

HEALTH AND HUMAN SCIENCES

Vitamin D: What You Need to Know

James C. Fleet, Ph.D., Professor,
Department of Nutrition Science



What is vitamin D?

Vitamin D is a nutrient required for optimal bone health and essential for overall health. The vitamin can be found in two forms: vitamin D3, the form of vitamin D your skin makes in response to sun exposure, found in a few foods naturally, added to other foods, and as a dietary supplement, and vitamin D2, the form available in dietary supplements and added to certain foods. It is measured in international units (IU) where 1 IU is 0.025 micrograms of vitamin D.

No single recommendation for adequate sunlight exposure can be made for people, because the amount of vitamin D3 produced from sun exposure varies based on skin type, use of skin protection, length of sun exposure, season of the year, and time of day (Table 1).

Advanced readers can try to calculate their own vitamin D production at:
http://nadir.nilu.no/~olaeng/fastrt/VitD_quartMEDandMED.html

In a place like Indiana, your skin makes very little vitamin D during the winter, even if your skin is fair.

Why is vitamin D important to your health?

Vitamin D is a crucial part of the way your body handles the essential nutrients calcium and phosphorus in your diet. As a result, it is critical to the development and maintenance of bone strength.

Children who don't get enough vitamin D can develop weak, rubbery bones, a condition known as rickets. Lack of vitamin D is also one of many things that can contribute to osteoporosis, the brittle bone disease that leads to an increased risk of fracture in older people.

New research is showing vitamin D may also help prevent other chronic diseases. Higher vitamin D levels in a person's blood may protect against certain types of cancers, strengthen the immune system, and reduce risk of type 1 and 2 diabetes.

Table 1. Amount of vitamin D3 produced from sun exposure under clear skies in Indianapolis, Ind., (39° N latitude; 86° W longitude).

Skin type	% body exposed	Length of exposure*	Time to sunburn	Season	Time of day	International Units (IU) of vitamin D ₃
Fair	25	9 min	20 min	Summer	noon	2000
Medium	25	16 min	44 min	Summer	noon	2000
Very Dark	25	38 min	85 min	Summer	noon	2000

*Limit sun exposure to the skin to lower the risk of skin cancer.

Are you getting enough vitamin D?

Your vitamin D status (the amount of vitamin D in your blood) is determined by measuring 25-hydroxyvitamin D levels in the blood. This is reported to your doctor in either nanomoles per liter (nmol/L) or nanograms per milliliter (ng/mL, which is nmol/L divided by 2.5). The requirements for how much vitamin D you need to stay healthy are set by the Institute of Medicine’s Food and Nutrition Board based on the strength and quality of current scientific evidence.

There is some controversy regarding what value is considered deficient. Everyone agrees that blood levels less than 25 nmol/L (10 ng/ml) are very low and that people with blood levels below this need more vitamin D (Table 2). If your blood level is less than 37.5 nmol/L (15 ng/mL), you are at risk for having a problem. The average blood level seen in the United States is around 60 nmol/L (24 ng/mL). Some researchers believe you need serum levels greater than 80 nmol/L (32 ng/mL) to get optimal health benefits from vitamin D. However, a recent report from the federal government says there isn’t enough evidence for this, yet.

Table 2. Landmarks for assessing vitamin D status base on 25-hydroxyvitamin D levels in the blood.

Vitamin D (nmol/L)*	Vitamin D (ng/mL)*	Status
Less than 25	Less than 10	Deficient
Less than 37.5	Less than 15	Inadequate
Greater than 50	Greater than 20	Adequate
Greater than 80	Greater than 32	Proposed “optimal”
Greater than 250	Greater than 100	Potential toxicity

*Blood levels are expressed in nanomoles per liter (nmol/L) and nanograms per milliliter (ng/mL)

What factors affect the amount of vitamin D you need?

Because vitamin D can be made in your skin, the amount you need from your diet can change based on your exposure to the sun. A number of things can block vitamin D production in skin: having dark skin tones, covering exposed skin, or using sunscreen. Even the glass in your windows filters out UV rays from the sun and prevents your skin from making vitamin D. Also, as you age, your skin changes in ways that makes it harder

for your body to make vitamin D. Finally, the further north you live, the more your body’s ability to make vitamin D is affected by the season. For example, in Indiana, you can’t make much vitamin D in your skin from October through March due to the filtering of the atmosphere and the angle of the sun. In the winter, the right UV rays from the sun just don’t reach you.

Regardless of the reasons, the less your skin makes vitamin D, the more vitamin D you need to get from your diet or from other sources. In particular, people who are institutionalized (especially the elderly), those with dark skin tones, and people who cover their skin for religious reasons should get their vitamin D status tested. Exclusively breastfed infants should receive a vitamin D supplement.

How much vitamin D do you need?

The Dietary Reference Intake (DRI) for vitamin D was set based on bone health outcomes (Table 3). An expert panel reviewed the research on how vitamin D affects bone health and set the vitamin D requirement for the various age groups and populations.

Table 3. Recommended vitamin D intakes for individuals.

Life stage	Average daily recommended amounts in International Units (IU)
Birth to 12 months	400
Children 1–13 years	400
Teens 14–18 years	600
Adults 19–50 years	600
Adults 51–70 years	600
Adults 71 years and older	800
Pregnant and breastfeeding women	600

Aside from sunlight, what are other sources for vitamin D?

Other sources of vitamin D include food and supplements. However, very few foods are naturally rich in vitamin D. Foods that are sources of vitamin D include: salmon, sardines, eggs, fortified milk, fortified orange juice, and fortified cereal (Table 4).





While these foods provide vitamin D, people do not typically consume most of these foods every day. While in a given day you might eat a combination of these foods to meet the requirement, day in and day out most people won't consume what they need. Because of this, many people may need to take a vitamin D supplement.

Table 4. Food sources of vitamin D.

Food	Vitamin D (IU)
Egg, whole, cooked, hard-boiled, 1 large	44
Cereal, ready-to-eat, ¾–1 cup	40 or more
Orange juice, fortified with vitamin D, ½ cup	68
Milk, fluid, with vitamin D added, 1 cup	108–128
Sardines, canned in oil, 3 ounces	164
Salmon (sockeye), cooked, 3 ounces	447

Source: USDA National Nutrient Database for Standard Reference, Release 24, www.nal.usda.gov/fnic/foodcomp/search

In the last couple of years, many multivitamin-mineral supplements have increased the amount of vitamin D in the supplement to 800 IU/day, which will meet the vitamin D requirement for every age group. If after talking with your doctor you decide you need more vitamin D, don't just take another multivitamin pill; there are other substances in the multivitamin supplements that could affect you adversely if you take too much. There are many options on the market for a separate vitamin D supplement. You will find the vitamin D in two forms, vitamin D2 and vitamin D3.

Both work well if taken every day. Some recommend vitamin D3, because it is the form that your skin makes in response to sunlight.

Are there any safety concerns with taking a vitamin D supplements?

For healthy people, supplementing with vitamin D is safer than people used to think. The recommended upper limit for safe intake of vitamin D is 4000 IU per day for an adult (Table 5). Some research suggests even higher levels may be safe. Too much vitamin D causes high blood calcium levels. Most of the symptoms of vitamin D toxicity are general, for example, loss of appetite, weight loss, nausea, and weakness. These symptoms start to occur when 25-hydroxyvitamin D levels in the blood rise to greater than 250 nmol/L.



Table 5. Recommended upper levels of intake for vitamin D.

Life stage	Recommended upper intake level in International Units (IU)
Birth to 6 months	1000
6 months to 12 months	1500
Children 1-3 years	2500
Children 4-8 years	3000
All other groups	4000

As with other dietary supplements, vitamin D might interact with other medicines or supplements you may be taking. Talk to your healthcare provider before you start taking any new supplement.

Where can I get more information about vitamin D?

- Office of Dietary Supplements
<http://ods.od.nih.gov/factsheets/VitaminD-QuickFacts/>
- The Linus Pauling Institute Micronutrient Information Center
<http://lpi.oregonstate.edu/infocenter/vitamins/vitaminD/>
- The Institute of Medicine
www.iom.edu/vitaminD

Reviewers

Reviewers of the content of this publication were:

Connie M. Weaver, PhD, Distinguished Professor and Head, Department of Nutrition Science, Purdue University, West Lafayette, Ind.

John Scott Radcliffe, PhD, associate professor, Department of Animal Sciences, Purdue University, West Lafayette, Ind.

Lisa Graves, MS, RD, Extension specialist, Department of Nutrition Science, Purdue University, West Lafayette, Ind.

Richard J. Wood, PhD, associate professor, Department of Nutrition, University of Massachusetts, Amherst, Mass.

Donna Vandergraff, MS, RD, Extension specialist, Department of Nutrition Science, Purdue University, West Lafayette, Ind.

Georgia Wagner, MA, RD, CD, Extension educator, Wayne County, Ind.

Vitamin D: Purdue Research Impacts You

Faculty in the Department of Nutrition Science at Purdue are national leaders in discoveries related to vitamin D. Some of the research efforts include:

- exploring the relationship between diet, vitamin D status, and prostate and breast cancer prevention.
- investigating vitamin D regulation and muscle mass function.
- helping set vitamin D requirements for adolescents.
- determining the genetic profile of vitamin D receptors.
- studying vitamin D regulation of colon cancer.

For more about the research, visit www.purdue.edu/hhs/nutr



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