

Orentreich
Foundation for the
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Vital Longevity™

September 2005

Vitamin D

Until Coco Chanel made having one fashionable, a tan signified lower class status because it was associated with outdoor labor and field work. Conversely, having pale skin indicated upper class status with its associated fully-clothed body, including gloves and parasol. Coco's fashion precedent conceivably had two medical consequences: more sun-induced skin damage, but healthier levels of Vitamin D (the metabolic pathway of which is shown in Figure 1).

Bones & Sunshine

Although cod liver oil (rich in Vitamin D) was empirically known for three centuries to keep bones healthy, the first scientific publication on the relationship between sunlight and bone health was in 1822 and was based upon the different incidence of rickets in children living in Warsaw vs in the countryside. In 1890 another paper described the discrepancy between the pandemic of rickets in undernourished children growing up in Europe's sooty, smoggy industrial cities vs its relative rarity in undernourished Indian and Chinese children; the paper recommended a sunbathing cure. The advent of the mercury arc lamp in 1919 advanced the technology of UV exposure. By the '30s many foods (including beer) were fortified with Vitamin D. Unfortunately, erratic quality control led to cases of Vitamin D intoxication (see below), and most fortification fell by the wayside.

Not Just for Bones

More recently the negative consequences of Vitamin D deficiency from inadequate sun exposure or supplementation have expanded beyond rickets to include pandemic osteoporosis (especially spine and hip fractures), low bone mass, deteriorated bone microarchitecture, skeletal fragility, tooth loss, and adult rickets.

Vitamin D, though called a vitamin, is really, depending on its form, a pro-hormone or hormone. Yes, it regulates calcium and phosphorus metabolism and therefore bone mineralization (its first known hormonal effect), but now it is known that it affects other metabolic systems and is influenced by them. Appropriate levels of Vitamin D beneficially affect blood pressure, glucose levels, immune system function, and responses to inflammatory stimuli. In recent years, Vitamin D deficiency has been correlated with a variety of other risks (Table 1).

For example, it is noteworthy that the incidence of prostate, breast, and colon cancers is higher in latitudes that provide less sunlight.

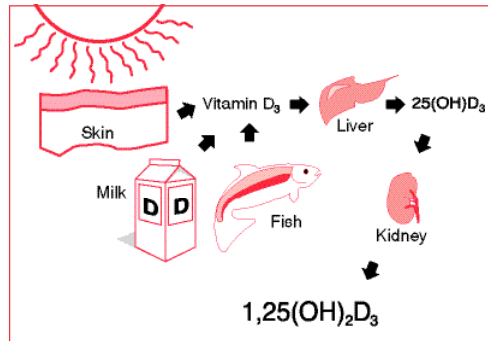


Figure 1.

Adapted from MF Hollick, *Am J Clin Nutr* 2004; 80(suppl):1678S-88S

Pandemics & Food

Fortification of foods with necessary nutrients has proven to be a valuable public health measure. For example, many readers will recall that the birth defect spina bifida was correlated with insufficient folic acid in the diet of pregnant women. This correlation resulted in the fortification of many foods, especially cereals, with folic acid, and a subsequent dramatic reduction of the incidence of this tragic birth defect. (Folic acid is basic Vitamin B and should not be confused with B₆ or B₁₂, which have their own important roles.)

Like Vitamin B before, there is considerable evidence to suggest that there would be a substantial public health benefit from broad reintroduction of Vitamin D fortification. Although one can encourage people to eat more of the few foods naturally high in Vitamin D and the lone routinely fortified food (Table 2), it is unlikely that diet alone will provide adequate intake to guard against the increasing list of consequences of Vitamin D deficiency. When foods are fortified, Vitamin D₃ is the preferred form; it is long-lasting and approximately 3 times more potent than Vitamin D₂, the plant form of Vitamin D typically used in soy milks.

Vitamin D Deficiency Correlated with Increased Risk of:

- Autoimmune disease, *e.g.*, rheumatoid arthritis
- Cancer: prostate, colon, breast, ovarian, non-Hodgkin's lymphoma, squamous cell carcinoma of the skin
- Cardiovascular disease, *e.g.*, cardiomyopathy
- Falling due to decreased nerve and muscle function
- Fibromyalgia and persistent, non-specific musculoskeletal pain
- Hypertension
- Increased pain and disability from osteoarthritis
- Irritable Bowel Syndrome
- Multiple Sclerosis
- Nervous system dysfunction
- Pre-menstrual syndrome
- Type II diabetes and Metabolic Syndrome

Table 1.

RDA (Recommended Daily Allowance)

There is growing consensus that the current RDA of 400-600 IU for Vitamin D is insufficient (multivitamins typically have 400 IU). Research suggests that the RDA be raised to 600-800 IU for those over 70 and to a minimum of 1000 IU (2000 IU is unlikely to cause harm) for any adult with no sun exposure (e.g., the homebound, elderly, those regularly wearing full-body dress). Meeting such requirements is likely only to be achieved with supplementation; calcium should accompany supplementary Vitamin D because they work in concert. (Calcium comes in various forms; the carbonate form is more digestible with food, but many find the citrate and gluconate forms quite digestible without food. Calcium RDA is 1200-1500 mg/day from all sources; since humans cannot efficiently absorb more than 500-600 mg at a time, doses should be divided.)

The Simple Sun Solution

Vitamin D toxicity from excessive sun exposure is almost inconceivable (see below), but we all know that excess sun exposure has a host of negative skin consequences needing no repeating.

However, the sun provides a straightforward, inexpensive way to get adequate Vitamin D without compromising healthy skin. It's just a matter of making sure you expose your arms-legs or hands-arms-face 2-3 times/week for 5-15 minutes before applying sunblock. The combination of frequency and duration should be adjusted for amount of skin exposed and sun intensity. Intensity varies by time of day, season, latitude, and a number of other factors (Table 3). Winter doses of sunlight are only sufficient in the most southern latitudes of the US. (For perspective, enough sun exposure in a bathing suit to pinken the skin yields 10,000-25,000 IU.)

Aging is an important factor in the Sun Solution. Ultraviolet exposure (specifically UVB) works by converting 7-dehydrocholesterol in the skin to pre-Vitamin D₃ and about 80% of this conversion takes place in the epidermis. The

amount of epidermal 7-dehydrocholesterol decreases with age, and between 18 and 80 there is a two-fold decrease in the amount of pre-Vitamin D₃ produced by the skin's response to sun exposure. This aging effect is further complicated by the aging kidneys becoming less able to make the ultimately utilized form, 1,25(OH)₂D₃. Of course, calcium supplementation is still needed with the Sun Solution.

Please note: Because of confusion in the lay press, we clearly state that the Sun Solution for Vitamin D production encourages routine prophylactic use of sunblock after the very limited exposure necessary for adequate production of Vitamin D by the

epidermis in response to UVB. Also, avoid tanning salons (they use UVA light); they assault cutaneous health and cause premature dermal aging.

What is Enough? Too Much?

The current goal is a blood level greater than or equal to 50 ng/mL of 25(OH)D₃; this is the form of the vitamin in the blood that best reflects stable, overall Vitamin D status because the level of 25(OH)D₃ is independent of recent incidental variables, e.g., diet, sun, or supplements. When you have your annual checkup and associated blood tests, ask for this test to assess your Vitamin D health status. However you choose to get your Vitamin D, get enough.

It is difficult to achieve toxic blood levels of Vitamin D₃, but it can occur; symptoms include nausea/vomiting, poor appetite, constipation, weakness, and weight loss. Vitamin D₃ intoxication levels range from 150 to 400 ng/mL.

While the current 'upper limit of normal' for a typical 25(OH)D₃ assay is 50 ng/mL (some think it should be more like 80 ng/mL), keep in mind that lifeguards and sunbathers can have levels around 100 ng/mL without D₃ intoxication. It is worth noting that, although excessive sun exposure does increase the risk of skin cancer and melanoma, it is estimated that 40,000+ Americans died prematurely each year (1970-94) from cancer associated with inadequate UVB/Vitamin D. Again, however you choose to get your Vitamin D, get enough—and enough calcium.

Good Food Sources of Vitamin D (USRDA = 400-600 IU)

- Catfish (cooked, 3 oz) ~ 500 IU
- Cod liver oil (1 teaspoon) ~ 450 IU
- Salmon/Mackerel (cooked, 3½ oz) ~ 350 IU
- Sardines (canned in oil, 1¾ oz) ~ 250 IU
- Tuna (canned in oil, 3 oz) ~ 200 IU
- Fortified foods including milk & some brands of orange juice ~ 100 IU

Table 2.

Conditions Decreasing Efficacy of Intentional Sun Exposure

- Shortened day length
- Increasing northern latitude
- Morning or late afternoon exposure
- Naturally darker pigment gradations
- Increasing age
- Cloud cover
- Pollution/smog

Table 3.

INFORMATION FOR DONORS

The Orentreich Foundation for the Advancement of Science, Inc., was founded in 1961. OFAS is a non-profit institution dedicated to biomedical research to prevent, halt, or reverse those disorders that decrease the quality or length of life. It is duly registered with the US Internal Revenue Service as an Operating Private Foundation under Section 4942(j)(3).

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