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Calcium and Colon Cancer

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Evidence is accumulating that vitamin D and calcium play a role in protection of the human colon from cancer. Epidemiological evidence shows a much higher incidence of colorectal cancer at higher latitudes and in metropolitan areas in which sun exposure (vitamin D formation) is less than in more southerly regions. Similarly, a fourfold difference in the incidence of colorectal cancer is seen between men of Japanese descent living in Hawaii and consuming less than 0.5 gram of calcium daily as compared with those in Japan who consume a diet rich in marine fish providing abundant calcium and vitamin D. A strong association between the level of calcium intake and the later development of colorectal neoplasm has been demonstrated in a 20-year prospective study of white Americans of primarily European descent near Chicago, with daily calcium intakes ranging from 200 to over 1200 mg. Within a sample of Japanese-American men in Hawaii, no difference in calcium intake was found between those with colorectal cancer and cancer-free controls in a 14- to 17-year prospective survey, but very little overall variation in dietary calcium intake was present. Animal studies suggest that calcium protects the colon from damaging effects of hydroxylated bile salts and free fatty acids, both of which stimulate proliferation of the colonic epithelium. Supplementation of 1250 mg per day of oral calcium to individuals with a high familial predisposition to rectal cancers suppressed the proliferative response of the rectal mucosa. Thus, dietary calcium requires consideration as a protective factor against development of colorectal cancers. (CLIN NUTR 1986;5:161-6)

After skin cancers, the most common cancers, in terms of reported annual incidence in the United States, are those of the lung, colorectum, and breast. For colorectal carcinomas, the current level of new cases in the United States is more than 140,000. The overall 5-year survival rate for this disease is only 40% to 50%. Once established, advanced colorectal cancer is particularly tenacious, resistant to both chemotherapy and radiotherapy. Dietary factors have been widely implicated in theories of causality, protection, and therapy for this form of malignant disorder.

In 1980, we proposed that vitamin D and calcium reduce the risk of cancer of the colon and rectum. Our theory was based on the observation that rates of colorectal cancer were highest in places in the world with the least sunlight, such as regions distant from the equator and in the "concrete canyons" of large metropolitan areas. There are major differences in sunlight energy even within the United States (Fig. 1), and sunlight is inversely correlated with age-adjusted death rates from colon cancer, both in states with largely metropolitan populations ($r = -0.9$) (Fig. 2) and largely nonmetropolitan populations ($r = -0.6$) (Fig. 3). New Hampshire, for example (latitude 45° north), had nearly three times the annual age-adjusted colon cancer mortality rate (15.3 per 100,000) as New Mexico (latitude 35° north) (6.7 per 100,000)."

Sunny places in general, worldwide, from North Africa to the Caribbean to Central America, had very low rates of colon cancer, vanishing to nearly zero in equatorial Africa. There were few exceptions to this pattern worldwide, and the main exception was Japan. Japan occupies 33° to 47° north latitude, but most of its population is centered around 45° north, a region in which only moderate sunlight energy reaches ground level. It is a level of sunlight intensity associated almost everywhere else in the world with high rates of colorectal cancer. However, the incidence rate of colorectal cancer in Japan is very low (approximately 5 per 100,000 population per year, age-adjusted to a world standard). Rates in San Francisco and Connecticut, by comparison, range from 25 to 30 per 100,000 population per year, although these places are at approximately Japan's latitude.

We suspected that Japan offered a clue about the cause of colorectal cancer. It was a significant exception to a rule that had few exceptions. Diet in Japan differs from that in Western countries in many ways, but one of the most notable differences is in the vast amount of fish consumed regularly by the population. Fish near the surface of the ocean receive considerable amounts of sunlight, which causes vitamin D to form in the flesh. When the fish are eaten, the consumer absorbs the vitamin D. In Japan, the epidemiological evidence favored speculation that the vitamin D from fish had made up for the relative lack of sunlight-induced vitamin D owing to Japan's location in an area distant from the equator. The Japanese taste for fish may therefore have explained the low rates of colorectal cancer in Japan. Historically, Japan was spared from rickets when the disease swept England and the inland Northern European countries in the late 1700s, probably as a result of a diet rich in topfish - an

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