Cholecalciferol (Vitamin D3)

Cholecalciferol (vitamin D3) is a key nutrient for bone health and made in the skin through sunlight exposure. Other sources of vitamin D3 include fortified milk and dietary supplements. Vitamin D3 supplementation is indicated as a prophylaxis and treatment for vitamin D deficiency. Symptoms of vitamin D deficiency include rickets in children (slow growth and weak bones with deformities), and osteomalacia with hypocalcemia in adults. Compared with ergocalciferol (vitamin D2), vitamin D3 is more effective at raising serum levels of vitamin D (refer to the Picmonic on "Ergocalciferol (Vitamin D2)"). Excessive intake of vitamin D is toxic and may lead to hypervitaminosis D. Accidental vitamin D poisoning in children and adults requires medical attention.



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Mechanism

Vitamin D3

Viking (D) Daisy (3) Tree

Vitamin D3, as well as vitamin D2, helps regulate calcium and phosphorus homeostasis by increasing nutrient absorption from the intestines and mobilization from bone. Vitamin D3 also decreases renal excretion of calcium and phosphate. Vitamin D3 is naturally produced in the skin through UVB exposure found in sunlight. Fortified dairy, especially milk, is also a source of vitamin D3.

Indications

Dietary Supplement

Nutritional-plate

Dietary sources of vitamin D include shiitake mushrooms and oily fish such as salmon and tuna. Since natural foods have little vitamin D, foods including cereals, milk, cheese, and orange juice are vitamin D-fortified. Since dietary sources of vitamin D are limited, a dietary supplement may be necessary since many people do not get enough vitamin D through diet and sun exposure.

Vitamin D Deficiency

Viking (D) Daisy Broken

Vitamin D3 supplementation is used for prophylaxis and treatment of vitamin D deficiency. Symptoms of vitamin D deficiency include bone and muscle weakness and pain. In individuals with vitamin D deficiency, children experience rickets while adults develop osteomalacia. Vitamin D deficiency may contribute to bone loss, kidney disease, cancer, and diabetes. Other consequences of vitamin D deficiency include heart and lung disorders, rheumatoid arthritis, and overall mortality.

Side Effects

Fatigue

Sleepy-guy

Excessive amounts of vitamin D3 may cause fatigue and muscle weakness. Too much vitamin D may cause hypercalcemia (refer to the Picmonic on "Hypercalcemia"). Excessive levels of serum calcium affects the central nervous system and may cause confusion and lethargy. Weakened bone related to calcium leaching from the bones to the blood may cause bone pain.

Constipation

Corked Con-toilet

Vitamin D toxicity may present with constipation, vomiting, and nausea. Excessive amounts of serum calcium related to vitamin D toxicity slows down peristalsis and the digestive symptom resulting in stomach upset and constipation.

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Hypercalcemia

Hiker-calcified-cow

Hypercalcemia, an elevated level of calcium in the blood, is a possible side effect of cholecalciferol primarily because cholecalciferol plays a crucial role in calcium absorption in the body. When taken in excessive amounts, cholecalciferol can enhance calcium absorption from the gut, reduce calcium excretion via the kidneys, and mobilize calcium from bones into the bloodstream. This increased availability of calcium can lead to hypercalcemia, especially if dietary calcium intake is also high or if there is an underlying sensitivity or dysfunction in how the body handles vitamin D and calcium.

Kidney Stones

Kidney-throwing Stones

Renal function is affected by excessive amounts of ingested vitamin D3. Persistent hypercalcemia may cause polyuria, nocturia, and proteinuria. Calcium deposition into the kidneys leads to nephrolithiasis or kidney stones.

Considerations

More Effective Than Ergocalciferol

Coal-casserole better than Eagle-casserole

Cholecalciferol (vitamin D3) is more effective than ergocalciferol (vitamin D2) at raising total serum levels of vitamin D. Vitamin D3 has increased binding to tissue vitamin D receptors, an increased half-life, and increased potency when compared to vitamin D2.

Hypervitaminosis D

Hiker-viking (D) Daisy

Excessive amounts of vitamin D3 may lead to hypervitaminosis D, a toxicity from exceeding recommended doses or accidental poisoning. Vitamin D doses exceeding 1000 IU/day in infants and 50,000 IU/day in adults results in hypervitaminosis D. Symptoms include weakness, fatigue, nausea, vomiting, and constipation. Excess calcium causes tissue damage after deposition in the heart, blood vessels, and lungs. Vitamin D poisoning in children may suppress growth for at least 6 months. Treatment of hypervitaminosis D includes ceasing vitamin D ingestion, increasing fluid intake, and initiating a low-calcium diet.

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