



## The Diet and Cancer Connection

Adapted by Kathleen M. Stadler\*

One out of every three Americans will be diagnosed with cancer at some time. Cancer affects three of every four families.

Cancer is the second leading cause of death in the U.S. Each year, nearly 500,000 Americans die from cancer. While the rates for coronary heart attacks and uncontrolled high blood pressure are declining, certain cancer rates are increasing.

Many people assume that getting cancer is a matter of bad luck and environmental hazards. But many cancer experts now believe that lifestyle factors—smoking, diet, stress, sunbathing, etc.—are more important factors than thought possible a few years ago. Lifestyle factors are involved in most cancers, with controllable factors estimated to be as high as 80 to 90 percent of all causes. Diet may account for some 35 percent, and smoking another 30 percent.

A critical factor needing much more study is the influence of heredity on cancer susceptibility. Some people never develop cancer despite years of exposure to tobacco, poor diet, alcohol, sunlight, etc., while others, unexposed, will get it. Why? The answer must involve heredity. For some, the genes, with all their inherited deoxyribonucleic acid (DNA), resist permanent damage (mutation) by cancer-causing agents, known as carcinogens. For unlucky others, a combination of modified genes and a suitable internal environment results in the dreaded diagnosis.

Maintaining good nutrition and avoiding tobacco, certain heavy metals, pesticides, excessive ultraviolet light and radiation provides a strong defense against many common cancers. Food with protective nutrients may add many disease-free years as well as pleasure from good eating.

Researchers believe that everyone harbors initiated cells that will not become cancerous if they are destroyed or kept in check by the immune system. In most cases, the body's immune system recognizes and destroys these strange, initiated cells. However, in cancer, the immune system may become overwhelmed or lose its ability to recognize the foreign cells, allowing them to escape destruction and multiply.

A number of agents are known to cause DNA mutations: ultraviolet light, radiation, certain chemicals such as those found in tobacco, smog and pesticides, a few viruses and certain diet-related agents.

Known dietary agents include oxidized fats, nitrates and nitrites, and chemicals produced during charcoaling, smoking or grilling meat.

Contrary to popular opinion, food additives have few, if any, cancer-causing properties. New food additives are carefully researched before being allowed in food and are safer than many natural chemicals. Some experts believe there is much more risk from natural food substances than from food additives.

In animal studies, two commonly used preservatives, BHA and BHT, usually protect against cancer, especially if they are added to the food before the animals are exposed to the carcinogen. No one knows whether this is true for humans, but this and other questions need continuing study to ensure a safe food supply.

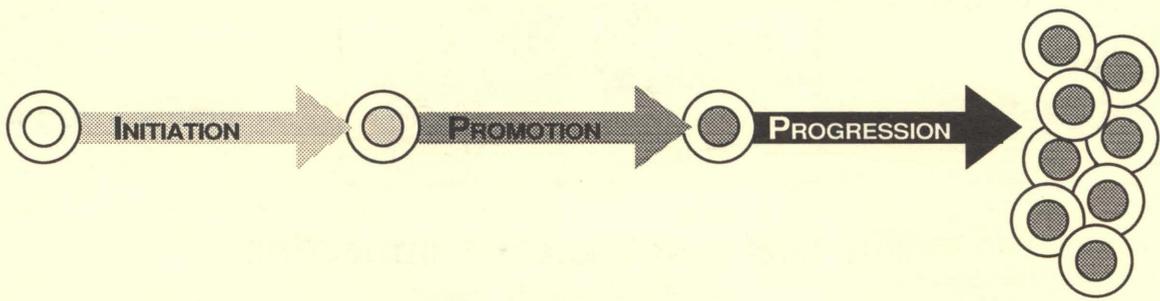
### Lung Cancer and Diet

Smoking is clearly associated with high death rates from lung cancer. More women now die from lung cancer than breast cancer, and women's lung cancer death rate is expected to continue rising because of the large number of women who started smoking after World War II. Men's rates are falling as they stop smoking. If smoking trends continue (currently three or four male smokers for every female), men and women may develop lung cancer at equal rates by the year 2000.

Researchers are still unsure about diet's role in lung cancer, but the nutrient most associated with protection is beta-carotene, a vitamin A precursor. Bright yellow-orange beta-carotene is one of a number of carotenoids that have anti-cancer activity even greater than vitamin A. Other possible lung protectors are foods high in vitamin C, other antioxidant nutrients and indoles, a natural chemical in vegetables.

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### The Three Stages of Cancer

Cancer is a multi-stage disease. First, a cell must be **initiated** by a carcinogen such as a chemical or virus. The DNA genetic material is modified and becomes capable of producing abnormal cells. During the **promotion** phase and under favorable conditions, these initiated cells will multiply because normal growth restraints have been removed. This phase can last from a few months to more than 20 years. In the final stage, **progression**, cancer cells multiply rapidly, disrupting body functions and leading to death.

**Figure 1.** Diet can affect any phase of the process but likely is most important during the promotion stage.

These nutrients may protect lung linings but cannot totally prevent damage. Experts believe that taking vitamin A or carotene supplements is no substitute for stopping smoking.

Dark green and dark yellow-orange vegetables and yellow fruits have the most beta-carotene. Vegetables high in carotene are carrots; green and red peppers; leafy greens such as kale, spinach, and turnip greens; sweet potatoes and winter squash. Among fruits, mangoes have the most carotenes but apricots and cantaloupes are also excellent sources. Other fruits and vegetables contain good amounts of beta-carotene. Other nutrients, such as vitamins C and E and the mineral selenium, may offer additional protection.

*To reduce your risk for lung cancer, stop smoking and eat lots of fruits and vegetables, especially those colored deep yellow and dark green or high in vitamin C.*

### Gastrointestinal Tract, Prime Cancer Target

Cancer can develop anywhere along the gastrointestinal tract, but colon cancer is the most common gastrointestinal tract cancer in the U.S.

An unbalanced diet, with too much fat and not enough fiber and antioxidants, is the most likely promoter of colon cancer. For humans, the closest associations between diet and colorectal cancer are high fat intake, particularly saturated fat, and low consumption of vegetables. Some studies link colon cancer with obesity and high protein intakes, particularly meat, but this may reflect too much meat fat rather than protein and not enough dietary fiber or other plant substances. While fiber may protect the colon lining, the protective factors may be the associated antioxidants in plant foods, notably vitamins A and C in fruits and vegetables and the mineral selenium in grains.

Other natural food chemicals may also be beneficial. Ample intakes of cruciferous vegetables—those belonging to the

*Brassica* genus—are associated with lower colorectal risk in females. The best evidence that cruciferous vegetables may prevent colon cancer is found in low colon cancer rates among people consuming the raw forms of cabbage, Brussels sprouts, and broccoli. Other cruciferous vegetables are bok choy, cauliflower, collards, kale, kohlrabi, mustard greens, rutabagas, and turnips and their greens. Some chemicals in the *Allium* family—onions, garlic, shallots, chives—also may be protective.

Another possible dietary factor is calcium, which can bind with intestinal fatty and bile acids preventing them from irritating the intestinal wall. Calcium-bound carcinogens are then excreted with the feces. Fiber, especially insoluble fiber as in wheat bran, may also bind or at least come between the irritants and the bowel wall.

Alcohol is associated with cancer at several locations along the gastrointestinal tract. All forms of alcohol—beer, wine, spirits—are linked with cancer of the mouth, larynx, pharynx and esophagus, and heavy beer drinking is associated with cancer of the rectum.

After colorectal cancer, the most common cancers are those of the upper gastrointestinal tract. Again, high intakes of fruits and vegetables appear to protect the linings of the mouth, throat and esophagus from the effects of alcohol and smoking. Combining tobacco and alcohol use is especially dangerous.

High intakes of pickled, salted, and smoked foods that contain nitrosamines (produced from nitrates and nitrites) and other potential carcinogens are linked with stomach and esophageal cancer. Some experts suggest limiting consumption of charcoaled and grilled foods because they may contain hazardous compounds formed when fats and proteins come into contact with high heat.

According to the *Surgeon General's Report on Nutrition and Health*, stomach cancer has been found among populations who eat lots of pickled vegetables (Japan), salted fish (Norway) and smoked trout and mutton (Ireland). Esophageal cancer is

common in Chinese who eat a lot of pickled vegetables. Even drinking lots of very hot foods and beverages is associated with cancer in some parts of the world.

Vitamin C is the most likely protector of these linings. Other nutrients, including beta-carotene, vitamin E, folacin, riboflavin and vitamin B12 as well as calcium, selenium and other trace elements, appear to be gastrointestinal protectors. Oddly enough, under some conditions, a protective nutrient may become a cancer promoter.

High intakes of vitamin supplements, such as a gram or more of vitamin C, are neither necessary nor desirable. A diet that follows the Food Guide Pyramid—a variety of at least five fruits and vegetables daily—offers ample protection.

*To protect your gastrointestinal tract, eat a diet high in plant foods and low in fat. Limit the amounts of alcohol and grilled, charcoaled, pickled and highly salted foods.*

## Sex Organs, Diet and Cancer

In general, studies suggest that high fat intakes promote breast and prostate cancer. Among fats, saturated fats are most often associated with prostate and breast cancer. Other fats, except for fish oils, may also promote cancer. More research is needed, but experts believe that eating a lowfat diet throughout life may be the best protection against these common cancers. Some studies suggest that carotenes may protect men from prostate cancer, but

that too much vitamin A may increase cancer risk. Neither is a high vitamin C intake an advantage. Workplace exposure to the heavy metal cadmium may increase risk for prostate cancer, but the evidence is still sketchy.

Endometrial (uterine lining cell) and ovarian cancer do not appear to be linked with diet. While some studies link coffee consumption with ovarian cancer, others do not. Obesity, however, may increase the risk for endometrial cancer. Cervical cancer is most likely due to non-dietary factors, but beta-carotene, folacin and possibly selenium are protectors. Some evidence suggests that obesity and too much copper may promote cervical cancer.

*Sex organ cancer is most often associated with high fat intakes and obesity. Vitamin A and other nutrients may be protective.*

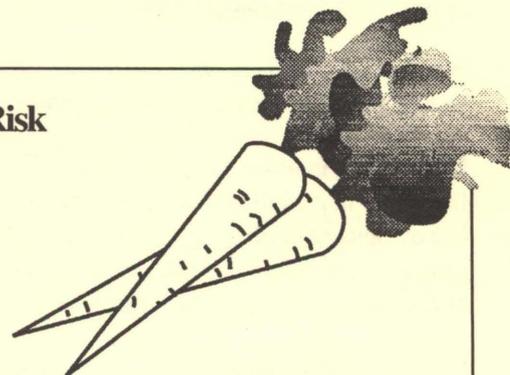
*One in nine women can expect to be told they have breast cancer. Most breast cancer victims are women, but men are not immune. And prostate cancer is a common killer in men.*

## Cancer in Other Organs

**Pancreatic cancer.** Cigarette smoking is the only clearly established risk factor for pancreatic cancer. It strikes more men than women and more blacks than whites. Pancreatic cancer rates had been rising but now have leveled. Nonetheless, cancer of the pancreas, a “silent” disease, is the fifth leading cause of cancer death because it is usually not detected until well-advanced.

## Eight Ways to Reduce Your Cancer Risk

- 1** Eat a variety of foods. Many foods contain protective substances—some that researchers are still discovering. And, getting nutrients from a varied, balanced diet will prevent you from getting too much of a potentially harmful substance.
- 2** Eat less fat. “Lean” toward low-fat meat, poultry and dairy foods, watch the high-fat snacks and desserts, salad dressings, etc., and bake, broil, stir-fry or steam—don’t fry foods or add fatty extras.
- 3** Eat more fruits and vegetables—at least three servings of vegetables and two servings of fruits daily. Think color; deep green and yellow orange.
- 4** Choose high-fiber foods. Besides fresh fruits and vegetables, add more whole grain breads and cereals and legumes (dried peas and beans) to your diet.
- 5** Limit highly salted, pickled and smoked foods, including charcoaled, grilled or broiled meats, fish and poultry.
- 6** Control your weight—avoid obesity. Keep an acceptable weight by eating moderately, limiting fats and sugars, and exercising regularly. Avoid diet and exercise extremes. Have a checkup before beginning a strenuous exercise program.
- 7** If you drink alcohol, cut back. More than two alcoholic drinks per day puts you at risk for developing certain types of cancer, especially if you drink and smoke.
- 8** Stop smoking, if you smoke, or don’t start. Smoking is clearly linked to lung cancer. Chewing tobacco, snuff and pipes also cause cancer.



Studies looking at meat, coffee, or alcohol have found links in some cases but not others. Investigators have been unable to find any consistent connection between coffee drinking and pancreatic cancer. Tea is apparently a safe drink, with few reports of any connections with different forms of cancer.

In countries where diets are high in fat, pancreatic cancer rates are also higher. If the cancer strikes the epithelial (lining) cells in the pancreas, vitamin A or the synthetic retinoids (forms of vitamin A) may offer some protection.

**Liver cancer.** Nationwide, about 12,000 people (2.3 percent of all cancer deaths) die of liver cancer each year. While liver cancer is prominent in other parts of the world, there is little primary liver cancer in the U.S. Most cases come from invasion (metastasis) by cancer cells from elsewhere.

Chronic alcoholism does not appear to cause liver cancer. Alcoholics who develop liver cancer likely have been exposed to hepatitis B virus. In fact, exposure to hepatitis B virus may be the primary initiator. Some researchers believe that aflatoxin may also initiate liver cancer. The molds that produce aflatoxin are found chiefly on moldy nuts, seeds and grains. The U.S. food supply is monitored to keep aflatoxin levels low. The limited exposure comes mainly from corn and peanuts with lesser amounts from tree nuts.

High protein intakes of 20 to 25 percent of calories may enhance tumor growth whereas low protein levels suppress it. Also, several vitamins, notably folacin and B12, may inhibit liver cancer, but the evidence is weak.

*When cancer occurs in other internal organs—pancreas, liver, kidney, bladder—diet is more likely a promoter than an initiator.*

**Kidney and bladder cancer.** These cancers are found more frequently in men than in women. Obesity is a risk factor for kidney cancer and smoking is the greatest risk factor for bladder cancer. Apparently, bladder cancer is primarily the result of environmental hazards such as nitrates and nitrites.

Because bladder linings are epithelial cells, fruits and vegetables may be important protectors because of vitamin C, carotenes and other unknown factors. Therapeutic and synthetic retinoids (modified vitamin A compounds) may also be useful but should only be taken under medical supervision.

*The immune system protects the body from cancer by destroying most, if not all, cancerous cells and excreting carcinogens as harmless chemicals. Cancerous cells also are discarded from intestinal linings, skin, and other organs.*

## Caution: Toxic Levels of Nutrients



**Vitamin A.** Retinoic acid and synthetic retinoids (modified vitamin A) should only be taken under medical supervision. High vitamin A doses are toxic, so researchers are looking for synthetic, safer retinoids.

While high carotene intakes have caused a yellow skin tone, this color change is not toxic. The color will gradually disappear once the carotene is stopped.

**Vitamin C.** Excessive amounts of vitamin C supplements may irritate the gastrointestinal tract, increase the chance of iron overload in susceptible individuals, alter the metabolism of certain drugs, and promote calcium oxalate kidney stones.

**Vitamin D.** Vitamin D toxicity is well known. Excessive amounts of vitamin D remove bone calcium (needed to prevent osteoporosis) and can promote undesirable oxidation of fats in cells.

**Selenium.** Known to be toxic in animals and suspected of being a human carcinogen, experts now question those early selenium studies. A number of forms of selenium are under study. Excessive levels of trace minerals usually are damaging, but how toxic is still unknown.

## Bibliography

- American Journal of Clinical Nutrition*, Vol. 54, No. 1, July 1991 Supplement.
- Cancer Facts and Figures, 1991.* American Cancer Society, Atlanta, Georgia.
- Jacobs, M. 1991. *Vitamins and Minerals in the Prevention and Treatment of Cancer*. CRC Press. Boca Raton, Florida.
- Marshall, C.W. 1983. *Vitamins and Minerals; Help or Harm?* George F. Stickle, Philadelphia.
- National Research Center. 1989. *Diet and Health*. National Academy Press. Washington, D.C.
- Nutrition Research Newsletter*, Vol. 7, August 1988.
- Pike, R.L. and M.L. Brown. 1984. *Nutrition, an Integrated Approach*. 3rd ed. John Wiley, New York.
- The Surgeon General's Report on Nutrition and Health*. U.S. Dept. of Health and Human Services (PHS) Publ. No. 88-50210, 1988. Public Health Service, Washington, D.C.