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Effects of Exercise and Diet on Chronic Disease Part VI Cancer

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Your Life Your Health

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We continue our summary of the review article in the November, 2005 issue of *Journal of Applied Physiology* entitled, "Effects of exercise and diet on chronic disease." We have looked at the effect of diet and exercise on heart disease, hypertension, diabetes and the Metabolic Syndrome. Today, we review their effect on cancer.

Cancer is the second leading killer in the United States accounting for approximately 23% of all deaths in 2001 (553,768). Prostate cancer is the most common cancer in men, followed by lung and colon. For women, breast cancer is the most common, followed by lung and colorectal. However, it should be noted that lung cancer is the leading killer in both men and women.

The following lifestyle factors play major roles in the development of these common cancers:

- exposure to chemical carcinogens (mainly from smoking)
- physical inactivity
- diet

The current human diet contains a number of carcinogens (cancer causing substances) that may act through the production of reactive oxygen species -- atoms which are very damaging to the body -- and which lead to cancer and other chronic diseases. Diet also can produce reactive oxygen species.

For example, consumption of red meat is associated with cancers of the colon, breast, and prostate, as charbroiling and frying meats at high temperatures forms potent carcinogens. Evidence also indicates that physical activity protects against cancer risk and as the amount of exercise increases the cancer risk decreases.

Several mechanisms may contribute to the benefits of physical activity and diet on risk of lifestyle-related cancers.

- First, **lifestyle modification may affect oxidant/antioxidant status.** Diets high in whole grains, fruits, and vegetables contain a high amount of natural antioxidants that might play an important role in preventing cancer, and this type of diet

combined with physical activity has been shown to reduce oxidative stress by reducing the production and presence of reactive oxygen species in the body. Physical activity has also been shown to increase the body's antioxidant mechanisms.

- Second, **physical activity and diet may induce reductions in free sex hormone levels** (testosterone, estrogen, dihydrotestosterone) and/or may increase circulating sex hormone-binding globulin (SHBG), which binds sex hormones and decreases their ability to interact with target tissues. Sex hormones often promote cancer growth.
- Third, **exercise and diet may reduce metabolic hormone levels** such as insulin and Insulin-like Growth Factor-I (IGF-1), which have been associated with increased risk of prostate, breast, and colorectal cancers.
- Additionally, moderate **physical activity and diet improve immune function**.

Lung cancer

The link between smoking and lung cancer was established in the first Surgeon General's Report in 1964. However, a number of studies have reported that exercise lowers the risk for lung cancer. The large Norwegian study of 81,516 men and women followed for 19 years reported a 25% reduction in lung cancer risk for men who walked or cycled for at least 4 hours per week, after controlling for smoking habits and the number of cigarettes smoked. The mechanism by which exercise might reduce that risk for lung cancer has not been investigated, although it is reported that IGF-1 is a risk factor for lung cancer. Greater consumption of vegetables, fruits, or both together has also been associated with a lower risk of lung cancer.

Prostate cancer

Prostate cancer is the most common male cancer in the United States but has a very low incidence in Asian men; this suggests that lifestyle factors play an important role in the development of prostate cancer. Also, when Japanese and Chinese men migrate to the United States and adopt a Western lifestyle, their incidence of prostate cancer approaches that of US whites. In addition, as underdeveloped countries in the world adopt a more Western lifestyle, prostate cancer increases. A study of the risk for cancer among 44,788 pairs of twins in Sweden, Denmark, and Finland concluded that **42% of the prostate cancer cases were attributed to inheritance and the majority to lifestyle factors**.

International data show a positive correlation between dietary fat and prostate cancer mortality, with the lowest rates found in East Asian men and the highest rates found in US and European men. Current evidence from experimental and human studies implicates omega-6 polyunsaturated fatty acids (corn and safflower oils, fats and oils, meat and poultry, cereal-based products and cereals, vegetables, and nuts and seeds) in the promotion of cancers and omega-3 polyunsaturated fatty acids (Fish Oil) and omega-9 monounsaturated fatty acids (Olive Oil) as being protective. Furthermore, it is possible that in the international data not only do men with a low incidence of prostate cancer

mortality consume lower fat diets, consumption of other dietary components may be different, and they may be more physically active.

A few recent studies have investigated lifestyle modification and/or supplementation in men with documented prostate cancer. In patients with prostate cancer, who chose a “watchful waiting,” course, those with a diet and exercise program showed a decrease in their Prostate Specific Antigen (PSA) which is a marker for prostate cancer. The diet and exercise group also showed a 60% reduction of cancer cell growth in laboratory studies without other treatment. Additionally, after 1 year, 6 of 43 in the control group had progressed to conventional treatment, owing to rising prostate-specific antigen, whereas none of the 41 in the diet and exercise group had treatment.

Breast cancer

Breast cancer is the most common cancer in US women and like prostate cancer is hormone dependent. Although breast cancer is estrogen dependent, most breast cancer occurs in postmenopausal women in whom estrogen levels are low; however, elevated serum estradiol has been shown to be a risk factor for breast cancer in postmenopausal women.

The influence of lifestyle factors in breast cancer is supported by the fact that breast cancer incidence and mortality for Asian immigrants in the United States is intermediate between US white women and Asian women who live in Japan or China. These differences have been attributed in part to adoption of Western diets among Asian immigrants. Fat intake has been suggested as a contributor to breast cancer, with reports of a positive correlation between per capita fat consumption and both incidence and mortality from breast cancer. In a large retrospective study of 2,599 breast cancer patients and 2,588 controls, it was found that increased consumption of calories, saturated fat, sugar, and alcohol all significantly correlated with increased risk for breast cancer.

The low breast cancer incidence in East Asian women is associated not only with dietary fat, but also with diets high in omega-3 fatty acids (i.e., fish oil) and fiber. In addition, Asian women may be more physically active. 32 of the 44 studies to date have observed a reduction in breast cancer risk in women who were most physically active, and of the 32 studies that observed a decrease, the average risk reduction was 30–40%. Additionally, a dose-response relation between increasing activity and decreased risk was noted in 20 of 23 studies.

Physical activity may decrease the production, metabolism, and excretion of sex hormones, as sedentary, postmenopausal women have higher serum estradiol concentrations. Additionally, increased body fat, present in sedentary women, is a location of increased aromatization (the forming of estradiol out of other hormones of steroid hormones). Sedentary women also have high insulin, which may be a promoter of breast tumor development.

One study reported a 50% reduction in estradiol in postmenopausal women after lifestyle modification (exercise and high-fiber, low-fat diet). Other more recent studies have also reported reductions in serum estradiol by adopting a low-fat diet by both pre- and postmenopausal women. Insulin and IGF-I have been reported to be risk factors for breast cancer.

Colon cancer

Cancer of the colon and/or rectum is the second leading cause of cancer deaths and is the third most common cancer in both men and women in the United States. Over the years there has been a lot of controversy regarding the involvement of lifestyle factors in colon cancer. However, the most definitive evidence for an association between physical activity and cancer exists for colon cancer. Of 51 studies on colon or colorectal cancer, 43 demonstrated a reduction in risk in the most physically active men and women with an average reduction of 40–50%.

Several potential mechanisms have been purported to explain how physical inactivity and diet affect colon cancer.

1. One study noted a high incidence of colon cancer in British subjects living in Uganda; however, it was rarely seen in native Africans. The Africans consumed large amounts of fiber which suggested that fiber played an important role in colorectal cancer and that removal of fiber by refining carbohydrates reduced stool bulk and increased gastrointestinal transit time as well as adversely affected intestinal flora.
2. Second, hyperinsulinemia resulting from consumption of high-fat, refined-carbohydrate diets may play a role in the etiology of colorectal cancer, and, as discussed, insulin sensitivity is improved by exercise training.
3. Third, physical activity and diet may alter bile acid metabolism. Some bile acids are thought to be carcinogenic.

A Western diet high in glycemic load and red meat is correlated with increased cancer mutations. Red meat consumption also appears to affect colon cancer, as 19 of 33 studies have reported an association between red meat and colon cancer with the relative risk being 2.5-fold higher for women who consumed animal fat in the form of beef, lamb, or pork at least once per day compared with those at once per month. How much of the association between red meat and colon cancer is due to total fat or saturated fat and how much is due to other constituents of meat or the diet is presently unknown.

Increased fruits and vegetables are also protective against colon cancer. A protective effect of vegetable intake was noted in a study of over 760,000 adults, which documented a 40% decrease in women and a 20% decrease in men in the highest vs. lowest vegetable intake. The benefits may be independent of fiber.

Summary

Several forms of cancer are influenced by lifestyle factors, and cancers of the prostate, breast, and colon are significantly affected by exercise and diet. Several dietary factors can affect cancer progression, including fiber, fat (amount and type), and meat intake. Exercise has been documented to be associated with reduced risk of developing several forms of cancer. Antioxidant, growth factor, and hormonal effects appear to mediate in large part the benefits noted with exercise and/or diet intervention.

Remember, it is your life and it is your health and your choices do make a difference.