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Vitamin D: A D-Lightful Health Supplement

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Welcome to our new section on complementary and alternative medicine (CAM). The editorial board for *Nutrition in Clinical Practice* has recognized that many patients and nutrition practitioners are using nutraceuticals as adjunctive therapies for a number of health problems. Eisenberg et al¹ first reported the widespread use of CAM, which approximated 33% of the U.S. population in 1998. Since their seminal report, we have observed a grassroots movement driven by consumers who are choosing to pay out of pocket for alternative healthcare practitioners to prevent and treat chronic disease. Because nutrition specialists are frequently asked by patients about herbal preparations and nutraceuticals, we will emphasize supplements in an evidence-based format.

The next 3 issues of “CAM Corner” will focus on the role of vitamin D in gastrointestinal disease and highlight the proceedings on this topic held at Digestive Disease Week on June 1, 2009, in Chicago, Illinois.

What Is Vitamin D?

Vitamin D, which is actually more a hormone than a vitamin, is used by the body for many vital functions and to prevent disease, although it is mostly known for its role in maintaining a strong skeleton. It also targets more than 2000 genes and helps regulate brain growth and function. It is manufactured by the body from sunshine and is difficult to obtain from food. Because many people experience vitamin D deficiency even with regular exposure to sun, scientists now urge routine blood testing for deficiency and supplementation when needed, which could apply to much of the population.² There are 2 types of

vitamin D found in supplements: vitamin D₂ from plant sources (ergocalciferol), and vitamin D₃ from animal sources and sun (cholecalciferol). Vitamin D₃ is the better absorbed form of vitamin D.

Health Claims

Many health claims have been attributed to vitamin D, including lower risks of certain cancers,³⁻⁵ autoimmune disease,⁶ cardiovascular disease,⁷ and all-cause mortality.^{8,9} However, most nutrition specialists agree that although the role of vitamin D in health and disease is one of the hottest topics in nutrition, it is also one of the most controversial. We are in the “golden age” of research on solar ultraviolet-B (UVB) irradiance and vitamin D, and new findings on vitamin D are reported weekly. At the time of this writing, there are 45,700 total hits on PubMed for vitamin D and 1,033 for 2009 alone.

Vitamin D Levels

Normal acquisition of vitamin D occurs through direct exposure to sunlight, which induces the production of cholecalciferol (vitamin D₃). Vitamin D can also be ingested orally as either ergocalciferol (vitamin D₂) or cholecalciferol (vitamin D₃). Interpretation of 25-(OH) D levels has been a point of controversy for clinicians. Most, if not all, agree that 25-(OH) D levels > 200 ng/mL are potentially toxic (causing hypercalcemia or hyperphosphatemia), whereas levels < 11 ng/mL represent overt deficiency that is associated with symptoms (rickets). However, the definition of desirable and adequate levels spurs contention among experts.¹⁰ Most laboratories define “adequacy” as ≥ 30 ng/mL. However, many experts believe that 25-(OH) D levels of 50-80 ng/mL are required to achieve prevention of chronic diseases, such as autoimmune disease and cancer.¹¹

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Prevalence of Vitamin D Deficiency

Holick¹¹ estimates that 1 billion people worldwide have vitamin D deficiency or insufficiency. In the United States, the majority of postmenopausal women taking medication for osteoporosis have inadequate vitamin D status. Likewise, most elderly men and women in the U.S. and Europe (nursing home) have inadequate vitamin D levels. For example, a 70-year-old person produces only a quarter of vitamin D of what a 20-year-old produces. Some patients fail to improve their vitamin D status even after supplementation. DNA testing points to frequent mutation on the vitamin D receptors, in which case much higher doses of vitamin D are needed for therapeutic effect.

Because factors such as geography, exposure to solar radiation, age, and skin color affect vitamin D status, the prevalence of vitamin D deficiency will vary among populations in a given country. For example, in the United States, the prevalence of vitamin D deficiency during the winter months is higher in New England than in Florida.¹² Finally, the vitamin D status of patients in the hospital setting is frequently overlooked. In the U.S., the prevalence of low vitamin D status has been reported to be 57%, with low intake, UVB exposure, use of anticonvulsants, low serum albumin level, and winter season as predictors.¹³

Food Sources

Individuals with inadequate sun exposure should seek out the foods presented in Table 1, which have the highest levels of vitamin D.

Drug Interactions

The ability of medications to interfere with the absorption, metabolism, or action of vitamin D is a frequently overlooked factor in both the hospital and outpatient clinic setting. Anticonvulsant medications have been shown to decrease the activity of vitamin D.¹⁴ Bile acid sequestrants used for lowering cholesterol have been reported to reduce the absorption of the fat-soluble vitamins A, D, E, and K.¹⁵ Heparin, an anticoagulant, may interfere with vitamin D levels.¹⁶ Vitamin D has been shown to interfere with calcium channel blockers used for chest pain, unusual heart-beat, or high blood pressure.¹⁷ Thiazide diuretics, which are frequently prescribed for hypertension and fluid overload states, have been shown to interact synergistically with vitamin D to increase calcium blood levels to above normal.¹⁸ Finally, corticosteroids have been demonstrated to impair vitamin D function, and low vitamin D status has been reported to impair the actions of corticosteroids in treating inflammatory bowel disease.¹⁹

Table 1. Foods That Have the Highest Levels of Vitamin D

Sun-dried shiitake	21,400 IU (100 g or 3.5 oz)
Shiitake, fresh	100 IU (100 g)
Shiitake, dried	1660 IU (100 g)
Cod liver oil	1360 IU (1 Tbsp)
Sockeye salmon	740 IU ^a (4 oz)
Chinook salmon	400 IU ^a (4 oz)
Pink salmon, canned	624 IU (100 g or 3.5 oz)
Sardines	250 IU (1.75 oz)
Shrimp	160 IU ^a (4 oz)
Milk	100 IU ^a (8 oz)
Sunflower seeds	92 IU (3.5 oz)
Cod	60 IU (4 oz)
Eggs	25 IU (1 whole)

^aThe George Mateljan Foundation. *World's Healthiest Foods: Vitamin D*. <http://www.whfoods.com/genpage.php?tname=nutrient&dbid=110>. Accessed February 6, 2009.

Summary

- Vitamin D has classic calcemic actions that are critical to a healthy skeleton, as well as noncalcemic actions that support vital bodily functions (cardiovascular, immune).
- The definition of vitamin D adequacy remains controversial; however, 25-(OH) D levels > 30 ng/mL are recommended to support classic calcemic actions, whereas many investigators cite 50-80 ng/mL as optimal for disease prevention via nonclassical pathways (cardiovascular, immune).
- There appears to be a pandemic of vitamin D deficiency, more notable in regions with poor UVB exposure. Other risk factors include being elderly or dark skinned, wearing excessive sunblock, having a diet poor in vitamin D-containing foods, taking anticonvulsant medications, and being bed-bound or in the hospital setting. Oily fish and shiitake mushrooms are overlooked food sources that are rich in vitamin D.

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