

The Relationship Between Vitamin D and Cancer

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Vitamin D, a fat-soluble vitamin naturally present in very few foods, is synthesized when ultraviolet rays from sunlight contact the skin. Research suggests that vitamin D insufficiency may result from lack of exposure to sunlight and ultraviolet-B radiation. Individuals from geographic areas of high latitude and low sunlight exposure may be at increased risk for vitamin D deficiency. Emerging evidence supports the protective role of vitamin D in the prevention of several cancers, including breast, colon, and prostate.

More than one billion people worldwide are estimated to be vitamin D deficient (Lenz, 2009). Vitamin D is a fat-soluble vitamin naturally present in some foods, added to others, and available as a dietary supplement (Institute of Medicine [IOM] Food and Nutrition Board, 2011). Vitamin D is produced when ultraviolet-B (UV-B) rays from sunlight contact the skin. In children, vitamin D deficiency causes rickets, a disease manifested by a failure of bone tissue to mineralize, resulting in bone softening (Wharton & Bishop, 2003). Vitamin D deficiency and insufficiency can result from lack of exposure to sunlight and UV-B rays (IOM Food and Nutrition Board, 2011).

The association between sunlight and vitamin D synthesis first was discovered in 1890, when British researcher Theodore Paline noted that rickets was virtually nonexistent in countries near the equator. His research suggested that the geographic incidence of sunlight exposure had a fundamental relationship with the prevalence of the disease (Mohr, 2009). In the 1930s, U.S. Navy personnel with abundant sunlight exposure reportedly had higher rates of skin cancer but lower rates of other malignancies (Lappe, 2011). In 1937, Windaus, Schenck, and van Warder won the Nobel Prize for discovering the link between UV-B radiation through skin exposure and vitamin D synthesis (Mohr, 2009).

An association between geographic latitude and cancer mortality rates first was reported in 1941 (Lappe, 2011). No additional reports came until 1980, when rates of cancer were found to be notably higher in the northeast United States than in the southwest states. That was attributed to greater sunlight exposure in the southwest mediated by the apparent benefit of sunlight exposure by vitamin D (Garland & Garland, 1980). Rapid advances in vitamin D research began in the 1980s, when the first link between colon cancer risk and vitamin D deficiency was discovered (Mohr, 2009).

Serum concentration of 25(OH)D is the best indicator of vitamin D status. It reflects both vitamin D produced cutaneously and obtained from food and supplements (IOM Food and Nutrition Board, 2011). According to the IOM Food and Nutrition Board (2011), people are at risk for vitamin D deficiency at serum 25(OH)D concentrations less than 30 nmol/L (less than 12 ng/ml). A serum 25(OH)D level of 50 nmol/L represents the needs of almost 98% of the population. Table 1 outlines serum 25(OH)D levels and associated health statuses.

Vitamin D and Cancer

Research indicates that vitamin D status may affect cancer risk, as vitamin D might have a role in the prevention of colon, prostate, and breast cancers and a protective effect with lung cancer (Davis et al., 2007; IOM Food and Nutrition Board, 2011). Although optimal levels of 25(OH)D for cancer prevention have not been established, a mean serum 25(OH)D level of greater than 38 ng/ml has been associated with a 58% lower risk for breast cancer when compared to levels of less than 15 ng/ml (Garland, Gorham, Mohr, & Garland, 2009). Patients with higher vitamin D levels who underwent surgery or cancer treatments for lung cancer in the summer had improved recurrence-free survival (Porojnicu et al., 2007; Zhou et al., 2005). Comparable results were found, along with a 20%–30% reduced mortality rate, when diagnoses occurred in autumn versus winter (Giovannucci, 2009).

The Nurses' Health Study, which evaluated the vitamin D intake of almost 3,500 patients with breast cancer from 1980–1996, found that premenopausal women consuming more than 500 international

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