

What Will They Think of Next? How About Vitamin D Fortified Orange Juice!

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Vitamin D insufficiency is still extremely prevalent in regions of North America that experience long winters, during which sunlight intensity is quite low. Few foods contain vitamin D naturally, so the human body produces it through direct exposure to sunlight, which catalyzes a reaction in the skin that converts 7-dehydrocholesterol to cholecalciferol (vitamin D). Cholecalciferol enters the bloodstream and travels to the liver, where it is converted into 25-hydroxy cholecalciferol, five times more potent than cholecalciferol in terms of vitamin D activity. The 25-hydroxy cholecalciferol is the form of vitamin D measured in the blood to determine patients' vitamin D status.

However, it should be noted that 25-hydroxy cholecalciferol is converted by the kidneys into an even more potent form, 1,25 dihydroxy cholecalciferol or calcitriol (two times more potent than 25-hydroxy cholecalciferol). However, as we age, the conversion of 25-hydroxy cholecalciferol to 1,25 dihydroxy cholecalciferol drops off significantly; this is a contributing factor to the development of osteoporosis in women over 50, and men over 65. Some local tissues can also make 1,25 cholecalciferol for their own internal purposes. In fact, most organ systems have been shown to have vitamin D receptors, including the breast; prostate; gonads; large and small intestinal epithelial cells; kidney; bone; brain; skin; pancreas; and the cells of the immune system.

Thus, in addition to regulating calcium absorption and utilization as it impacts bone density, vitamin D (particularly the local tissue production of 1,25 dihydroxy cholecalciferol) is associated with a reduced risk of breast, prostate, colon and other cancers, as well as multiple sclerosis. Many epidemiological studies indicate that low vitamin D blood levels (vitamin D insufficiency) are correlated with an increased risk of these cancers, as well as multiple sclerosis and osteoporosis, in North Americans.

Experimental data have shown that vitamin D fortification can prevent these diseases in animal models. It also (again, especially local tissue production of 1,25 dihydroxy cholecalciferol) slows the division rate of cells that possess vitamin D receptors and enhances their cellular differentiation (maturation) during development. These two physiological effects are associated with a reduction in cancer development.

Because vitamin D nutritional status has been consistently shown to be insufficient in many northern regions of North America that experience inadequate sunlight intensity for many months of the year, researchers are looking at ways to enhance vitamin D blood levels across the population in an effort to reduce the incidence of osteomalacia; osteoporosis; breast, prostate and colon cancers; and possibly multiple sclerosis.

In the U.S., rates of vitamin D deficiency are highest among elderly and institutionalized adults. Adolescents and young adults are also at risk. A study found that 32 percent of young adults ages 18-29 were vitamin D deficient at the end of the winter in Boston - an example of how prevalent this

problem is in areas of North America above the 40¼ latitude (which essentially divides the U.S. into North and South). In addition, darker-pigmented individuals and Asians have a higher prevalence of vitamin D insufficiency, because their skin is unable to produce vitamin D efficiently on exposure to sunlight.

In recent years, the government has allowed companies to add calcium to juice products (e.g., orange juice) to help address the poor calcium nutritional status also prevalent across North America. This strategy is regarded as successful in terms of making calcium more accessible to a greater number of individuals, especially those who have milk allergies or are lactose intolerant (particularly Asians and Native Americans) and/or those who choose to drink less milk than is recommended by government food guides (i.e., the majority of Americans). In North America, milk is fortified with vitamin D, yielding 100 IU per every eight ounces, although random testing shows that some samples contained only 50 percent of the amounts stated on the containers.

As an alternative, Drs. Vin Tangpricha, Polyxeni Koutkia and Suzanne M. Rieke, et al., set out to see if vitamin D fortified orange juice could be an efficient means of raising serum vitamin D levels in otherwise healthy American adults. As one arm of their study, 14 adults ingested 240 ml of orange juice each day that was fortified with 1,000 IU of vitamin D, and 12 subjects consumed the equivalent amount of unfortified orange juice, for a period of 12 weeks. The subjects consuming the fortified orange juice demonstrated a 150-percent increase in their blood levels of 25-hydroxy cholecalciferol compared to the control subjects, who experienced a 45-percent seasonal increase in their blood levels of 25 hydroxy cholecalciferol, due primarily to increasing seasonal sunlight intensity over the 12-week test period.

These researchers state that fortification of orange juice is an inexpensive approach to ensuring adequate vitamin D nutrition in all children and adults. The U.S. Department of Agriculture reported that 49 percent of the U.S. population over two years of age drinks one or more glasses (240 ml) of a fruit juice daily. These researchers suggest that orange juice be fortified with 100 IU of vitamin D per 240 ml of juice, the same level found in milk products in North America. Their recent study, published in the *American Journal of Clinical Nutrition*, has shown that fortified orange juice is a highly bioavailable source of vitamin D, despite the fact that it contains no fat and that vitamin D is fat-soluble. Studies of this nature are likely to affect government policy regarding future considerations with respect to improving the dismal vitamin D status prevalent across much of North America.

Improving vitamin D status across the population is likely to reduce the incidence of osteoporosis, osteomalacia, the cancers listed above, and possibly multiple sclerosis. Fortification of juice products may be an effective way to achieve this objective. However, it should also be noted that providing patients with a multiple vitamin that contains 400 IU of vitamin D (which is not uncommon) has been shown to raise serum vitamin D levels by 45 nmol/L. Studies suggest that serum levels of approximately 90-120 nmol/L are associated with a significant reduction of osteoporosis; osteomalacia; breast, prostate and colon cancer; and multiple sclerosis. During the winter months, many people living above the 40¼ latitude in North America have vitamin D blood levels between 40-65 nmol/L. Thus, the use of a multiple vitamin and mineral product alone may be of great (yet unrecognized) importance in helping patients prevent or forestall these serious health conditions. In my opinion, this intervention should be looked into more carefully when public policy pertaining to vitamin D status is evaluated and formulated.

Reference

Tangpricha V, Koutkia P, Rieke SM, et al. Fortification of orange juice with vitamin D: a novel approach for enhancing vitamin D nutritional health. *Am J Clin Nutr* 2003;77:1478-83.

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