consumption of phytate-containing foods in combination with their iron sources.

Cereals and legumes contain a group of plant hormones known as phytoestrogens. These compounds are chemically related to estrogen, but do not seem to have the tumor promoting properties of estrogen. Good sources of phytoestrogens include soybeans and foods made from them, such as tofu, tempeh, miso, and soymilk. Japanese women, who consume more soy products

than American women, have lower rates of breast cancer. Some studies suggest that phytoestrogens may lower the risk of prostate cancer, but more research is needed.

Onions and Garlic

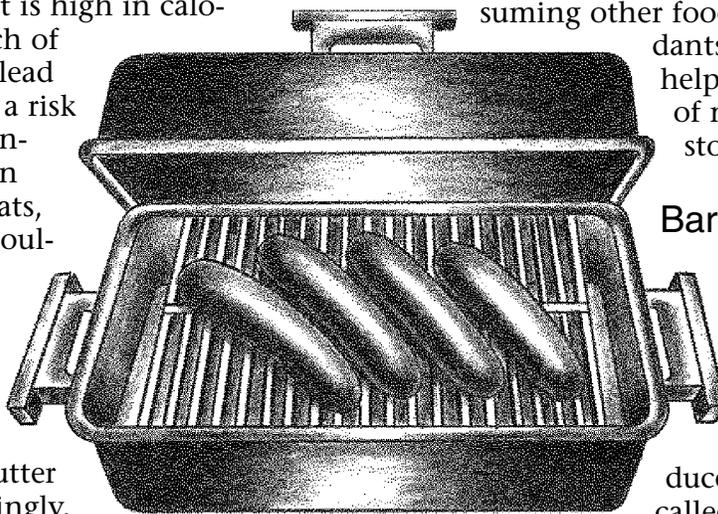
Scientists have been gathering evidence that onions, garlic, chives, scallions, and other plants belonging to the allium family may contain natural cancer-fighting substances. Some of these compounds were found to inhibit the growth of tumors in rats and mice. Although research is still in its early stages, a few studies also have shown that onion and garlic consumption is associated with a reduced risk of certain cancers in people. These results must be interpreted cautiously, however, because cooking and preparation methods affect the chemical properties of onions and garlic. At present,

there is no evidence that garlic supplements have any effect on the risk of cancer.

Foods to Avoid or Limit in Your Diet

Foods High in Fat

A diet high in fat, especially in polyunsaturated and saturated fatty acids, may increase the risk of breast, colon, rectal, prostate, and endometrial (uterine) cancer. Polyunsaturated fatty acids predominate in vegetable oils such as corn, sunflower, soybean, and safflower oil. Saturated fatty acids are more common in animal products such as beef, butter, and cheese. Monounsaturated fatty acids, found in olive and canola oil, do not seem to be associated with an increased cancer risk. Since fat is high in calories, eating too much of any type of fat can lead to obesity, which is a risk factor for certain cancers. To cut down on fat, choose lean meats, remove skin from poultry, select low-fat or skim milk dairy products, and eat less high-fat salad dressings, gravies, sauces, and rich desserts. Use butter and margarine sparingly. Cook with small amounts of oil, and bake or broil foods instead of frying.



Alcoholic Beverages

Excessive consumption of alcohol is associated with cancers of the mouth, liver and other organs. Heavy drinkers who also smoke have a markedly increased risk of cancer. If you do drink alcoholic beverages, limit your intake to one or two drinks per day. Instead of alcohol, try bottled mineral water with a twist of lemon or lime, club soda mixed with fruit juice, nonalcoholic beer or wine, or other alcohol-free beverages.

Nitrite-Cured Meats

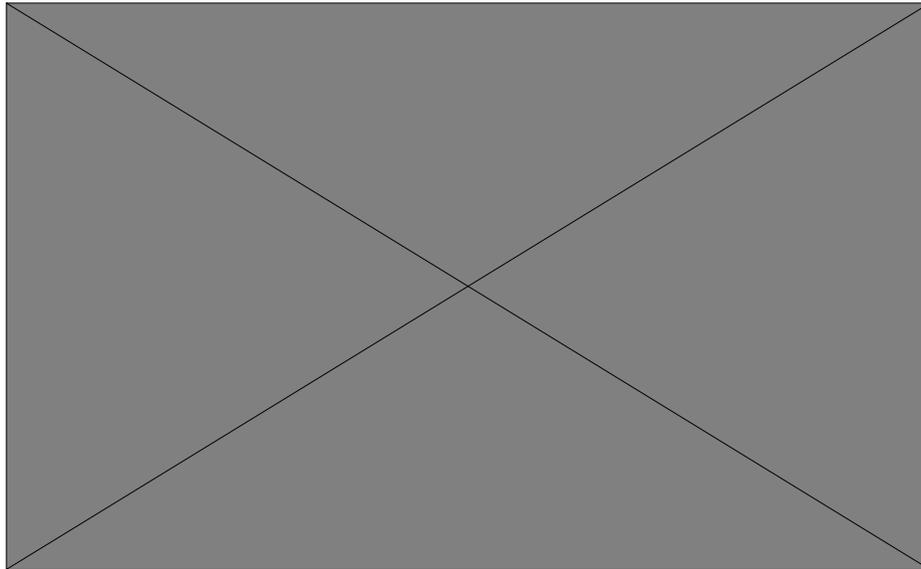
Nitrite is a preservative that enhances the color and flavor of foods. Hot dogs, deli meats, and other foods made with nitrite can contain cancer-causing chemicals called nitrosamines. Nitrosamines are formed both in the meat and in the stomach through chemical reactions involving nitrite. Nitrosamines are more likely to be formed when meats are cooked to a high temperature, as bacon is. Antioxidants help prevent the formation of nitrosamines, which is why manufacturers often add vitamin C or other antioxidants to cured meat products.

Check ingredient labels and avoid the frequent consumption of foods made with nitrite, such as sausages, ham, luncheon meats, and bacon. If you do eat these foods, drinking a glass of orange juice or consuming other foods containing antioxidants at the same time may help prevent the formation of nitrosamines in the stomach.

Barbecued and Smoked Foods

Some cooking methods, such as barbecuing and high-temperature broiling, can produce substances in food called mutagens. Mutagens cause cells to mutate, or undergo genetic alterations. Some mutagens are known to cause cancer in laboratory animals, and presumably they are carcinogenic in people as well. Smoke, which coats food during outdoor grilling or is deliberately applied during commercial processing, also contains mutagens.

The parts of food that become charred during grilling are especially high in mutagens. To reduce the charring caused by contact of meat with heat or flames, raise the barbecue grill away from the charcoal or heat source. If possible, scrape the charred areas off the food before eating. Also, trim excess fat from meat before barbecuing to reduce fat drippings, which produce smoke. If you eat grilled meat frequently, consider pre-



cooking it, such as in a microwave oven, to shorten the time on the grill. Also, research has shown that marinating foods in an oil-vinegar-garlic marinade prior to barbecuing can reduce the formation of mutagens.

There is evidence that smoked meats and smoked fish, including those that are commercially available, can increase the risk of stomach cancer, so these foods should be eaten in moderation.

Salt-Preserved and Salt-Pickled Foods

Highly salted preserved foods are associated with an increased risk of stomach cancer in areas of the world where these foods are consumed regularly. The specific components that may be carcinogenic have not been identified. The commercial manufacturing methods used for salt-preserved and salt-pickled foods are different in the United States than in countries where their consumption is associated with cancer. Therefore, it is not clear whether these foods present a significant cancer threat to Americans.

Moldy Nuts, Grains, and Seeds

Moldy foods may contain aflatoxin, a carcinogen produced by a mold. Consumption of aflatoxin may increase the risks of cancers of the stomach, liver, and kidney. You can reduce your exposure to aflatoxin by storing nuts, grains, and seeds in dry, sealed contain-

ers. Throw away moldy or shriveled seeds, nuts, and grains, and spit out any that taste moldy. The Food and Drug Administration and food manufacturers routinely test food products for the presence of aflatoxin. Aflatoxin contamination of commercially processed foods, such as peanut butter, is not believed to be a problem in the United States.

Cancer-Preventing Foods of the Future

In recent years, scientists have identified a large array of naturally occurring substances in fruits, vegetables, grains, herbs, and spices that may have potent cancer-fighting capabilities. These substances, called *phytochemicals* or *phytonutrients*, may interfere with or block the biological pathways that lead to cancer.

Phytochemical is a term that refers to any natural plant constituent. Not all phytochemicals have health benefits, and some might even be toxic. Among the plant foods currently generating interest for possessing beneficial phytochemicals are citrus fruits, soybeans, tea, licorice root, onions, garlic, flaxseed, tomatoes, and cruciferous vegetables. Indoles and isothiocyanates, mentioned earlier, are examples of phytochemicals found in cruciferous vegetables. Tomatoes are a good source of lycopene, a phytochemical that may help protect against prostate cancer.

Researchers are trying to determine specific phytochemicals or combinations having the

most beneficial properties. They also need to learn more about optimum levels of intake. Once this is known, scientists may be able to use genetic engineering techniques to custom design foods with enhanced cancer-fighting abilities. The term “functional food” is sometimes used to describe a food or food component that will provide medical or health benefits because of its phytochemical content.

Advice for Today

Follow the Pyramid Plan

The Food Guide Pyramid, developed by the U. S. Department of Agriculture, is a sensible eating plan that emphasizes foods rich in car-

bohydrates, such as breads, cereals, rice, and pasta (6–11 servings per day), and plenty of fruits and vegetables (5–9 servings per day).

The Pyramid plan calls for eating a variety of foods as well as the appropriate amount of calories to maintain a healthy weight. Following the Pyramid plan will help you get the nutrients you need while keeping your intake of total fat and saturated fat low.

Breads, cereals, fruits, and vegetables, emphasized in the Pyramid are rich in fiber, vitamins, antioxidants, and other phytochemicals which may help protect against cancer. These foods also are low in total fat, a cancer promoter.

Summary of Dietary Recommendations

The World Cancer Research Fund and American Institute for Cancer Research developed the following 14 dietary recommendations for decreasing the risk of cancer. These recommendations, based on a worldwide review of scientific literature, apply to everyone over the age of 2, and are generally consistent with lowering the risk of other chronic, diet-related diseases.

1. **Food supply.** Choose predominantly plant-based diets rich in a variety of fruits, vegetables, legumes, and minimally processed (whole grain) starchy, and staple foods.
2. **Body weight.** Avoid being underweight or overweight, and limit weight gain during adulthood to less than 11 pounds.
3. **Physical activity.** If work-related activity is low or moderate, take an hour's brisk walk or similar exercise daily, and also exercise vigorously for a total of at least one hour per week.
4. **Fruits and vegetables.** Eat five or more servings a day of a variety of fruits and vegetables throughout the year.
5. **Other plant foods.** Eat at least 7 servings a day of a variety of cereals, legumes, roots, and tubers, preferably from minimally processed (whole grain) foods, and limit the consumption of refined sugars.
6. **Alcohol.** Alcohol consumption is not recommended, but for those who do drink, limit alcoholic beverages to less than two drinks a day for men, and one for women.
7. **Meat.** If eaten at all, limit intake of red meat to less than three ounces daily. It is preferable to choose fish and poultry in place of red meat.
8. **Fats and oils.** Limit consumption of fatty foods, particularly those of animal origin. Consume moderate amounts of oils, preferably those that are predominately monounsaturated (e.g., olive and canola) and low in saturated and trans fat.
9. **Salt and salting.** Limit consumption of salted foods and the use of cooking and table salt. Instead, use herbs and spices to season foods.
10. **Storage.** Do not eat foods which, as a result of prolonged storage, are likely to be contaminated with mold-producing toxins such as aflatoxin.
11. **Preservation.** Use refrigeration and other appropriate methods to preserve perishable foods at home.
12. **Additives and residues.** When levels of food additives, contaminants, and other residues are properly regulated, their presence in food and beverages is not known to be harmful.
13. **Preparation.** Do not eat charred food and avoid burning meat juices. Consume only occasionally cured meats, smoked meats, and meat and fish that is grilled or roasted in direct flames.
14. **Dietary supplements.** Dietary supplements are probably unnecessary, and possibly unhelpful, for reducing the risk of cancer if the above 13 recommendations are followed.

(Source: Food, Nutrition and the Prevention of Cancer: A Global Perspective. World Cancer Research Fund/American Institute for Cancer Research. 1997.)

The public health program, "5 A Day," encourages all American adults to eat at least five servings of fruits and vegetables each day. The National Cancer Institute defines a serving as one medium piece of fruit, 1 cup of raw leafy vegetables, ¼ cup of dried fruit, ½ cup of cooked or chopped raw vegetables or fruit, or ¾ cup of 100-percent fruit or vegetable juice.

Supplements: Caution Advised

Most nutrition experts do not advise the public to take supplemental doses of antioxidants, herbs, or other phytochemicals with the hope of warding off cancer. Currently, there are not enough data showing that such supplements are safe, effective, or beneficial. In fact, supplements may cause harm by creating nutritional imbalances. Although some

investigations have suggested that certain antioxidant supplements may help prevent cancer, other studies have shown the opposite effect or no effect at all.

Dietary supplements are recommended in certain situations. Women of child-bearing age should take folic acid supplements to help prevent neural-tube birth defects. People who avoid dairy products or are at risk for osteoporosis should consider taking calcium supplements. Consumers should realize that a concentrated extract in a supplement may not necessarily have the same effects in the body as the same substances naturally found in whole foods. Food may have cancer-fighting properties yet to be discovered.

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¹ A single free copy of these brochures can be ordered by calling the Cancer Information Service at 1-800-4-Cancer.

Cancer Prevention and Your Food

by

Mark A. Kantor

Extension Food and Nutrition Specialist
Department of Nutrition and Food Science

Reviewed by

Bernadene Magnuson

Assistant Professor

Department of Nutrition and Food Science

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