



Drugs and Supplements

Vitamin D

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Background

Vitamin D is found in many foods, including fish, eggs, fortified milk, and cod liver oil. The sun also adds to the body's daily production of vitamin D, and as little as 10 minutes of exposure is thought to prevent deficiency.

The term "vitamin D" refers to several different forms of this vitamin. Two forms are important in humans: vitamin D₂, which is made by plants, and vitamin D₃, which is made by human skin when exposed to sunlight. Foods may be fortified with vitamin D₂ or D₃.

The major role of vitamin D is to maintain normal blood levels of calcium and phosphorus. Vitamin D helps the body absorb calcium, which forms and maintains strong bones. It is used alone or together with calcium to improve bone health and decrease fractures. Vitamin D may also protect against osteoporosis, high blood pressure, cancer, and other diseases.

Rickets and osteomalacia are classic vitamin D deficiency diseases. In children, vitamin D deficiency causes rickets, which is a softening or weakening of the bones. In adults, vitamin D deficiency can lead to osteomalacia, which causes weak bones and muscles. People who may be at a high risk for vitamin D deficiency include those who are elderly or obese, those with limited sun exposure, and babies who are exclusively breastfed. People who have conditions such as cystic fibrosis (mucus build-up in the lungs) or inflammatory bowel disease are also at risk for vitamin D deficiency.

Dosing

The below doses are based on scientific research, publications, traditional use, or expert opinion. Many herbs and supplements have not been thoroughly tested, and safety and effectiveness may not be proven. Brands may be made differently, with variable ingredients, even within the same brand. The below doses may not apply to all products. You should read product labels, and discuss doses with a qualified healthcare provider before starting therapy.

Adults (18 years and older)

Vitamin D is included in most multivitamins, usually in strengths from 50-100 international units (IU). It can be found as softgels, capsules, tablets, and liquids. The new 2010 recommended daily allowance (RDA) is 600 IU for those 1-70 years of age and pregnant or breastfeeding women, and 800 IU for those over 71 years of age. An adequate blood level of vitamin D is 20 nanograms per milliliter, which can be achieved through daily skin exposure to sunlight. Levels over 50 nanograms per milliliter may cause side effects.

For osteomalacia caused by anti-seizure drugs, 2,000 IU of vitamin D2 and 390 milligrams of calcium lactate have been taken by mouth daily for three months.

For atopic eczema, 1,600 IU of cholecalciferol has been taken by mouth alone or with 600 IU man-made all-rac-alpha-tocopherol, daily for 60 days.

For autoimmune diseases, 0.25-2 micrograms of alfacalcidol has been taken by mouth 1-2 times daily and 0.5 micrograms of 1- α -OH D3 has been taken by mouth daily for up to 12 months.

For cancer prevention, 400-1,100 IU of vitamin D has been taken by mouth daily, sometimes with 1,400-1,500 milligrams of calcium, for 4-7 years. A dose of 100,000 IU of vitamin D3 has been taken by mouth every four months.

For prostate cancer treatment, 10 micrograms of doxercalciferol has been taken by mouth daily for 28 days. A dose of 45 micrograms of calcitriol (DN-101) has been taken by mouth weekly for three weeks out of every four weeks. Doses of 400-1,100 IU of vitamin D have been taken by mouth daily for 4-7 years.

For heart disease, 200-2,000 IU or 10-25 micrograms of vitamin D2 or D3 has been taken by mouth daily for 1.4-84 months, with or without calcium. A dose of 100,000 IU of vitamin D2 or D3 has been taken by mouth three times yearly for up to three years. A dose of 300,000 IU of vitamin D2 has been injected, followed by doses taken by mouth: 1 gram of vitamin D2, 800 IU of vitamin D3, plus 1 gram of calcium daily for 12 months.

For cognition, 528-9,000 IU of vitamin D2 or D3 has been taken by mouth daily for 8-40 weeks.

For cystic fibrosis, calcitriol, doxercalciferol, or paricalcitol have been taken by mouth. Doses of 800-2,000 IU of vitamin D3 have been taken by mouth daily, which could be increased to a maximum of 10,000 IU daily.

For dental cavities, Vi-delta Liquid emulsion® and Ostelin® have been taken by mouth. A vitamin D mixture in milk has also been used.

For fall prevention, 100-15,000 IU of vitamin D2 or vitamin D3 has been taken by mouth daily, often with calcium for up to 62 months. A dose of 100,000 IU of vitamin D2 has been taken by mouth every three months for up to five years. Single doses of 300,000-500,000 IU have been taken by mouth. Doses of 700-60,000 IU or 0.50 micrograms have been taken by mouth daily or weekly for eight weeks to three years. Doses of 300,000-500,000 IU of vitamin D have been taken yearly without calcium for 1-4 years. A dose of 1 micrograms of alfacalcidol has been taken by mouth daily for 36 weeks and 0.25 micrograms of calcitriol has been taken by mouth daily for three years.

For fertility, 400-50,000 IU of vitamin D has been taken by mouth weekly or every two weeks, alone or with calcium. Elocalcitol has been taken by mouth for three months.

For fibromyalgia, 50,000 IU of vitamin D has been taken by mouth once weekly for three months.

For preventing fractures, 200-1,370 IU or 10-20 micrograms of vitamin D3 has been taken by mouth daily for 7-60 months, with or without calcium (200-1,600 milligrams). Vitamin D has also been taken by mouth in the following forms and doses: 100,000 IU of vitamin D2 every four months for 36 months; 400-5,000 IU daily or twice weekly with calcium; 1 microgram or milligram of alpha-calcidol daily; 0.25 micrograms of 1 alpha-hydroxyvitamin D daily for six months; and 0.25 milligrams of calcitriol twice daily for two years. A dose of 300,000 IU of vitamin D2 has been injected into the muscle every 12 months for 36 months, or 7,500 micrograms injected into the muscle every 12 months.

For low calcium levels caused by overactive parathyroid glands, 0.5-1 microgram of calcitriol, 0.5 grams of vitamin D, and 400 IU of vitamin D have been taken by mouth 1-2 times daily with 0.5-1.5 grams of calcium carbonate.

For high cholesterol levels, 300-3,332 IU or 7.5-1,250 micrograms have been taken by mouth daily from 42 days to three years and single doses have ranged from 100,000-200,000 IU, in the form of D3 cholecalciferol, calcitriol, ergocalciferol, and alpha-calcidol, sometimes with calcium (500-1,200 milligrams). Calcitriol has been injected into the vein at a dose of 1 microgram twice weekly for eight weeks.

For high blood pressure, 400-8,571 IU of vitamin D has been taken by mouth daily (with or without calcium), without benefit. A dose of 1,800 IU of vitamin D has been taken by mouth.

For low calcium levels, 0.25 micrograms of calcitriol has been taken by mouth daily, and dosing may be increased by 0.25 micrograms daily at 4-8-week intervals.

For low parathyroid gland activity, dihydrotachysterol has been taken by mouth at an initial dose of 0.75-2.5 milligrams daily for several days. A maintenance dose of 0.2-1 milligram has been taken by mouth daily. Ergocalciferol has been taken by mouth at a dose of 50,000-200,000 IU daily along with four grams of calcium lactate, six times daily.

For immune function, the following doses have been taken by mouth: 40 IU of vitamin D3 daily for 20 years to 100,000 IU of vitamin D3 bimonthly for 12 months, or 10,000 IU daily.

For inflammatory bowel disease, 0.5 micrograms of alfacalcidol has been taken by mouth daily. Cholecalciferol has been taken by mouth in doses of 1,000-1,200 IU daily with 1,200 milligrams of calcium for 12 months.

For chronic kidney disease, 1-9 micrograms of vitamin D has been taken once daily or weekly over a 4-24 week period. Doses of 400-100,000 IU have been taken by mouth daily to monthly for six months to two years. Doses of 0.04-4 micrograms per kilogram of vitamin D have been injected into the vein once or three times weekly over a 4-12 week period.

For mood disorders, 400-800 IU daily or 100,000 IU weekly has been taken by mouth for up to one month to improve symptoms of depression associated with seasonal affective disorder. In obese people, 20,000-40,000 IU of vitamin D has been taken by mouth per week for one year.

For increasing lifespan, 10 micrograms to 400-500,000 IU have been taken by mouth daily for up to 7 years, once every third or fourth month, or once yearly. The following doses have been taken by mouth: cholecalciferol (vitamin D3), 300-1,800,000 IU; ergocalciferol (vitamin D2), 200-300,000 IU; alfacalcidol (1-alfahydroxy-vitamin D), 1 microgram; and calcitriol (1, 25-dihydroxy-vitamin D), 0.5-2 micrograms, sometimes with 300-1,600 milligrams of calcium, daily to yearly from one day to seven years.

For multiple sclerosis, 10,000 IU has been taken by mouth daily for 12 weeks. Other doses of vitamin D taken by mouth include 5,000 IU daily (in the form of cod liver oil), progressive weekly increases of vitamin D3 (700 micrograms per week, escalating to 7,000 micrograms per week) plus 1,200 milligrams of calcium.

For muscle strength, 20-600,000 IU of ergocalciferol has been taken by mouth or cholecalciferol in doses of 400-150,000 IU, sometimes in combination with 800-1,100 milligrams of calcium, daily for 2-36 months. Vitamin D has been taken by mouth or injected at doses of 400-150,000 IU of D3, 1,000-600,000 IU of D2, and 0.25 micrograms of calcitriol.

For muscle weakness or pain, 100,000 IU of calciferol has been taken by mouth daily for 12 months.

For osteoporosis, 100-200,000 IU of vitamin D2 or D3 have been taken by mouth daily or every two months for six months, sometimes with 800-1,500 milligrams of calcium.

For osteoporosis in people with cystic fibrosis, 0.25 micrograms of calcitriol has been taken by mouth for those under 45 kilograms of weight (0.5 micrograms for those over 45 kilograms) for two years. Doses of 800-1,600 IU have been taken by mouth, with or without 1 gram of calcium for six months.

For osteoporosis caused by drugs, 200-800 IU has been taken by mouth daily,

occasionally in combination with calcium (500-1,500 milligrams daily) for up to 24 months.

For parasitic infections, 40 IU of vitamin D has been taken by mouth daily for five days.

For physical performance in elderly subjects, 400 IU of vitamin D plus 800 milligrams of calcium has been taken by mouth daily. In older adults, 8,400 IU of vitamin D3 has been taken by mouth weekly for 16 weeks.

For pregnancy, 400-600,000 IU of vitamin D has been taken by mouth daily from week 12, week 27, or during the third trimester to a single dose (100,000-600,000 IU) at either the seventh or eighth month of pregnancy. Doses of 400-4000 IU vitamin D have been taken by mouth daily for the third trimester or starting the 12th week of pregnancy; other doses were 120,000-600,000 IU of vitamin D taken by mouth monthly at the 5th, 7th, and/or 8th months or the 27th week of pregnancy.

For the prevention of respiratory tract infections: 400-2,000 IU vitamin D has been taken by mouth daily for up to three years. A dose of 4,000 IU has been taken by mouth daily for one year. An initial dose of 200,000 IU of vitamin D3 has been taken by mouth, followed by 200,000 IU one month later, and 100,000 IU monthly.

For the treatment of respiratory infections, 2,000 IU per kilogram of body weight has been taken by mouth daily for three days.

For rheumatoid arthritis, 50,000 IU of vitamin D has been taken by mouth weekly for 12 weeks.

For tuberculosis, a single dose of 10,000 IU of vitamin D2 has been taken by mouth. Four daily doses of 2.5 milligrams of vitamin D (Viganoil®, Merck Serono) have been taken by mouth on day seven of usual tuberculosis treatment, followed by supplementation on days 14, 28, and 42.

For type 2 diabetes, vitamin D has been taken by mouth in the form of calcitriol, 1-alpha calcidiol, cholecalciferol, doxercalciferol, and ergocalciferol, at doses ranging from 400-200,000 IU, 0.25-2 micrograms, and 1.5 milligrams for seven days to seven years.

For viral infections, 800 IU of vitamin D has been taken by mouth daily for two years, followed by 2,000 IU of vitamin D daily for 12 months.

For deficiency, at least 1,000 IU (25 micrograms) of vitamin D has been taken by mouth daily (or 8,400 IU of vitamin D3 weekly). Other doses that have been studied include 50,000 IU daily for six weeks, 300,000 IU of oral vitamin D3 three times a year, 800 IU daily in combination with calcium, 400 IU daily, and 300,000 IU every three months. 300,000 IU of vitamin D has been used intramuscularly as a bolus dose of vitamin D2 or D3, three times per year, and 600,000 IU (15 milligrams) of vitamin D has been used as a single injection.

For psoriasis, calcipotriene (Dovonex®) has been applied to the skin twice daily. Substances similar to vitamin D have been used alone or with steroids applied to the skin

for 3-52 weeks. A dose of 50 milligrams per gram of calcipotriol, 4 milligrams per gram of tacalcitol, and 3 milligrams per gram of calcitriol have been applied to the skin 1-2 times daily for 4-12 weeks.

For senile warts, vitamin D analogs have been applied to the skin in ointments for up to 12 months.

For vitiligo, calcipotriol ointment has been applied to the skin twice daily. Betamethasone dipropionate has been applied to the skin in the morning and calcipotriol in the evening. Calcipotriol or tacalcitol have been used alone or combined with light therapy or steroids applied to the skin twice weekly to twice daily for six weeks to 18 months.

For fall prevention, doses of 300,000-600,000 IU of vitamin D₂ have been injected into the muscle once yearly for up to 62 months. The following doses have been used: a single injection into the muscle containing 300,000-600,000 IU of vitamin D or 300,000 IU of vitamin D yearly for three years.

Children (under 18 years old)

The new recommended daily allowance (RDA) is as follows: for those 1-70 years of age, 600 IU daily; and for infants aged 0-12 months, 1,000 IU daily.

For anticonvulsant-induced osteomalacia, 2,000 IU of vitamin D₂ has been taken by mouth daily plus 500 milligrams of calcium for three months.

For atopic eczema, 1,600 IU of cholecalciferol, either with or without 600 IU man-made all-rac-alpha-tocopherol, has been taken by mouth daily for 60 days. A dose of 1,000 IU ergocalciferol has been taken by mouth daily for one month.

For cystic fibrosis, 400-10,000 IU of vitamin D has been taken by mouth daily from birth to 12 months.

For immune function, 2,000 IU of vitamin D has been taken by mouth daily during the first year of life.

For osteoporosis (general), 0.25 micrograms of calcitriol has been taken by mouth in combination with 500 milligrams of elemental calcium daily for nine months. Alfacalcidol has been taken by mouth daily for six months.

For osteoporosis (in those with cystic fibrosis), 0.25 micrograms has been taken by mouth for those under 45 kilograms of weight and 0.5 micrograms for those over 45 kilograms, daily for two years. Doses of 800-1,600 IU of vitamin D have been taken by mouth, with or without 1 gram of calcium for six months.

For the prevention of respiratory tract infections, 300-1,200 IU of vitamin D or D₃ has been taken by mouth daily for three months to three years, sometimes in milk over three months in winter. A single dose of 100,000 IU vitamin D has been injected into the vein.

For the treatment of respiratory tract infections, a single dose of 100,000 IU of vitamin D₃ has been taken by mouth.

Rickets may be treated gradually over several months or in a single day's dose. Based on a clinical trial, a single dose of 600,000 IU of oral vitamin D3 was comparable to a dose of 20,000 IU of oral vitamin D3 daily for 30 days. Gradual dosing may be 125-250 micrograms (5,000-10,000 IU) taken daily for 2-3 months, until recovery is well established and the alkaline phosphatase blood concentration is close to normal limits. Single-day dosing may be 15,000 micrograms (600,000 IU) of vitamin D, taken by mouth divided into 4-6 doses. Injection into the muscle is also an alternative for single-day dosing. For resistant rickets, some authors suggest a higher dose of 12,000 to 500,000 IU daily.

For tuberculosis (TB), 1,000 IU of vitamin D has been taken by mouth in combination with standard TB therapy.

For type 1 diabetes, 2,000 IU of vitamin D taken by mouth daily for a year was associated with a reduced risk of type 1 diabetes.

For viral infection, 60,000 IU has been taken by mouth weekly for six weeks.

For vitamin D deficiency, 2.5 milligrams of vitamin D has been taken by mouth every three months during infancy. A dose of 600,000 IU of cholecalciferol has been taken by mouth.

Evidence

These uses have been tested in humans or animals. Safety and effectiveness have not always been proven. Some of these conditions are potentially serious, and should be evaluated by a qualified healthcare provider.

Key to grades

- A** Strong scientific evidence for this use
- B** Good scientific evidence for this use
- C** Unclear scientific evidence for this use
- D** Fair scientific evidence against this use (it may not work)
- F** Strong scientific evidence against this use (it likely does not work)

Grading rationale

A**Deficiency (phosphate)**

Familial hypophosphatemia is a rare, inherited condition in which there are low blood levels of phosphate and problems with vitamin D metabolism. It is a form of rickets. Taking calcitriol or dihydrotachysterol by mouth along with phosphate supplements is effective for treating bone disorders in people with this disease. Those with this disorder should be monitored by a medical professional.

A**Kidney disease (causing low phosphate levels)**

Fanconi syndrome is a kidney disease in which nutrients, including phosphate, are lost in the urine instead of being reabsorbed by the body. Taking ergocalciferol by mouth is effective for treating low phosphate levels caused by Fanconi syndrome.

A**Osteomalacia (bone softening in adults)**

Adults who have severe vitamin D deficiency may experience bone pain and softness, as well as muscle weakness. Osteomalacia may be found among the following people: those who are elderly and have diets low in vitamin D; those with problems absorbing vitamin D; those without enough sun exposure; those who undergo stomach or intestine surgery; those with bone disease caused by aluminum; those with chronic liver disease; or those with bone disease associated with kidney problems. Treatment for osteomalacia depends on the cause of the disease and often includes pain control and surgery, as well as vitamin D and phosphate-binding agents.

A**Psoriasis (disorder causing skin redness and irritation)**

Many different approaches are used to treat psoriasis, including light therapy, stress reduction, moisturizers, or salicylic acid. For more severe cases, calcipotriene (Dovonex®), a man-made substance similar to vitamin D3, may help control skin cell growth. This agent is a first-line treatment for mild-to-moderate psoriasis. Calcipotriene is also available with betamethasone and may be safe for up to one year. Vitamin D3 (tacalcitol) ointment or high doses of becocalcidiol applied to the skin are also thought to be safe and well-tolerated.

A**Rickets (bone weakening in children)**

Rickets may develop in children who have vitamin D deficiency caused by a diet low in vitamin D, a lack of sunlight, or both. Babies fed only breast milk (without supplemental vitamin D) may also develop rickets. Ergocalciferol or cholecalciferol is effective for treating rickets caused by

vitamin D deficiency. Calcitriol should be used in those with kidney failure. Treatment should be under medical supervision.

A

Thyroid conditions (causing low calcium levels)

Low levels of parathyroid hormone may occur after surgery to remove the parathyroid glands. Taking high doses of dihydrotachysterol, calcitriol, or ergocalciferol by mouth, with or without calcium, may help increase calcium levels in people with this type of thyroid problem. Increasing calcium intake, with or without vitamin D, may reduce the risk of underactive parathyroid glands.

A

Thyroid conditions (due to low vitamin D levels)

Some people may have overactive parathyroid glands due to low levels of vitamin D, and vitamin D is the first treatment for this disorder. For people who have overactive parathyroid glands due to other causes, surgery to remove the glands is often recommended. Studies suggest that vitamin D may help reduce the risk of further thyroid problems after undergoing partial or total removal of the parathyroid glands.

A

Vitamin D deficiency

Vitamin D deficiency is associated with many conditions, including bone loss, kidney disease, lung disorders, diabetes, stomach and intestine problems, and heart disease. Vitamin D supplementation has been found to help prevent or treat vitamin D deficiency.

B

Dental cavities

Much evidence has shown that vitamin D helps prevent cavities; however, more high-quality research is needed to further support this finding.

B

Fall prevention

Many studies suggest that vitamin D helps prevent falls, especially in people who live in care facilities. However, there is conflicting evidence. Substances similar to vitamin D have been shown to help prevent falls and reduce fractures, including alfacalcidol and alendronate. Calcium in combination with cholecalciferol may help reduce the risk of falls.

B

Muscle weakness/pain

Vitamin D deficiency has been linked to muscle weakness and pain. Strong evidence is lacking to support the use of vitamin D

supplementation for pain, and more research is needed.

B

Osteoporosis (general)

Vitamin D and calcium are used to treat people with osteoporosis, especially after a fracture, as well as to prevent osteoporosis in people who have endocrine or nutrition problems.

B

Renal osteodystrophy (bone problems due to chronic kidney failure)

Renal osteodystrophy refers to the bone problems that occur in people with chronic kidney failure. Calcifediol or ergocalciferol taken by mouth may help prevent this condition in people with chronic kidney failure who are undergoing treatment.

C

Asthma

People with asthma may have an increased risk of vitamin D deficiency. Vitamin D may help reduce inflammation, decrease asthma severity, and improve treatment. More studies are needed before firm conclusions can be made.

C

Autoimmune diseases

Vitamin D may reduce inflammation and help prevent autoimmune diseases, including rheumatoid arthritis, multiple sclerosis, and Crohn's disease. However, further high-quality research is needed to confirm these results.

C

Bone density (children)

Vitamin D improves bone density in children who are vitamin D deficient. However, results are unclear and more research is needed.

C

Bone diseases (kidney disease or kidney transplant)

Vitamin D has been studied for people with chronic kidney disease. The use of substances similar to vitamin D has been found to increase bone density in people with kidney disease. The effect of vitamin D itself is unclear. Further research is needed before conclusions can be made.

C

Cancer prevention (breast, colorectal, prostate, other)

Many studies have looked at the effects of vitamin D on cancer. Positive

results have been reported with the use of vitamin D alone or with calcium. Vitamin D intake with or without calcium has been studied for colorectal, cervical, breast, and prostate cancer. A reduced risk of colorectal cancer has been shown with vitamin D supplementation. However, there is a lack of consistent or strong evidence. Further study is needed.

C

Cognition

Higher blood levels of vitamin D3 are associated with better mental performance in people with Alzheimer's disease. Weekly dietary intake of vitamin D has been linked to better mental performance in older women. However, high-quality studies are still needed in this area.

C

Fertility

Vitamin D may benefit fertility. However, more study is needed to understand its potential effects on pregnancy completion and live birth.

C

Fibromyalgia (long-term, body-wide pain)

Vitamin D has been studied for the treatment of fibromyalgia, but evidence is lacking in support of its effectiveness. Further study is needed.

C

Fractures (prevention)

Conflicting results have been found on the use of vitamin D for fracture prevention. The combination of alfacalcidol and alendronate has been found to reduce the risk of falls and fractures. However, further high-quality research is needed before firm conclusions can be made.

C

Fractures (treatment)

Studies have suggested that vitamin D levels may decrease after a hip fracture, and that vitamin D may help improve these levels. However, further research is needed.

C

Hepatic osteodystrophy (bone disease in people with liver disease)

Metabolic bone disease is common among people with chronic liver disease, and osteoporosis accounts for the majority of cases. Varying degrees of poor calcium absorption may occur in people with chronic liver disease due to malnutrition and vitamin D deficiency. Vitamin D taken by mouth or injected may play a role in the management of this condition.

C

High blood pressure

Low levels of vitamin D may be linked to high blood pressure. Blood pressure is often higher during the winter season, at a further distance from the equator, and in people with dark skin pigmentation. However, the evidence is unclear. More research is needed in this area. People who have high blood pressure should be managed by a medical professional.

C

HIV

There is a high prevalence of vitamin D deficiency in HIV-positive men. However, there is a lack of strong evidence to support the use of vitamin D in this population. More research is needed before a conclusion can be made.

C

Immune function

Early research suggests that vitamin D and similar compounds, such as alfacalcidol, may impact immune function. Vitamin D added to standard therapy may benefit people with infectious disease. More studies are needed to confirm these results.

C

Increasing lifespan

Intake of vitamin D may be linked to a longer lifespan. More evidence is needed to confirm this finding.

C

Inflammatory bowel disease

Studies on the use of vitamin D for inflammatory bowel disease are limited. Early evidence suggests benefit for people who have Crohn's disease. More research is needed.

C

Kidney disease (chronic)

Vitamin D has been studied for people with chronic kidney disease. However, the effects of supplementation are unclear at this time. Further research is needed before conclusions can be made.

C

Loose teeth

Research suggests that intake levels of calcium and vitamin D aimed at preventing osteoporosis may help prevent teeth from falling out. More studies are needed before a firm conclusion can be made.

C

Mood disorders

Some studies suggest an association between low vitamin D levels in the blood and various mood disorders, including depression, seasonal affective disorder (SAD), and premenstrual syndrome (PMS). Also vitamin D supplementation may improve symptoms of depression associated with SAD. More research is needed before a conclusion can be made.

C

Multiple sclerosis (MS)

Vitamin D may have a protective effect on the risk of developing MS. A link has been suggested between low vitamin D and MS risk. More evidence is needed.

C

Muscle strength

Evidence is mixed regarding the effect of vitamin D on strength in the elderly. Further research is required in order to confirm these results.

C

Muscle wasting/weakness

Vitamin D has been studied for muscle wasting/weakness. There is insufficient evidence in this area, and further research is needed.

C

Myelodysplastic syndrome (disease of blood cell production)

Although vitamin D is commonly used by people with myelodysplastic syndrome, there is insufficient evidence in this area.

C

Osteoarthritis

Results have been inconclusive on the use of vitamin D for knee pain or cartilage volume loss. Further study is needed in this field before conclusions may be made.

C

Osteogenesis imperfecta (disorder in which bones break easily)

OI is a genetic disease in which bones break easily due to a malfunction in the body's production of collagen. Proper calcium and vitamin D intake is essential to maintaining strong bones. More research is needed on the use of vitamin D for this disorder.

C

Osteomalacia (bone softening caused by anti-seizure drugs)

Vitamin D plus calcium may help improve overall well-being in people who have seizure disorders. This combination may also improve bone

mineral content when taken with anti-seizure drugs.

C

Osteoporosis (due to corticosteroids)

Some evidence suggests that steroids may lead to problems with vitamin D metabolism, which may lead to bone loss and the development of osteoporosis associated with steroid medications. There is limited evidence that vitamin D may improve bone strength in people taking long-term steroids. Further research is needed.

C

Osteoporosis (due to drugs)

Early study suggests that vitamin D and calcium supplementation is needed to maintain bone health in men who are receiving androgen deprivation therapy (ADT) for prostate cancer. Calcitriol and alfacalcidol have been found to significantly reduce bone mass loss caused by drugs. More research is needed.

C

Osteoporosis (in people with cystic fibrosis)

Osteoporosis is common in people with cystic fibrosis (a build-up of mucus in the lungs). This is due to poor absorption of fat, which leads to vitamin D deficiency. Calcitriol taken by mouth appears to increase calcium absorption.

C

Pregnancy

Evidence is conflicting on the use of vitamin D as a nutritional supplement during pregnancy. Some studies suggest potential benefit for birth weight, length, and weight, as well as reduced risk of diabetes during pregnancy. Further study is needed.

C

Prevention of respiratory tract infections

Use of vitamin D has been found to help prevent respiratory tract infections in children. However, some conflicting results have been found in humans. Although evidence supports the effects of vitamin D on prevention of respiratory tract infections in children, further study in both adults and children is needed.

C

Rickets (that does not respond to treatment)

Vitamin D has been studied for a form of rickets (bone weakening in children) that is associated with low phosphate levels and does not respond to treatment. More research is needed.

C

Seasonal affective disorder (SAD)

SAD is a form of depression that occurs during the winter months, possibly due to reduced exposure to sunlight. In one study, vitamin D was found to be better than light therapy in the treatment of SAD. Further studies are necessary to confirm these findings.

C

Senile warts

In early research, senile warts have been treated with vitamin D3 applied to the skin. Further research is needed.

C

Sexual dysfunction

Vitamin D has been studied for sexual dysfunction. However, evidence is mixed. More research is needed before a conclusion can be made.

C

Skin conditions

Calcipotriol (Dovonex®) is a man-made version of vitamin D3 that is often used for the treatment of plaque psoriasis (a condition causing redness and itching). Calcipotriol may also be effective for skin conditions other than psoriasis. More research is needed.

C

Skin pigmentation disorders

Applying vitamin D3 ointment to the skin with other therapies may help treat some skin pigmentation disorders. More evidence is needed.

C

Stroke

Higher levels of vitamin D may decrease the risk of stroke. However, further study is needed to confirm the use of vitamin D for this condition.

C

Tuberculosis

Vitamin D has been studied for the treatment of tuberculosis. Although some benefit has been found, more research is needed in this area.

C

Type 1 diabetes

Some studies suggest that vitamin D may help prevent the development of type 1 diabetes. However, there is a lack of strong evidence to support this finding.

C

Type 2 diabetes

Vitamin D has mixed effects on blood sugar and insulin sensitivity. It is often studied in combination with calcium. Further research is needed to confirm these results.

C

Vitamin D deficiency (infants and breast feeding mothers)

Early studies suggest that vitamin D may benefit both breastfeeding mothers and their babies. More research is needed to confirm these findings.

C

Vitiligo (irregular white patches on the skin)

Results are unclear as to the effects of vitamin D and similar compounds for treating vitiligo. More research is needed before a conclusion can be made.

C

Weight gain (in women with menopause)

Vitamin D and calcium may have an effect on weight gain in women undergoing menopause. Evidence suggests that this may be particularly true in women consuming inadequate calcium. Further research is needed.

D

Atopic eczema (skin condition causing itchy, scaly rashes)

Studies show a lack of effect of vitamin D on symptoms of atopic eczema. Further research is needed.

D

Cancer treatment (prostate)

Evidence suggests a lack of effect of vitamin D as a part of cancer treatment for prostate cancer. Further study is needed using other formulations of vitamin D and other types of cancer.

D

Heart disease

Vitamin D is recognized as being important for heart health. Overall, research is not consistent, and some studies have found negative effects of vitamin D on heart health. More high-quality research is needed to make a firm conclusion.

D

High cholesterol

Many studies have looked at the effects of vitamin D alone or in combination with other agents for high cholesterol, but results are inconsistent. Some negative effects have been reported. More research is needed on the use of vitamin D alone or in combination with calcium.

Uses based on tradition or theory

The below uses are based on tradition or scientific theories. They often have not been thoroughly tested in humans, and safety and effectiveness have not always been proven. Some of these conditions are potentially serious, and should be evaluated by a qualified healthcare provider.

Arthritis (long-term), autism, chemotherapy side effects, dementia, ear infections, exercise performance, Graves' disease (overactive thyroid), high blood pressure associated with pregnancy, hyperparathyroidism in renal dialysis (overactive parathyroid glands in people undergoing kidney failure treatment), hypocalcemic tetany (muscle contraction due to low calcium), inflammation, kidney transplant-related bone loss, learning disabilities, lupus (long-term inflammation), menopause, metabolic disorders, metabolic syndrome (coronary heart disease), nervous system disorders, osteitis fibrosa in dialysis (soft, weak bones), pain, psoriasis (native vitamin D), recovery after surgery, rheumatoid arthritis, rickets (genetic), sarcoidosis (tissue inflammation disorder), schizophrenia, scleroderma (build-up of scar tissue on skin), spinal cord injury, systemic sclerosis (disease causing skin thickening), vaginal disorders (thinning of walls and dryness).

Interactions

Interactions with Drugs

Vitamin D may affect blood sugar levels. Caution is advised when using medications that may also affect blood sugar. People taking drugs for diabetes by mouth or insulin should be monitored closely by a qualified healthcare professional, including a pharmacist. Medication adjustments may be necessary.

Vitamin D may affect blood pressure. Caution is advised in people taking drugs that affect blood pressure.

Vitamin D may interfere with the way the body processes certain drugs using the liver's "cytochrome P450" enzyme system. As a result, the levels of these drugs may be altered in the blood, and may cause altered effects or potentially serious adverse reactions. People using any medications should check the package insert, and speak with a qualified healthcare professional, including a pharmacist, about possible interactions.

Vitamin D may also interact with acitretin, agents that affect the immune system, agents that bind bile, agents that prevent seizures, agents that promote urination, agents that treat heart disorders, agents that treat retrovirus infections (HIV), aluminum, antacids, antiandrogens, anti-asthma agents, antibiotics, anticancer agents, anti-inflammatories,

birth control, bisphosphonates, calcipotriene, calcium salts, cardiac glycosides, cholesterol-lowering agents (such as HMG-CoA reductase inhibitors), cimetidine, cinacalcet, corticosteroids, cyclosporine, dental agents, diltiazem, exemestane, fat-soluble agents, fertility agents, heparins, hormonal agents, insulin, interferon, ketoconazole, laxatives, lung agents, mineral oil, nervous system agents, opioids, orlistat, osteoporosis agents, pain relievers, rifampin, sevelamer, skin agents, stomach agents, sunscreens, tar-based shampoo, thyroid hormone antagonists, vaccines, and vitamin D receptor agonists.

Interactions with Herbs and Dietary Supplements

Vitamin D may affect blood sugar levels. Caution is advised when using herbs or supplements that may also affect blood sugar. Blood glucose levels may require monitoring, and doses may need adjustment.

Vitamin D may affect blood pressure. Caution is advised in people taking herbs or supplements that affect blood pressure.

Vitamin D may interfere with the way the body processes certain herbs or supplements using the liver's "cytochrome P450" enzyme system. As a result, the levels of other herbs or supplements may be altered in the blood. It may also alter the effects that other herbs or supplements possibly have on the P450 system.

Vitamin D may also interact with aluminum, antacids, antiandrogens, anti-asthma herbs and supplements, antibacterials, anticancer herbs and supplements, anti-inflammatories, athletic performance enhancers, birth control, calcium, cardiac glycosides, cholesterol-lowering herbs and supplements, dental herbs and supplements, fat-soluble herbs and supplements, fertility herbs and supplements, herbs and supplements that affect the immune system, herbs and supplements that decrease calcium, herbs and supplements that prevent seizures, herbs and supplements that promote urination, herbs and supplements that treat heart disorders, hormonal herbs and supplements, hormone replacement therapy, laxatives, lung herbs and supplements, magnesium, micronutrients, mineral oil, nervous system herbs and supplements, osteoporosis herbs and supplements, pain relievers, silicon, stomach herbs and supplements, sunscreens, vitamin A, and vitamin K.

Methodology

This information is based on a systematic review of scientific literature and has been edited and peer-reviewed by contributors to the Natural Standard Research Collaboration (www.naturalstandard.com).

[Monograph methodology](#)

Related terms

1,25-DHCC, 1,25-dihydroxy-22-ovavitamin D(3), 1,25-dihydroxycholecalciferol, 1,25-

dihydroxy-vitamin-D (1,25(OH)(2)D), 1,25-dihydroxyvitamin D3, 1,25-diOHC, 1,25(OH) 2D3, 1-alpha (OH) D3, 19-nor-1, 1-alpha-hydroxycholecalciferol, 1-alpha-hydroxyvitamin D2, 1-hydroxyvitamin D, 22-oxacalcitriol (OCT), 24,25(OH)(2)vitamin D(3), 25 hydroxyvitamin D (25(OH)D), 25-dihydroxyvitamin D2, 25-dihydroxyvitamin D2, 19-nor-1, 25-HCC, 25-hydroxycholecalciferol, 25-hydroxyvitamin D, 25-hydroxyvitamin D3, 25-OHCC, 25-OHD3, activated 7-dehydrocholesterol, activated ergosterol, alfacalcidol, calcifediol, calcipotriene, calcipotriol, calcitriol, cholecalciferol, colecalciferol, cod liver oil, dichysterol, dihydrotachysterol, dihydrotachysterol 2, doxercalciferol, ecocalcidiol, ED-21 (vitamin D analog), ED-71 (vitamin D analog), ergocalciferol, ergocalciferolum, falecalcitrol, hexafluoro-1,25dihydroxyvitamin D3, irradiated ergosterol, maxacalcitol, MC903, Ostelin®, paracalcin, paricalcitol, tacalcitol, Vi-delta Liquid emulsion®, viosterol, vitamin D2, vitamin D3, vitamina D.

Safety

The U.S. Food and Drug Administration does not strictly regulate herbs and supplements. There is no guarantee of strength, purity or safety of products, and effects may vary. You should always read product labels. If you have a medical condition, or are taking other drugs, herbs, or supplements, you should speak with a qualified healthcare provider before starting a new therapy. Consult a healthcare provider immediately if you experience side effects.

Allergies

Avoid in people with known allergy or sensitivity to vitamin D, any similar compounds, or any part of the formula.

Side Effects and Warnings

Vitamin D is likely safe when taken by mouth in doses of 100 micrograms of vitamin D3 daily (4,000 IU) and when applied to the skin alone or in combination with corticosteroids for up to three months.

Vitamin D is possibly safe when taken by mouth or injected into the muscle in doses of 300,000 IU three times a year for vitamin D deficiency.

Vitamin D may cause allergic skin reactions (inflammation, irritation, rash, and thinning), build-up of calcium in the arteries, changes in cholesterol levels, daytime sleepiness, excessive vitamin D levels, hardening of the arteries, headaches, increased calcium excretion or levels, increased risk of falls and fractures, increased risk of heart attack and stroke, increased risk of high blood pressure during pregnancy, increased risk of urinary tract infection, kidney or urinary stones, muscle pain, respiratory tract infection, and stomach problems (constipation, cramps, diarrhea, upset stomach, and vomiting).

Vitamin D may affect blood sugar levels. Caution is advised in people with diabetes or low blood sugar, and in those taking drugs, herbs, or supplements that affect blood

sugar. Blood sugar levels may need to be monitored by a qualified healthcare professional, including a pharmacist, and medication adjustments may be necessary.

Vitamin D may affect blood pressure. Caution is advised in people with blood pressure disorders or those taking drugs or herbs and supplements that affect blood pressure.

Use cautiously in people with headaches, heart disease, immune disorders (including lymph cancer and tuberculosis), kidney disease, liver disease, lung disorders, musculoskeletal disorders, skin disorders, stomach disorders, and thyroid disorders.

Use cautiously in pregnant women at risk of high blood pressure associated with pregnancy.

Use cautiously in breastfeeding women.

Avoid in people with known allergy or sensitivity to vitamin D, any similar compounds, or any part of the formula.

Avoid in people with abnormal calcium excretion or levels.

Pregnancy and Breastfeeding

Use cautiously in pregnant women at risk of high blood pressure associated with pregnancy. The recommended adequate intake for pregnant women is the same as for non-pregnant adults. Most prenatal vitamins provide 400 IU of vitamin D daily as cholecalciferol, while high-risk populations may benefit from higher amounts (2,000-4,000 IU daily).

Use cautiously in breastfeeding women. The daily recommended intake for vitamin D during breastfeeding is 400 IU (10 micrograms) daily. Vitamin D₂ in doses of 2,000 IU daily or 60,000 IU monthly for three months has been found to be safe and effective. Exclusively breastfed babies may be supplemented with 400-2,000 IU daily.

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