USANA Technical Bulletin

Vitamin D_3 (Cholecalciferol)

Technical Background

- Vitamin D is a fat-soluble nutrient that plays a central role in bone growth and health.[1] It can be acquired either through the diet or through exposure to sunlight, when ultraviolet light reacts with a form of cholesterol and converts it to vitamin D. Cholecalciferol is the form of vitamin D normally found in humans and the form typically found in nutritional supplements.
- A unique property of vitamin D is that it functions very much like a hormone. Its target tissues in the human body include the kidneys, intestines, and bones, where it acts to regulate calcium and phosphorus homeostasis.[1]
- In the intestines, vitamin D plays an important role in the absorption of calcium. In bone tissue, vitamin D plays a role in regulating calcium deposition (bone mineralization) and mobilization.[1]
- Given the above functions, vitamin D is essential for normal bone development, particularly in children. Without it, bones do not calcify properly, leading to the condition known as "rickets". Vitamin D also plays an important role in tooth development. It is necessary for proper tooth eruption, growth, and ultimate strength.
- Research is currently being done to examine the role of vitamin D and its analogues in inhibiting prostate cancer[2] and breast cancer.[3] Recently, a research team reviewed 63 studies on the relationship between vitamin D and certain types of cancer. In addition to prostate and breast cancer, the majority of studies found a relationship between vitamin D status and lower risk of colon and ovarian cancers as well.[4] In another recent study, women taking a calcium and vitamin D supplement had a 60 percent lower incidence of all cancers than women not taking the supplement.[5]
- Vitamin D intake is especially important for women. In addition to its possible role in breast cancer and osteoporosis prevention,[6] recent studies have found that vitamin D and calcium supplementation in pre-menopausal women may also decrease in the incidence of pre-menstrual syndrome (PMS).[7]
- A recent study found that over half of the women in North America receiving treatment for osteoporosis had an inadequate intake of vitamin D.[8] New research indicates that vitamin D deficiencies are widespread among pregnant women and infants despite prenatal vitamin usage.[9]
- Vitamin D is also being researched for its role as an immune system regulator and modulator,[10,11] for its role in reducing insulin resistance and type-2 diabetes,[12,13] and for its role in healthy heart and lung function.[14,15]

Sources and Recommended Intake

- The Recommended Dietary Allowance (RDA) for vitamin D is 5 micrograms (200 IU) per day for children, and 5-15 micrograms (200-600 IU) per day for adults.[16] These amounts can be obtained with 15-30 minutes of exposure to sunlight on the hands, arms, and face. The use of sunscreens interferes with vitamin D synthesis. Dark skin (i.e. having a high melanin content) requires longer exposure than lighter skin to achieve the same degree of vitamin D synthesis[17]. Furthermore, the capacity of skin to synthesize vitamin D decreases with age.[18]
- The only significant dietary source of vitamin D is fortified milk. Other sources include fish and fish liver oils.[19]
- Although the upper limit established by the Food and Nutrition Board is 2,000 IU (or 50 mcg), many prominent researchers view this a being too restrictive. Human clinical trial data published after the establishment of the UL support a significantly higher UL. Absence of toxicity in trials conducted in healthy adults support the level of 10,000 IU as a more reasonable UL.[20]
- Importantly, the benefits of vitamin D supplementation are achieved only if adequate calcium and phosphorus are provided in the diet.

Abstracts

Augier P and Gandini S. Vitamin D Supplementation and Total Mortality: A Meta-analysis of Randomized Controlled Trials. Arch Intern Med 2007 Sep 10;167(16):1730-7. Ecological and observational studies suggest that low vitamin D status could be associated with higher mortality from life-threatening conditions including cancer, cardiovascular disease, and diabetes mellitus that account for 60% to 70% of total mortality in high-income countries. We examined the risk of dying from any cause in subjects who participated in randomized trials testing the impact of vitamin D supplementation (ergocalciferol [vitamin D(2)] or cholecalciferol [vitamin D(3)]) on any health condition. METHODS: The literature up to November 2006 was searched without language restriction using the following databases: PubMed, ISI Web of Science (Science Citation Index Expanded), EMBASE, and the Cochrane Library. RESULTS: We identified 18 independent randomized controlled trials, including 57 311 participants. A total of 4777 deaths from any cause occurred during a trial size-adjusted mean of 5.7 years. Daily doses of vitamin D supplements varied from 300 to 2000 IU. The trial size-adjusted mean daily vitamin D dose was 528 IU. In 9 trials, there was a 1.4- to 5.2-fold difference in serum 25-hydroxyvitamin D between the intervention and control groups. The summary relative risk for mortality from any cause was 0.93 (95% confidence interval, 0.87-0.99). There was neither indication for heterogeneity nor indication for publication biases. The summary relative risk did not change according to the addition of calcium supplements in the intervention. CONCLUSIONS: Intake of ordinary doses of vitamin D supplements seems to be associated with decreases in total mortality rates. The relationship between baseline vitamin D status, dose of vitamin D supplements, and total mortality rates remains to be investigated. Population-based, placebo-controlled randomized trials with total mortality as the main end point should be organized for confirming these findings.

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