

Vitamin D and You

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What is Vitamin D?

Vitamin D is a fat-soluble vitamin produced in the body when ultraviolet rays from sunlight strike the skin. At least 75 per cent of the body's supply comes from conversion of 7-dehydro-cholesterol in the skin. This molecule is then converted in the liver to 25-OH vitamin D₃, the major form circulating in the blood. Functioning as an endocrine gland, the kidneys further process 25-OH vitamin D₃ to its active metabolite, 1 α ,25-OH-D₃. Receptors for this hormone-like substance are present in nearly every organ. Lack of exposure to sunlight is the main cause of vitamin D deficiency.



Why should I be tested?

Serum (blood) concentrations reflect the amount of vitamin D produced through the skin and obtained through foods and supplements. There is no way to know for certain if you have adequate levels without a test. The minimal acceptable therapeutic level for both children and adults is 50 ng/mL. Below that level, the body uses vitamin D as quickly as it is made; above that level, vitamin D can be stored for future use. The optimal range is between 50 and 80ng/mL year round. Levels greater than 200ng/mL are considered toxic.* Everyone, from infants to seniors, need to be tested regularly.

*Blood tests for 25-OH vitamin D are reported in both nanograms per milliliter (ng/mL) and nanomoles per liter (nmol/L). **Ex: 1 ng/mL = 2.5 nmol/L** **Ex: 32ng/mL = 80nmol/L**

Vitamin D for bones; what else?

Over the past 25 years, more than 5,000 scientific papers have been published describing the impact of vitamin D and its metabolites on health. Here are just a few studies showing the effects of inadequate vitamin D level.

Adults:

1. **Increased the risk of recurrent upper respiratory infections, especially in persons with asthma and chronic obstructive pulmonary disease (COPD).** REF: *Archives of Internal Medicine*, Vol. 169 No. 4, February 23, 2009
2. **Increased incidence of colds and flu during winter season.** REF: *Epidemiological Infection* 134: 1129-40, Dec. 2006

3. **Increased risk of epidemic influenza.** REF: *Epidemiology Infections* Dec; 134(6) 1129-40. 2006
4. **Increased risk of heart attack in men.** REF: *Archives of Internal Medicine*. Vol. 168 No. 11, June 9, 2008
5. **Increased risk of preeclampsia in pregnancy.** REF: *The Journal of Clinical Endocrinology & Metabolism* Vol. 92, No. 9 3517-3522. 2007
6. **Increased likelihood of having an unscheduled a cesarean section.** REF: *Journal of Clinical Endocrinology & Metabolism*, doi:10.1210 /jc. 2008-1217. Dec 2008
7. **Increased problems with blood sugar dysregulation in Type-2 diabetes.** REF: *The Journal of Clinical Endocrinology & Metabolism* Vol. 92, No. 6 2017-2029. 2007
8. **Increased incidence of chronic pain and need for pain medication.** REF: *American Society of Anesthesiologists 2007 Annual Meeting in San Francisco, California, October 13-17, 2007*
9. **Substantially increased incidence of colon, breast, ovarian, renal, pancreatic, aggressive prostate and other cancers.** REF: *Annals of Epidemiology*. Volume 19, Issue 7, Pages 468-483. July, 2009

Adolescents and children:

1. **Abnormal weight gain and stunted growth in adolescent girls.** REF: *The Journal of Clinical Endocrinology & Metabolism* Vol. 94, No. 1 67-73. 2009
2. **Weakened muscles and decreased power in adolescent girl athletes.** REF: *The Journal of Clinical Endocrinology & Metabolism* Vol. 94, No. 2 559-563. 2009
3. **Increased incidence risk of asthma exacerbations in children on inhaled corticosteroids.** REF: *Pediatric News*. Volume 42, Issue 7, Page 28. July, 2008
4. **Increased risk of high blood pressure, high blood sugar and metabolic syndrome in teenagers.** REF: *Reported at the American Heart Association's 49th Annual Conference on Cardiovascular Disease Epidemiology and Prevention, March, 2009*
5. **Low vitamin D may be the cause of asthma.** REF: *Current Opinion: Allergy Clinical Immunology* Jun;9(3):202-7. 2009

Infants

1. **Weaker bones in infants when maternal vitamin-D levels are low in third trimester.** REF: *The Lancet*, 2006, Vol 367, pp 36-43
2. **The majority (78%) of young infants diagnosed with vitamin D deficiency present with seizures.** REF: *The American Society for Nutritional Sciences J. Nutrition*. 135:279-282. February, 2005

What about Sunshine?

The public has been urged to avoid the sun and use sun-blocking agents beginning in 1971 to reduce the risk of skin cancer and melanoma. Usage peaked in 2004, when an estimated 72 percent of Americans were shown to be using a sunscreen when going outdoors. *REF: Skin & Allergy News, July 1, 2005*

Using sunscreen to protect from the sun's harmful rays may not be a good trade-off. Sunscreen doesn't protect against melanoma, the most dangerous form of skin cancer and using a sunscreen with as little as SPF15 cuts the skin's vitamin D production by 99 percent, leading to deficiency. A very report found that nearly 64 percent of Americans surveyed are unaware sunscreen hinders the body's ability to produce vitamin D.

Twenty to 30 minutes of daily sun exposure is essential to create vitamin D. However, very little, if any, vitamin D can be synthesized in the skin from November to February in persons living north of the 37 degrees latitude, a line extending from San Francisco to south of Washington DC. This makes testing and supplementation very important.

What about living in sunshine states or countries?

A study of 1,192 persons living in either Tucson or Phoenix, Arizona addressed that specific question. Blood was drawn each season and on average, only 22.3 percent of these persons had a 25-OH vitamin D level $>30\text{ng/mL}$. Those most deficient were blacks and Hispanics. Unfortunately, the study did not assess levels between 31- 50ng/mL or above. I suspect only a small fraction, if any, were in the ideal therapeutic range. Don't be fooled; have a blood test to know for sure. *REF: Am J Clinical Nutrition. Mar;87(3):608-13. 2008*



What about babies?

Infants, like adults, can only obtain vitamin D from sunshine when there is adequate UV-B available. In a 1987 study done in Cincinnati, Ohio, infants were found to have a 25-OH vitamin D level of 41-45 ng/mL in the summer, but sank to a dismal 21 ng/mL in the winter. Infants born during the winter had an average level of only 16 ng/mL one month after birth. *REF: Journal of Pediatrics, 110(5): 744-747.1987*

With levels this low, infants could certainly be at higher risk for influenza and even pertussis, especially if the infant's mother is deficient. Research has shown that from the time of birth, infants require 400IU/day. Mothers need at least 4,000 IU per day to be sufficient for their exclusively breastfed infant.

REF: Am J Clinical Nutrition. Aug;88(2):520S-528S.2008

Should I take Vitamin D₂ or Vitamin D₃?

Vitamin D supplements are available as either Vitamin D₂ (ergocalciferol) or Vitamin D₃ (cholecalciferol). Vitamin D₂ is not a naturally occurring vitamin. It is manufactured by radiating a fungus that contains fat-like substances called sterols. Vitamin D₂ is available in prescription pills and as injections. Take these products with caution, if at all.

Vitamin D₃ is the naturally occurring form of the vitamin and is essential for life. Its molecular structure is similar the body's steroid hormones, e.g. cortisol, estradiol, progesterone, aldosterone, and testosterone. Cholesterol is the precursor substance for these hormones and for vitamin D₃. Without adequate sunshine, D₃ supplementation is important. The manufacturing process is complex. It typically starts by extracting cholesterol from the lanolin of sheep wool and through a patented purification process, is converted to active D₃. When purchasing supplements, be sure the product is vitamin D₃, cholecalciferol.



How much is too much?

Most people who have been taking vitamins and supplements have memorized that the correct vitamin D dosage is 400IU/day and have concerns about vitamin D intoxication when taking dosages above that level. It appears that we have been so concerned about toxicity, we have made everyone "vitamin D phobic", resulting in serious deficiency.

In 1999, researcher Reinhold Vieth, PhD challenged the medical community to produce any evidence that taking 10,000 units of vitamin D per day was toxic. He stated, "*Throughout my research, I was amazed at the lack of evidence supporting statements about the toxicity of moderate doses of vitamin D.*"

Animal data suggest that toxicity can occur by the ingestion of 0.5 mg/kg (20,000 IU per kg). That would be equivalent to a 110-pound adult taking 176,000,000 IU or 440,000 of the 400IU capsules, hardly a possibility, even in an intentional overdose. Dr. Vieth agreed that long term, daily consumption of

approximately 40,000 IU/day (100 of the 400 IU capsules) can result in toxicity reflected in blood levels >200ng/mL. The Vitamin Council offers this great quote, “Living in America today while worrying about vitamin D toxicity is like dying of thirst in the desert while worrying about drowning.” *REF: The Truth about Vitamin D Toxicity. www.VitaminDCouncil.org.*

Should some persons be cautious taking Vitamin D?

Like any medicine, supplement or activity, some persons can have a reaction to too much of a good thing. Persons with hyperparathyroidism, and conditions such as sarcoidosis, granulomatous TB, and some cancers (specifically, oat cell carcinoma of the lung and non-Hodgkin's lymphoma) should not take vitamin D except when under the care of a knowledgeable physician who regularly monitors your blood levels of 25-OH vitamin D.

For that reason, while rare, persons over 60 years of age or those with undiagnosed health problems should consult a knowledgeable physician before adding vitamin D to a daily supplement program.

Food Sources for Vitamin D

Most foods contain very little vitamin D, so increasing levels needs to come from the sun or from supplementation.

FOOD	QUANTITY	Units per dose
Cod liver oil	1 tablespoon	1,360IU
Salmon, cooked	3.5 ounces	360 IU
Sardines, in oil	1.75 ounces	250 IU
Fortified O.J.	1 cup	140 IU
Fortified milk	1 cup	98 IU
Fortified yogurt	6 ounces	80 IU
Whole egg	1 egg	20 IU

Guidelines for Vitamin D supplementation in healthy persons^{^^}

Age	Ideal Range**	Normal Daily Dose
Birth to 6 months	>40ng/mL [^]	400IU/day
6 months to 5year	>50ng/mL [^]	1,000*IU per each 20lbs/day
5 year to 12 year	>60ng/mL	3-4000 IU/day
12 year to adult	>60ng/mL	5000 IU/day
Pregnant	>60nm/mL	6,000 IU/day
Dark skinned adults	>60ng/mL	5-6,000 IU/day

* One capsule at 1,000 IU is equivalent to 0.025 mg

** Higher levels of >30 ng/ml (or >75 nmol/L) as desirable for overall health and disease prevention

[^]Estimates vary. The medical literature recommends a level of >30ng as a “normal” level

^{^^} Daily supplements should also include a good probiotic and vitamin C 20mg/pound

Guidelines for Vitamin D supplementation at first sign of illness^{^^}

Age	Daily Dose for 7 days
Birth to 6 months	800IU/day
6 months to 3year	10,000IU/day
3 year to 5 year	25,000IU/day
5 year to 12 year	50,000 IU/day
12 year to adult	100,000 IU/day
Pregnant	25,000 IU/day
Dark skinned adults	100,000 IU/day

^{^^}For children 5-12 years, also include Vitamin A 50,000IU/day for three days

^{^^}For persons 12 years and over, include Vitamin A 100,000IU/day for three days

DISCLAIMER: These dosages are guidelines only. Blood testing is essential as a baseline, with recommended follow up testing at 3 months and 9 months after starting this regimen. Consult your physician for further discussion to determine the right amount of vitamin D for you.