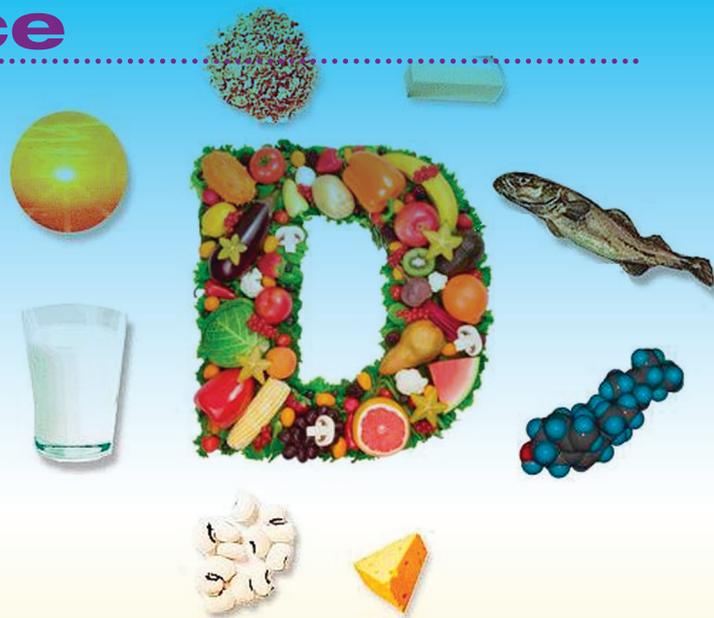


Vitamin D: A Research Update



By Gene Bruno, MS, MHS

Arguably more human research on vitamin D has been conducted in the last five years than any other nutrient. According to a PubMed search, in 2012 alone there were 128 human clinical studies published in scientific journals on vitamin D. In fact, the new and ongoing research on vitamin D is so prolific, that by the time I have finished writing this article it will not reflect the current state of vitamin D science. That being said, this article will review some of the significant areas of vitamin D research.

Vitamin D Functions

Vitamin D is the “sunshine vitamin,” so coined because exposure to the sun’s ultraviolet (UV) light will convert a form of cholesterol under the skin into vitamin D. This nutrient is best known for its role in helping to facilitate the absorption of calcium and phosphorus (as well as magnesium), and so helping to promote bone health.¹ In addition, vitamin D: 1) inhibits the uncontrolled proliferation of cells (as in the case of cancer) and stimulates the differentiation of cells (specialization of cells for specific functions)², 2) is a potent immune system modulator³, 3) plays a role in insulin secretion under conditions of increased insulin demand⁴ and 4) may be important for decreasing the risk of high blood pressure via the renin-angiotensin system’s regulation of blood pressure.⁵ Furthermore, research on vitamin D suggests that it has many other contributions to make to human health.

Deficiency & Insufficiency

Outright vitamin D deficiency is present in 41.6 percent of the U.S. population⁶,

while vitamin D insufficiency (i.e., lacking sufficient vitamin D) is present in 77 percent of the population.⁷ If you are deficient in vitamin D, you will not be able to absorb enough calcium to satisfy your body’s calcium needs.⁸ It has long been known that severe vitamin D deficiency has serious consequences for bone health, but other research indicates that lesser degrees of vitamin D deficiency are common and increase the risk of osteoporosis and other health problems.^{9,10}

Vitamin D sufficiency is measured by serum 25-hydroxyvitamin D levels in the body.¹¹ Laboratory reference ranges for serum 25-hydroxyvitamin D levels are based upon average values from healthy populations. However, recent research examining the prevention of secondary hyperparathyroidism and bone loss suggest that the range for healthy 25-hydroxyvitamin D levels should be considerably higher. Based upon the most current research, here are the ranges for serum 25-hydroxyvitamin D values:

- **Less than 20-25 nmol/L:** Indicates severe deficiency associated with rickets and osteomalacia.^{12,13}
- **50-80 nmol/L:** Previously suggested as normal range.¹⁴
- **75-125 nmol/L:** More recent research suggests that parathyroid hormone^{14,15} and calcium absorption¹⁶ are optimized at this level; this is a healthy range.¹⁷

Based upon the 75-125 nmol/L range, it is estimated that one billion people in the world are currently vitamin D deficient.¹⁸ Furthermore, research indicates that supplementation with at least 800-1,000 IU daily are required to achieve

serum 25-hydroxyvitamin D levels of at least 80 nmol/L.^{19,20}

Vitamin D2 & D3

There are two forms of vitamin D available as a dietary supplement: cholecalciferol (vitamin D3) and ergocalciferol (vitamin D2). Cholecalciferol is the form made in the human body, and it is more active than ergocalciferol. In fact, vitamin D2 potency is less than one third that of vitamin D3.²¹ Commercially, ergocalciferol is derived from yeast, and so is considered vegetarian, while cholecalciferol is derived from lanolin (from sheep) or fish oil.

Bone Health

Without sufficient vitamin D from sun exposure or dietary intake, intestinal calcium absorption cannot be maximized. This causes PTH secretion by the parathyroid glands; elevated PTH results in increased bone resorption, which may lead to osteoporotic fracture.²² A prospective cohort study that followed more than 72,000 postmenopausal women in the U.S. for 18 years found that those who consumed at least 600 IU/day of vitamin D from diet and supplements had a 37 percent lower risk of osteoporotic hip fracture than women who consumed less than 140 IU/day of vitamin D.²³ The results of most clinical trials suggest that vitamin D supplementation can slow bone density losses or decrease the risk of osteoporotic fracture in men and women who are unlikely to be getting enough vitamin D.

However, recent analyses indicate that there is a threshold of vitamin D intake that is necessary to observe

reductions in fracture risk. For instance, a recent meta-analysis of randomized controlled trials in older adults found that supplementation with 700-800 IU vitamin D daily had a 26 percent and 23 percent lower risk of hip fracture and nonvertebral fracture, respectively. In contrast, supplementation with 400 IU of vitamin D daily did not decrease risk of either hip or nonvertebral fracture.²⁴ Bischoff-Ferrari et al. suggest that daily intakes of greater than 700 IU of vitamin D may be necessary to optimize serum concentrations of 25-hydroxyvitamin D and thus reduce fracture risk.²⁵

In addition, oral supplementation with vitamin D prevents corticosteroid-induced osteopenia (bone mineral density that is lower than normal but not low enough to be classified as osteoporosis) and osteoporosis.²⁶

Falls in Older Adults

Individuals with a vitamin D deficiency have a higher risk of experiencing falls.^{27,28} However, falls can be reduced by 22 percent in older adults if they are taking vitamin D supplements. This reduction in risk does not seem to be related to calcium supplementation, although some experts think a combination of calcium and vitamin D may be the best choice.²⁹ The combination of vitamin D and calcium seems to prevent falls by decreasing body sway and systolic blood pressure instead of increasing bone mass strength.³⁰

The Immune System

It has been more than 20 years since the first appreciation that vitamin D can exert effects on cells of the immune system. Since then, substantial literature has accumulated to suggest that these effects are exerted on multiple immune cell types, are predominantly suppressive at pharmacologic levels and are potent enough to have true therapeutic potential in the management or prevention of immune-mediated diseases.³¹ This includes evidence that vitamin D may help reduce inflammation, prevent susceptibility to chronic bacterial infections and serve as a vaccine adjuvant enhancing antibody-mediated immunity³², and act as a chemopreventive agent against several malignancies including cancers of the prostate and colon.³³ In fact, a dose-response analysis estimated that 1,000 IU of oral vitamin D daily would lower one's risk of colorectal cancer by 50 percent.³⁴

There is also a diverse and rapidly growing body of epidemiological, climatological, genetic, nutritional and biological evidence³⁵ indicating that the vitamin D endocrine system functions in the establishment and/or maintenance of immunological self-tolerance (i.e., prevention of autoimmune disease). Studies done in animal models of multiple sclerosis (MS), insulin-dependent diabetes mellitus (IDDM), inflammatory bowel disease (IBD) and transplantation support a model wherein vitamin D₃ may support the function of suppressor T cells that maintain self-tolerance to organ-specific self-antigens, preventing an autoimmune reaction. This is consistent with population-based research has shown that long-term supplementation with vitamin D may decrease the risk of MS in women by up to 40 percent³⁶, and that older women who have a higher intake of vitamin D from foods or supplements tend to have a lower risk of developing rheumatoid arthritis (an autoimmune disease).³⁷

Insulin Function

Research³⁸ on women with type 2 diabetes found that they were not only low in vitamin D during winter months, but that supplementation with 1,332 IU daily for one month significantly increased insulin secretion by 34.3 percent and resulted in a decrease of 21.4 percent in insulin resistance. In other research³⁹, type 2 diabetics supplemented with vitamin D experienced significant improvements in insulin secretion and serum calcium levels, as well as a reduction in free fatty acids.

PMS

Increasing total or dietary intake of vitamin D is associated with a decreased risk of developing premenstrual syndrome (PMS). Women who consume an average of 706 IU daily of vitamin D appear to have about a 40 percent lower risk of developing PMS in comparison to women consuming 112 IU daily of vitamin D.⁴⁰

Depression in the Elderly

In older adults (aged 65-95 years), researchers found that vitamin D levels were 14 percent lower in subjects with major and minor depression, compared to non-depressed individuals. Likewise, parathyroid hormone levels were five percent and 33 percent higher in people with minor and major depression, compared to non-moody individuals.⁴¹

In older people the prevalence of minor depression is 13 percent, which is relatively high.

Urinary Tract Disorders

Research data from 2,387 men who participated in the 2005-06 cycle of the National Health and Nutrition Examination Survey, indicated that vitamin D insufficiency and deficiency are highly prevalent among adult men in the U.S., and vitamin D deficiency is associated with moderate-severe urinary infections and lower urinary tract symptoms (e.g., benign prostatic hyperplasia, or BPH).⁴²

Weakness of the pelvic muscles is referred to as a pelvic floor disorder (PFD). Women with PFD may have problems controlling their bladders. Research has shown that vitamin D levels were significantly lower for women reporting at least one pelvic floor disorder and for those with urinary incontinence, whereas higher vitamin D levels are associated with a decreased risk of pelvic floor disorders in women.⁴³ Similar results were found in other research on women with PFD.⁴⁴

Ideal Vitamin D Dosing

The Linus Pauling Institute recommends that generally healthy adults take 2,000 IU of supplemental vitamin D daily.⁴⁵ The Vitamin D Council states that if well adults and adolescents regularly avoid sunlight exposure, then it is necessary to supplement with at least 5,000 IU of vitamin D daily.⁴⁶ The Council for Responsible Nutrition recommends 2,000 IU daily for adults.⁴⁷ Taking a conservative position, at least 2,000 IU of vitamin makes sense for adults.

For a full list of references, visit www.vitaminretailer.com.

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