

Evidence-based Vitamin D Usage

Name(s): Calciferol. Alfacalcidol, calcifediol, calcitriol, and dihydrotachysterol are forms of vitamin D to treat hypocalcaemia (not enough calcium in the blood). Ergocalciferol (D3) is the form of vitamin D used in vitamin supplements.

Description: This fat-soluble vitamin is a stable compound that is made from a cholesterol derivative which is converted by the sun's rays. As with any fat-soluble vitamin, vitamin D must be emulsified before it can be used nutritionally. This vitamin is unique in that it acts like a hormone as it targets organs such as the kidneys and intestine. The synthesis of the enzymes in mucous membranes that are important for the transport of calcium to the bones is enhanced by vitamin D. This attributes to vitamin D's capability to promote bone mineralisation, maintaining bone growth.¹

Absorption/Storage: Vitamin D and fats are absorbed through the intestinal walls with the help of bile. The synthesis of vitamin D is inhibited with the use of sunscreens with SPF's higher than 8. After absorption, this vitamin is transported and stored in the liver.¹

Recommended Dietary Allowance/Dietary Reference Intake:²

Persons	Mcg	Units
Birth to 3 years of age	5	200
4 to 8 years of age	5	200
9 to 13 years of age	5	200
Adolescents and adults	5-15	200-600
Pregnant females	5	200
Breast-feeding females	5	200

Optimum Daily Allowance (Adult): 400 IU.³

Tolerable Upper Intake Levels:²

Persons	Mcg
Birth to 3 years of age	25-50
4 to 8 years of age	50
9 to 13 years of age	50
Adolescents and adults	50
Pregnant females	50
Breast-feeding females	50

Principal Uses: Crohn's disease,⁴⁻⁹ preventing and treating osteoporosis (with calcium supplementation),¹⁰⁻²⁰ and

rickets.²¹⁻²²

Proposed Uses: Celiac disease (for deficiency) and depression.²³

Traditional Uses: Alcohol withdrawal support, amenorrhoea (calcium for preventing bone loss), breast cancer (reduces risk), cardiac arrhythmia, colon cancer (reduces risk), diabetes, migraine headaches, multiple sclerosis, Parkinson's disease, seasonal affective disorder, vitiligo (topical calcipotriol only).

Healthy Sources:

High (40%+ US RDA): So-called fortified cereals, fortified soy and rice milks and sunlight.

Medium (25-39% US RDA): None.

Contraindications: If you are taking this dietary supplement without a prescription, carefully read and follow any precautions on the label. For vitamin D and related compounds, the following should be considered:

Allergies--Tell your health care professional if you have ever had any unusual or allergic reaction to alfacalcidol, calcifediol, calcitriol, dihydro-tachysterol, doxercalciferol, ergocalciferol, or paricalcitol. Also, tell your health care professional if you are allergic to any other substances, such as foods, preservatives, or dyes.

Pregnancy--It is especially important that you are receiving enough vitamin D when you become pregnant and that you continue to receive the right amounts of vitamins throughout your pregnancy. The healthy growth and development of the foetus depend on a steady supply of nutrients from the mother.

You may need vitamin D supplements if you are a strict vegetarian (vegan-vegetarian) and/or have little exposure to sunlight and do not drink vitamin D-fortified milk.

Taking too much alfacalcidol, calcifediol, calcitriol, dihydrotachysterol, or ergocalciferol can also be harmful to the foetus. Taking more than your health care professional has recommended can cause your baby to be more sensitive than usual to its effects, can cause problems with a gland called the parathyroid, and can cause a defect in the baby's heart.

Evidence-based Vitamin D Usage

Doxercalciferol or paricalcitol have not been studied in pregnant women. However, studies in animals have shown that paricalcitol causes problems in newborns. Before taking this medicine, make sure your doctor knows if you are pregnant or if you may become pregnant.

Breast-feeding--It is especially important that you receive the right amounts of vitamins so that your baby will also get the vitamins needed to grow properly. Infants who are totally breast-fed and have little exposure to the sun may require vitamin D supplementation. However, taking large amounts of a dietary supplement while breast-feeding may be harmful to the mother and/or baby and should be avoided.

Only small amounts of alfacalcidol, calcifediol, calcitriol, or dihydrotachysterol pass into breast milk and these amounts have not been reported to cause problems in nursing babies.

It is not known whether doxercalciferol or paricalcitol passes into breast milk. Be sure you have discussed the risks and benefits of the supplement with your doctor.

Children--Problems in children have not been reported with intake of normal daily-recommended amounts. Some studies have shown that infants who are totally breast-fed, especially with dark-skinned mothers, and have little exposure to sunlight may be at risk of vitamin D deficiency. Your health care professional may prescribe a vitamin/mineral supplement that contains vitamin D. Some infants may be sensitive to even small amounts of alfacalcidol, calcifediol, calcitriol, dihydro-tachysterol, or ergocalciferol. Also, children may show slowed growth when receiving large doses of alfacalcidol, calcifediol, calcitriol, dihydrotachysterol, or ergocalciferol for a long time.

Studies on doxercalciferol or paricalcitol have been done only in adult patients, and there is no specific information comparing the use of doxercalciferol or paricalcitol in children with use in other age groups.

Older adults--Problems in older adults have not been reported with intake of normal daily-recommended amounts. Studies have shown that older adults may have lower blood levels of vitamin D than younger adults, especially those who have little exposure to sunlight. Your health care professional may recommend that you take a

vitamin supplement that contains vitamin D.

Medicines or other dietary supplements--Although certain medicines or dietary supplements should not be used together at all, in other cases they may be used together even if an interaction might occur. In these cases, your health care professional may want to change the dose, or other precautions may be necessary. When you are taking vitamin D and related compounds, it is especially important that your health care professional know if you are taking any of the following:

- Antacids containing magnesium--Use of these products with any vitamin D-related compound may result in high blood levels of magnesium, especially in patients with kidney disease
- Calcium-containing preparations or
- Thiazide diuretics (water pills)--Use of these preparations with vitamin D may cause high blood levels of calcium and increase the chance of side effects
- Vitamin D and related compounds, other--Use of vitamin D with a related compound may cause high blood levels of vitamin D and increase the chance of side effects.

Other medical problems--The presence of other medical problems may affect the use of vitamin D and related compounds. Make sure you tell your health care professional if you have any other medical problems, especially:

- Heart or blood vessel disease--Alfacalcidol, calcifediol, calcitriol, or dihydrotachysterol may cause hypocalcaemia (high blood levels of calcium), which may make these conditions worse
- Kidney disease--High blood levels of alfacalcidol, calcifediol, calcitriol, dihydrotachysterol, or ergocalciferol may result, which may increase the chance of side effects
- Sarcoidosis--May increase sensitivity to alfacalcidol, calcifediol, calcitriol, dihydrotachysterol, or ergocalciferol and increase the chance of side effects.²⁴

Evidence-based Vitamin D Usage

Interactions:

Decreases Vitamin Availability:	Allopurinol, isoniazid, heparin, medroxyprogesterone, mineral oil, neomycin, orlistat, ²³ anticonvulsants, barbiturates, bile acid sequestrants, cimetidine, oral corticosteroids, ^{23,25} charcoal, etidronate, fibre supplementation, glutethimide, isoniazid, mineral oil, phenolphthalein, sucralfate, sunscreens (SPF \geq 8) and ulcer drugs. ²⁵
Increases Vitamin Availability:	Choline, essential fatty acids, phosphorus, vitamins A and C, ³ oestrogen, sodium fluoride, thiazide diuretics, ²³ calcium, ^{3,25} and vitamin E. ²⁵
Is Increased By Vitamin Availability:	Zinc, magnesium, ²⁵ conjugated estrogens, ²¹ and magnesium in actacids. ²²
Adverse Reactions:	Conjugated oestrogens, verapamil and warfarin. ²³ Hypercalcaemia may occur when used with digoxin or thiazide diuretics. Use with caution. ^{26,27}

Deficiency: Rickets is a vitamin deficiency. This disease is characterised by curved bones, especially in the tibia. The reason this occurs is because the marrow cavity is the site of osteoblast formation. Other symptoms of rickets include softening of the skull, enlargement of the wrist, knee, and ankle joints, and poorly developed muscles. Tetany may also be caused by a deficiency in vitamin D. This is a condition where the muscles feel numb and tingly, and may cause muscle spasms. The structure of teeth may also be affected without enough vitamin D.¹

Toxicity/Side Effects: Along with its needed effects, a dietary supplement may cause some unwanted effects. Alfacalcidol, calcifediol, calcitriol, dihydro-tachysterol, and ergocalciferol do not usually cause any side effects when taken as directed. However, taking large amounts over a period of time may cause some unwanted effects that can be serious.

Check with your doctor immediately if any of the following effects occur:

Late symptoms of severe overdose

- High blood pressure; high fever; irregular heartbeat; stomach pain (severe)

Check with your health care professional as soon as possible if any of the following effects occur:

Early symptoms of overdose

- Bone pain; constipation (especially in children or adolescents); diarrhoea; drowsiness; dryness of mouth; headache (continuing); increased thirst; increase in frequency of urination, especially at night, or in amount of urine; loss of appetite; metallic taste; muscle pain; nausea or vomiting (especially in children or adolescents); unusual tiredness or weakness

Late symptoms of overdose

- Bone pain; calcium deposits (hard lumps) in tissues outside of the bone; cloudy urine; drowsiness; increased sensitivity of eyes to light or irritation of eyes; itching of skin; loss of appetite; loss of sex drive; mood or mental changes; muscle pain; nausea or vomiting; redness or discharge of the eye, eyelid, or lining of the eyelid; runny nose; weight loss

Other side effects not listed above may also occur in some individuals. If you notice any other effects, check with your health care professional.²⁴

Treatment For Overdose: Withdraw vitamin D and calcium supplementation.²⁷ Saline, diuresis, furosemide (20-40 mg IV) and hydrocortisone (100 mg IV every 6 hours). Calcitonin (4-8 IU/kg IM every 6-12 hours for persistent and severe hypercalcaemia. Haemodialysis can also be used for severe hypercalcaemia.²⁸

Storage: To store this dietary supplement:

- Keep out of the reach of children.
- Store away from heat and direct light.
- Do not store in the bathroom, near the kitchen sink, or in other damp places. Heat or moisture may cause the dietary supplement to break down.
- Keep the oral liquid form of the dietary supplement from freezing.
- Do not keep outdated dietary supplements or those no longer needed. Be sure that any discarded dietary supplement is out of the reach of children.²⁴

Evidence-based Vitamin D Usage

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Evidence-based Vitamin D Usage

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