

Vitamin D: From Sunshine to Supplements

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Vitamin D, the “sunshine vitamin,” is known for its role in building and maintaining strong bones. But nutrition science is still unfolding, and many studies are now looking at vitamin D’s role in health and disease prevention. At the same time, current research shows that **more than three out of every four Americans** have inadequate vitamin D levels.

Vitamin D is unique among vitamins because it is made in the human body when skin is exposed to ultraviolet (UV) light in the sun’s rays. **We get vitamin D from very few foods.**

Naturally occurring vitamin D is found in:

- certain yeasts and plants
- oily fish – mackerel, tuna, sardines, salmon, and cod-liver oil

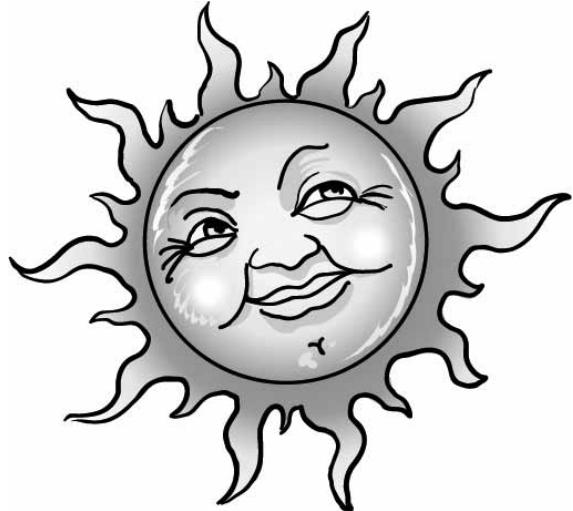
Smaller amounts of vitamin D are found in beef liver and egg yolks.

Fortified foods are major dietary contributors of vitamin D:

- milk
- butter
- some ready-to-eat cereals, bread, yogurt, and orange juice

Many vitamin supplements contain vitamin D, either as a single nutrient or as part of a multiple vitamin pill.

International Units — the unit of measure for vitamin D and other nutrients.



The sun’s role

Humans make vitamin D in their skin in the presence of sunlight. Five to 30 minutes of direct summer sun exposure twice a week is equal to a light-skinned person taking 20,000 IU of vitamin D orally.

Throughout the history of human life, vitamin D needs have been met by the sun. **Humans typically obtain 90 percent of their vitamin D from sunlight.** Over time, however, many things have changed the body’s ability to produce enough vitamin D.

Factors affecting vitamin D levels

Indoor living — The benefits from access to sunlight and its vitamin D-producing effects have greatly decreased as smog, the shade of tall buildings, and indoor work and play decrease regular access to the sun.

Sunscreen — Wearing sunscreen to protect from overexposure to the sun's harmful rays is an important health precaution. However, sunscreen blocks the body's ability to make vitamin D.

Season and latitude — Winter sunlight (from December to February in Kansas) is too indirect for vitamin D formation in most of the middle and northern United States. UV exposure is strongest in areas at or near the equator. Stored levels of vitamin D drop during winter months, and experts believe immunity drops as a result. This could explain why winter is "cold and flu" season.

Overweight/obesity — Body fat interferes with how vitamin D is formed and stored in the body. Persons who are obese (BMI of 30 or greater) are more likely to be deficient of vitamin D than persons with a lower BMI, because the vitamin is "trapped" in fat stores and unavailable for the body's use.

Age — As people age (50 and older), they are less able to produce vitamin D due to lower levels of pre-vitamin D in the skin.

Skin color — Persons with dark skin produce vitamin D at a lower rate than persons with lighter skin because of more pigment, *melanin*, in dark skin. Research is examining if this could explain why certain illnesses, such as high blood pressure or end-stage renal disease, strike non-Hispanic black persons more frequently than other racial groups.

Breastfeeding — Infant vitamin D requirements cannot *typically* be met



Oily fish, such as salmon, is a source of vitamin D.

by human milk alone. Breast milk varies in the amount of vitamin D it contains, but experts believe this is due to low levels of vitamin D in the mother, which lead to low levels of vitamin D in her breast milk.

A recent increase in nutritional rickets, especially in African American infants and children, led the American Academy of Pediatrics to recommend **400 IU of vitamin D each day, beginning at birth to age 1**. This *doubling* of previous recommended intake levels for infants was implemented to combat rickets – the classic vitamin D deficiency disease.

Why the interest in vitamin D?

In addition to its vital role in bone health, vitamin D continues to be studied for a wide variety of possible health benefits. As a hormone, vitamin D binds to receptor cells in the body, which in turn have the ability to control a far-reaching range of hormone and gene-expressing processes. These processes influence a vast number of the body's health responses. Here are some current areas of vitamin D research:

Vitamin D and immunity — Vitamin D plays an important role in keeping the body's immune system healthy. If the body is low on vitamin D, scientists believe it is less able to fight off infections and diseases. Adequate vitamin D is needed to prevent **autoimmunity** — The abnormal response of the immune system that causes the body to attack its own cells and tissues. Research focuses on the role of vitamin D deficiency in several autoimmune diseases, including rheumatoid arthritis and multiple sclerosis.

Vitamin D and cancer — Vitamin D regulates a number of genes in several cancers, including prostate, colon, and breast cancers. Other studies appear to suggest that low levels of the vitamin may not only affect the outcome of a cancer diagnosis, but may even play a role in the *cause* of certain cancers.

Vitamin D and diabetes — Adequate vitamin D appears to play an important role in improving the body's sensitivity to insulin, thereby lowering the risk of diabetes. Not only may vitamin D prevent or delay the onset of diabetes, recent research also shows that vitamin D may reduce complications for those already diagnosed.

How much vitamin D do people need?

Vitamin D is required throughout life, from before birth through old age. New daily recommendations are:

- Infants to age 1: 400 IU
- Children 1 to 18 years: 600 IU
- Adults age 19 to 70: 600 IU
- Adults age 71+: 800 IU

Tolerable upper levels of intake —

The upper levels of vitamin D are at the high end of the safety scale and should **not** be misunderstood as amounts people need or should try to consume. The Institute of Medicine encourages adults to stay below 4000 IU per day, from both food and supplements, to avoid the risk of harm.

Self-help steps to boost vitamin D levels

What can you do to protect your health and avoid vitamin D deficiency? Some tips for self care.

Talk to your doc. Many health-care providers recommend a simple lab test to determine vitamin D level. Your doctor can determine if vitamin D supplements are right for you.

Let the sun shine! While moderate exposure to sun is an ideal way to increase vitamin D levels for many people, too much unprotected sun exposure is known to lead to skin cancer. Experts in vitamin D research believe five to 30 minutes, twice a week, of direct sun on exposed skin **without** sunscreen allows light-skinned persons to manufacture ample vitamin D. Persons with dark skin may require up to three times as much sun exposure. Ask your health-care provider how much sunlight exposure is right for you.

Focus on food. The foods listed on page 1 are natural and fortified sources of vitamin D. Read the Nutrition Facts label. If vitamin D is added to a food, you will see it on the label.

Mind your meds. Several medications have the potential to increase the

destruction of vitamin D in the body. These include corticosteroids such as prednisone, which impairs vitamin D metabolism. The weight-loss drug orlistat (brand names *Xenical* and *alli*), and the cholesterol-lowering drug cholestyramine (brand names *Questran*, *LoCholest*, and *Prevalite*) can reduce vitamin D absorption. Individuals taking these medications should discuss vitamin D levels and intake with their health-care provider.

Research will be ongoing to determine the optimal amount of vitamin D needed. Vitamin D will remain in the news. The Institute of Medicine committee assessing Dietary Reference Intakes (DRIs) released results of their report on vitamin D recommendations in November 2010.

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References and Resources

Office of Dietary Supplements. National Institutes of Health. *Dietary supplement fact sheet: Vitamin D*. Updated 12/11/08. Retrieved October 15, 2009, from http://ods.od.nih.gov/factsheets/VitaminD_pf.asp

Wagner C.L., Taylor S.N., Hollis, B.W. (2008). "Does vitamin D make the world go 'round?" *Breastfeeding Medicine* 3 (4), 239-250.

Wagner C.L., Greer, F.R., Section on Breastfeeding and Committee on Nutrition (2008). "Prevention of rickets and vitamin D deficiency in infants, children, and adolescents." *Pediatrics* 122(5), 1142-1152.

Linus Pauling Institute, Micronutrient Research for Optimum Health. (2008, January). "Vitamin D." Retrieved Nov, 17, 2009, from <http://lpi.oregonstate.edu/infocenter/vitamins/vitaminD>

University of California-Riverside (1999). *History of vitamin D*. Retrieved October 13, 2009, from <http://vitamind.ucr.edu/history.html>

Vitamin D Council. *Understanding vitamin D cholecalciferol*. Retrieved January 13, 2010, from <http://www.vitamindcouncil.org>

Institute of Medicine of the National Academies (2010). Report brief. *Dietary reference intakes for calcium and vitamin D*. Retrieved November 30, 2010, from <http://www.iom.edu>



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