

Dietary Supplement Fact Sheet

Vitamin D: Consumer Fact Sheet

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What is vitamin D and what does it do?

Vitamin D is a nutrient found in some foods that is needed for health and to maintain strong bones. It does so by helping the body absorb calcium (one of bone's main building blocks) from food and supplements. People who get too little vitamin D may develop soft, thin, and brittle bones, a condition known as rickets in children and osteomalacia in adults.

Vitamin D is important to the body in many other ways as well. Muscles need it to move, for example, nerves need it to carry messages between the brain and every body part, and the immune system needs vitamin D to fight off invading bacteria and viruses. Together with calcium, vitamin D also helps protect older adults from osteoporosis. Vitamin D is found in cells throughout the body.

How much vitamin D do I need?

The amount of vitamin D you need each day depends on your age. Average daily recommended amounts from the Food and Nutrition Board (a national group of experts) for different ages are listed below in International Units (IU):

Infants 0-12 months	200 IU
Children 1-18 years	200 IU
Adults 19-50 years	200 IU
Adults 51-70 years	400 IU
Adults 71 years and older	600 IU
Pregnant and lactating women	200 IU

For infants, children, and adolescents, the American Academy of Pediatrics advises daily intakes of 400 IU, twice the official recommendation of 200 IU.

What foods provide vitamin D?

Very few foods naturally have vitamin D. Fortified foods provide most of the vitamin D in American diets.

- Fatty fish such as salmon, tuna, and mackerel are among the best sources.
- Beef liver, cheese, and egg yolks provide small amounts.
- Mushrooms provide some vitamin D. In some mushrooms that are newly available in stores, the vitamin D content is being boosted by exposing these mushrooms to ultraviolet light.
- Almost all of the U.S. milk supply is fortified with 400 IU of vitamin D per quart. But foods made from milk, like cheese and ice cream, are usually not fortified.
- Vitamin D is added to many breakfast cereals and to some brands of orange juice, yogurt, margarine, and soy beverages; check the labels.

One can get recommended amounts of vitamin D by eating a variety of foods with plenty of fortified milk and fatty fish.

Can I get vitamin D from the sun?

The body makes vitamin D when skin is directly exposed to the sun, and most people meet some or all of their vitamin D needs this way. Skin exposed to sunshine indoors through a window will not produce vitamin D.

Not much sun is needed to make enough vitamin D. During the warmest months, for example, as little as 5-30 minutes of exposure between 10 AM and 3 PM, several times a week to the face, arms, legs, or back without sunscreen may be enough.

However, despite the importance of the sun to vitamin D synthesis, it is prudent to limit exposure of skin to sunlight in order to lower the risk for skin cancer. When out in the sun, wear protective clothing and apply sunscreen with an SPF (sun protection factor) of 8 or more. Tanning beds also cause the skin to make vitamin D, but pose similar risks for skin cancer.

The energy from the sun is not enough for the skin to make vitamin D during the coldest months in the northern half of the United States—above a line drawn between Boston and the northern border of California. Cloudy days, shade, and having dark-colored skin also cut down on the amount of vitamin D the skin makes.

People who avoid the sun, who cover their bodies with sunscreen or clothing, or who live in the northern half of the United States during the winter months should include good sources of vitamin D in their diets or take a supplement.

What kinds of vitamin D dietary supplements are available?

Vitamin D is found in supplements (and fortified foods) in two different forms: D2 (ergocalciferol) and D3 (cholecalciferol). Both increase vitamin D in the blood, but the D3 form may do it better and keep levels raised for a longer time. Many supplements now provide vitamin D3 instead of D2.

Am I getting enough vitamin D?

Because vitamin D can come from sun, food, and supplements, the best measure of one's vitamin D status is blood levels of a form known as 25-hydroxyvitamin D. Levels are described in either nanograms per milliliter (ng/mL) or nanomoles per liter (nmol/L), where 1 ng/mL = 2.5 nmol/L.

In general, levels below 15 ng/mL (37.5 nmol/L) are too low for bone or overall health, and levels above 200 ng/mL (500 nmol/L) are too high. It's not yet clear, but some nutrition experts think a blood level of at least 30 ng/mL (75 nmol/L) is best for overall good health.

By these measures, some Americans are vitamin D deficient and almost no one has levels that are too high. In general, young people have higher blood levels of 25-hydroxyvitamin D than older people and males have higher levels than females. By race, non-Hispanic blacks tend to have the lowest levels and non-Hispanic whites the highest. The majority of Americans have blood levels lower than 30 ng/mL (75 nmol/L).

Certain other groups may not get enough vitamin D:

- Breastfed infants, since human milk is a poor source of the nutrient. The American Academy of Pediatrics advises that exclusively and partially breastfed infants be given a supplement of 400 IU of vitamin D each day.
- Older adults, since their skin doesn't make vitamin D when exposed to sunlight as efficiently as when they were young, and their kidneys are less able to convert vitamin D to its active form.
- People with dark skin, because their skin has less ability to produce vitamin D from the sun.
- People with disorders such as Crohn's disease or celiac disease who don't handle fat properly, because vitamin D needs fat to be absorbed.
- Obese people, because their body fat binds to some vitamin D and prevents it from getting into the blood.

What happens if I don't get enough vitamin D?

People can become deficient in vitamin D because they don't consume enough or absorb enough from food, their exposure to sunlight is limited, or their kidneys cannot convert vitamin D to its active form in the body. In children, vitamin D deficiency causes rickets, where the bones become soft and bend. It's a rare disease but still occurs, especially among African American infants and children. In adults, vitamin D deficiency leads to osteomalacia, causing bone pain and muscle weakness.

What are some effects of vitamin D on health?

Vitamin D is being studied for its possible connections to several diseases and medical problems, including diabetes, hypertension, and autoimmune conditions such as multiple sclerosis. Two of them discussed below are bone disorders and some types of cancer.

Bone disorders

As they get older, millions of people (mostly women, but men too) develop, or are at risk of, osteoporosis, where bones become fragile and may fracture if one falls. It is one consequence of not getting enough calcium and vitamin D over the long term. Supplements of both vitamin D3 (at 700-800 IU/day) and calcium (500-1,200 mg/day) have been shown to reduce the risk of bone loss and fractures in elderly people aged 62-85 years. Men and women should talk with their health care providers about their needs for vitamin D (and calcium) as part of an overall plan to prevent or treat osteoporosis.

Cancer

Some studies suggest that vitamin D may protect against colon cancer and perhaps even

cancers of the prostate and breast. But higher levels of vitamin D in the blood have also been linked to higher rates of pancreatic cancer. At this time, it's too early to say whether low vitamin D status increases cancer risk and whether higher levels protect or even increase risk in some people.

Can vitamin D be harmful?

Yes, when amounts in the blood become too high. Signs of toxicity include nausea, vomiting, poor appetite, constipation, weakness, and weight loss. And by raising blood levels of calcium, too much vitamin D can cause confusion, disorientation, and problems with heart rhythm. Excess vitamin D can also damage the kidneys.

The safe upper limit for vitamin D is 1,000 IU/day for infants and 2,000 IU for children and adults. Vitamin D toxicity almost always occurs from overuse of supplements. Excessive sun exposure doesn't cause vitamin D poisoning because the body limits the amount of this vitamin it produces.

Are there any interactions with vitamin D that I should know about?

Like most dietary supplements, vitamin D may interact or interfere with other medicines or supplements you might be taking. Here are several examples:

- Prednisone and other corticosteroid medicines to reduce inflammation impairs how the body handles vitamin D, which leads to lower calcium absorption and loss of bone over time.
- Both the weight-loss drug orlistat (brand names Xenical and Alli) and the cholesterol-lowering drug cholestyramine (brand names Questran, LoCholest, and Prevalite) can reduce the absorption of vitamin D and other fat-soluble vitamins (A, E, and K).
- Both phenobarbital and phenytoin (brand name Dilantin), used to prevent and control epileptic seizures, increase the breakdown of vitamin D and reduce calcium absorption.

Tell your doctor, pharmacist, and other health care providers about any dietary supplements and medicines you take. They can tell you if those dietary supplements might interact or interfere with your prescription or over-the-counter medicines, or if the medicines might interfere with how your body absorbs, uses, or breaks down nutrients.

Where can I find out more about vitamin D?

- [Office of Dietary Supplements Health Professional Fact Sheet on Vitamin D.](#)
- [Office of Dietary Supplements Vitamin D QuickFacts.](#)
- [MedlinePlus, Vitamins@.](#)
- [Vitamin D Content of Selected Foods Per Common Measure.](#)
- For more advice on buying dietary supplements, see the Office of Dietary Supplements Frequently Asked Questions: [Which brand\(s\) of dietary supplements should I purchase?](#)
- For information on the government's food guidance system, see [MyPyramid](#).

This fact sheet by the Office of Dietary Supplements provides information that should not take the place of medical advice. Talk to a doctor, registered dietitian, pharmacist, or other qualified health care provider before taking dietary supplements. They can tell you if dietary supplements are right for you and what effects they could have if you take them with other dietary supplements or medicines.

Glossary

absorption - In nutrition, the process of moving protein, carbohydrates, fats, and other nutrients from the digestive system into the bloodstream. Most absorption occurs in the small intestine.

American Academy of Pediatrics - AAP. An organization of pediatricians (medical doctors who specialize in the development, care, and diseases of children) that works to improve the health and well-being of infants, children, adolescents, and young adults.

autoimmune disease - A condition in which the body recognizes its own tissues as foreign and directs an immune response against them.

bacteria - Single-celled organisms that are too small to be seen without a microscope. Bacteria are found everywhere and may be helpful or harmful.

breast cancer - Uncontrolled growth of abnormal cells in the breast.

calcium - A mineral found throughout the body. Calcium is needed for healthy bones and teeth, for nerves and enzymes to function properly, and for blood clotting. Calcium is found in some foods, including milk, yogurt, and cheese, and in Chinese cabbage, kale, broccoli and fortified foods, such as many drinks, tofu, and cereals.

cancer - A group of diseases in which cells divide abnormally and without control, and spread to nearby tissues and other parts of the body. Without treatment, cancer can stop organs from working normally, damage body systems, and cause the patient to die. Cancer may be caused by multiple factors, such as radiation, sunlight, tobacco, certain viruses, and poisonous chemicals; however, the cause of many cancers is unknown.

celiac disease - An autoimmune disorder in which eating gluten (a protein found in wheat, rye, barley, and possibly oats) causes the immune system to damage the small intestine, making it unable to absorb nutrients. It is a genetic disease that sometimes becomes active for the first time after surgery, pregnancy, childbirth, viral infection, or extreme stress. Also called sprue.

cell - The individual unit that makes up the tissues of the body. All living things are made up of one or more cells, which are the smallest units of living structure capable of independent existence.

cholesterol - A substance found throughout the body. It is made by the liver and is an important component of cells. Cholesterol is also used to make hormones, bile acid, and vitamin D. Foods that come from animals contain cholesterol, including eggs, dairy products, meat, poultry and fish. High blood levels of cholesterol increase a person's chance (risk) of developing atherosclerosis and heart disease.

colon cancer - Uncontrolled growth of abnormal cells in the large intestine (the tube-like organ connected to the small intestine at one end and the anus at the other).

constipation - A condition in which stool becomes hard, dry, and difficult to pass and bowel movements happen infrequently. Other symptoms may include painful bowel movements and feeling bloated, uncomfortable, and sluggish.

consume - To eat or drink.

Crohn's disease - A long-lasting (chronic) disease that causes severe irritation in the gastrointestinal tract. It usually affects the lower small intestine (called the ileum) or the colon, but it can affect any part of the digestive tract from the mouth to the anus. It is painful, causing severe watery or bloody diarrhea, and may lead to life-threatening complications. Crohn's disease is a form of inflammatory bowel disease.

deficiency - An amount that is not enough; a shortage.

diabetes - A disease in which blood sugar (glucose) levels are high because the body is unable to use glucose properly. Diabetes occurs when the body does not make enough insulin, which helps the cells use glucose, or when the body no longer responds to insulin.

dietary supplement - A product that is intended to supplement the diet. A dietary supplement contains one or more dietary ingredients (including vitamins, minerals, herbs or other botanicals, amino acids, and other substances) or their components; is intended to be taken by mouth as a pill, capsule, tablet, or liquid; and is identified on the front label of the

product as being a dietary supplement.

disorder - In medicine, a disturbance of normal functioning of the mind or body. Disorders may be caused by genetic factors, disease, or trauma.

disorientation - A mental state marked by confusion about time, place, or who one is.

drug - Any substance (other than food) that is used to prevent, diagnose, treat, or relieve symptoms of a disease or abnormal condition. Also, a substance that alters mood or body function or that can be habit-forming or addictive, especially a narcotic.

epilepsy - A group of disorders that sometimes disrupts proper communication between brain cells, causing a seizure (a sudden change in behavior due to excessive electrical activity in the brain). It usually occurs in young children and the elderly. Epilepsy can be caused by abnormal brain development, brain damage, illness, tumors, or strokes. Often the cause is not known.

fat soluble - Able to be dissolved in fat.

fortify - To add nutrients to a food during processing or to replace nutrients lost when a food product is produced or stored. This process is sometimes called enrichment. For example, when calcium is added to processed orange juice, the orange juice is said to be "fortified with calcium." Another example is adding folic acid to flour.

fracture - A break, for example, a bone fracture.

fragile - Easily broken.

health care provider - A person who supplies health care services. Health care providers include individuals with professional training (including doctors, nurses, technicians, and aides).

heart rhythm - The regular beating of the heart as it moves blood throughout the body.

high blood pressure - A blood pressure measurement of 140/90 mmHg (millimeters of mercury) or higher is considered high blood pressure (hypertension). Blood pressure is the force of blood pushing against the walls of the arteries. Blood pressure measurements are written as two numbers, for example 120/80. The first number (the systolic pressure) measures the pressure when the heart beats and pumps out blood into the arteries. The second number (the diastolic pressure) measures the pressure when the heart is at rest between beats. High blood pressure is a condition that occurs when a person's blood pressure often measures above 140/90 or regularly stays at that level or higher. This condition usually has no symptoms but can be life-threatening. It damages the arteries and increases the chance of stroke, heart attack, kidney failure, and blindness. Also called hypertension.

immune system - A group of organs and cells that defends the body against infection, disease, and altered (mutated) cells. It includes the thymus, spleen, lymphatic system (lymph nodes and lymph vessels), bone marrow, tonsils, and white blood cells.

infant - A child younger than 12 months old.

inflammation - Redness, swelling, pain, and/or a feeling of heat in an area of the body. It is a protective reaction to injury, disease, or irritation of tissues.

interaction - A change in the way a dietary supplement acts in the body when taken with certain other supplements, medicines, or foods, or when taken with certain medical conditions. Interactions may cause the dietary supplement to be more or less effective, or cause effects on the body that are not expected.

International Unit - IU. A measurement used to measure the activity of some vitamins and other biological substances (such as enzymes and hormones).

kidney - One of two organs that remove waste from the blood (as urine). The kidneys also make erythropoietin (a substance that stimulates red blood cell production) and help regulate blood pressure. The kidneys are located near the back under the lower ribs.

label - When referring to dietary supplements, information that appears on the product container, including a descriptive name of the product stating that it is a "supplement"; the name and place of business of the manufacturer, packer, or distributor; a complete list of ingredients; and each dietary ingredient contained in the product. Supplements must also include directions for use, nutrition labeling in the form of a Supplement Facts panel that

identifies each dietary ingredient contained in the product and the serving size, amount, and active ingredients.

milligram - mg. A measure of weight. It is a metric unit of mass equal to 0.001 gram (it weighs 28,000 times less than an ounce).

multiple sclerosis - A disorder of the central nervous system marked by weakness, numbness, and loss of muscle coordination. It also causes problems with vision, speech, and bladder control. Multiple sclerosis is thought to be an autoimmune disease in which the body's immune system destroys myelin, a substance that insulates nerves and helps transmit nerve signals.

neuron - A nerve cell. Neurons send chemical and electrical messages throughout the nervous system that direct the body to function, move, think, and have emotions.

nutrient - A chemical compound in food that is used by the body to function and maintain health. Examples of nutrients include proteins, fats, carbohydrates, vitamins, and minerals.

nutrition - The process of eating, digesting, and absorbing nutrients (such as protein, carbohydrate, fat, vitamins, minerals, and water) from food to maintain the body, grow new cells, repair tissues, and supply energy. Nutrition is also the science of food, diet, and health.

obesity - A condition characterized by an excessive amount of body fat. Obesity can be assessed by calculating the body mass index (BMI). (BMI is a number that estimates the amount of body fat on a person, based on weight and height. In adults, a BMI of 30 or higher indicates obesity. Some people, such as bodybuilders or other athletes with a lot of muscle, can be overweight without being obese. See: overweight.

osteomalacia - A condition in adults in which bones become soft and deformed because they don't have enough calcium and phosphorus. It is usually caused by not having enough vitamin D in the diet, not getting enough sunlight, or a problem with the way the body uses vitamin D. Symptoms include bone pain and muscle weakness. When the condition occurs in children, it is called rickets.

osteoporosis - A condition in which bones become weak and brittle, increasing the chance they may break.

pancreatic cancer - Uncontrolled growth of abnormal cells in the pancreas, an organ behind the stomach that makes pancreatic juices to help digest food, and several hormones, including insulin.

pharmacist - A person licensed to make and dispense (give out) prescription drugs and who has been taught how they work, how to use them, and their side effects.

prescription - A written order from a health care provider for medicine, therapy, or tests.

prevent - To stop from happening.

prostate cancer - Uncontrolled growth of abnormal cells in the prostate (a gland in the male reproductive system found below the bladder and in front of the rectum). Prostate cancer usually occurs in older men.

prudent - Wise; using good judgment.

rickets - A condition in children in which bones become soft and deformed because they don't have enough calcium and phosphorus. It is caused by not having enough vitamin D in the diet or by not getting enough sunlight. In adults, this condition is called osteomalacia.

risk - The chance or probability that a harmful event will occur. In health, for example, the chance that someone will develop a disease or condition.

seizure - Sudden changes in behavior caused by excessive electrical activity in the brain.

sign - An indication of disease that can be seen and/or measured. Examples include high fever, high blood pressure, infection, and coughing up blood.

skin cancer - Cancer that forms in tissues of the skin. Most skin cancers form in older people on parts of the body exposed to the sun or in people who have weakened immune systems.

soy - A plant that produces beans used in many food products. Soy products contain isoflavones (estrogen-like substances) that are being studied in the prevention of cancer, hot flashes that occur with menopause, and osteoporosis (loss of bone density). Also called soya and soybean. Latin name: *Glycine max*.

SPF - Sun protection factor. A scale for rating the level of sunburn protection in sunscreen products. The higher the SPF, the more sunburn protection it gives.

status - The state or condition. For example, a person's vitamin B12 status is measured by doing a laboratory test on a blood sample.

sunscreen - A substance that helps protect the skin from the sun's harmful rays. Sunscreens reflect, absorb, and scatter ultraviolet A and ultraviolet B light to provide protection against both types of light. Using lotions, creams, or gels that contain sunscreens can help protect the skin from premature aging and damage that may lead to skin cancer.

supplement - A nutrient that may be added to the diet to increase the intake of that nutrient. Sometimes used to mean dietary supplement.

synthesis - Creating something new by putting together separate parts (such as, chemicals). For example, sunlight is needed for vitamin D synthesis in the skin.

toxic - Having to do with poison or something harmful to the body. Toxic substances usually cause unwanted health effects.

toxicity - The degree to which something is poisonous (toxic).

treat - To care for a patient with a disease by using medicine, surgery, or other approaches.

ultraviolet light - Invisible rays that are part of the energy that comes from the sun.

Ultraviolet light also comes from sun lamps and tanning beds. It can damage the skin and cause skin cancer.

virus - An organism that can grow and multiply only inside the cells of living humans, plants, or animals. It is able to change (mutate) as it multiplies, which makes viral illnesses difficult to treat. Viruses cause many infections and diseases such as the common cold, AIDS (acquired immunodeficiency syndrome), herpes, and hepatitis.

vitamin - A nutrient that the body needs in small amounts to function and maintain health. Examples are vitamins A, C, and E.

vitamin A - A general term for a group of compounds that includes provitamin A carotenoids (found in foods that come from plants) and retinol (preformed vitamin A found in foods that come from animals). The body can use retinol to make retinal and retinoic acid (other forms of vitamin A). Vitamin A plays an important role in vision, bone growth, reproduction, immunity, cell development, and skin health. Vitamin A is found in some foods, including eggs, liver, fortified milk, cheese, leafy green vegetables (such as spinach, kale, turnip greens, collards, and romaine lettuce), broccoli, dark orange fruits and vegetables (such as apricots, carrots, pumpkin, sweet potatoes, papaya, mango, and cantaloupe), and red bell pepper.

vitamin D - A nutrient that is obtained from the diet and can be made in the skin after exposure to sunlight. Vitamin D acts as a hormone. It helps to form and maintain strong bones, maintain normal blood levels of calcium and phosphorus, and increase calcium absorption; it also helps to maintain a healthy immune system and control cell growth. Vitamin D is found in some foods, including some types of fatty fish, and milk and breakfast cereals that are fortified with vitamin D.

vitamin E - A nutrient needed by the body to help keep the immune system healthy and to repair damage to DNA. It is an antioxidant that protects cells from free radical damage. Vitamin E is found in some foods, including vegetable oils, nuts and seeds, fortified breakfast cereals, and spinach, broccoli, kiwi, and mangos.

vitamin K - A nutrient needed by the body to function and stay healthy. It helps form blood clots and maintain strong bones. Vitamin K is found in some foods, including green leafy vegetables, broccoli, liver, and vegetable oils. It is also made by bacteria that live in the large intestine.

Disclaimer

Reasonable care has been taken in preparing this document and the information provided herein is believed to be accurate. However, this information is not intended to constitute an

"authoritative statement" under Food and Drug Administration rules and regulations.

About ODS

The mission of the Office of Dietary Supplements (ODS) is to strengthen knowledge and understanding of dietary supplements by evaluating scientific information, stimulating and supporting research, disseminating research results, and educating the public to foster an enhanced quality of life and health for the U.S. population.

General Safety Advisory

Health professionals and consumers need credible information to make thoughtful decisions about eating a healthful diet and using vitamin and mineral supplements. These Fact Sheets provide responsible information about the role of vitamins and minerals in health and disease. Each Fact Sheet in this series received extensive review by recognized experts from the academic and research communities.

The information is not intended to be a substitute for professional medical advice. It is important to seek the advice of a physician about any medical condition or symptom. It is also important to seek the advice of a physician, registered dietitian, pharmacist, or other qualified health professional about the appropriateness of taking dietary supplements and their potential interactions with medications.

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