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## **Vitamin D - do we need supplementation?**

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**ABSTRACT:** The role of vitamin D in the human body is not only participation in the regulation of calcium and phosphate metabolism, prevention of rickets in children or osteomalacia and osteoporosis in adults. Vitamin D deficiency can be caused by a variety of health conditions. Currently, epidemiological studies confirm the relationship between vitamin D deficiency in the body and an increased risk of neurodegenerative diseases, psychiatric disorders, autoimmune diseases and in cancer prevention. Vitamin D deficiency has been identified as a common metabolic abnormality. Despite known dietary sources of vitamin D and the role of sunlight in its production, a significant proportion of the population may have insufficient serum levels of 25-hydroxyvitamin D.

**KEYS WORDS:** vitamin D, vitamin D deficiency, calcitriol

**INTRODUCTION:** The term vitamin D is defined as: vitamin D<sub>2</sub> - ergocalciferol, found in yeast and mushrooms, and vitamin D<sub>3</sub> - cholecalciferol, found in animal products: fatty sea fish (salmon, mackerel), fish oils, in eggs, liver and in smaller amounts in meat red, poultry, as well as in offal and dairy products. Cholecalciferol is formed in the skin, mainly in the epidermis (mainly in keratinocytes of the reproductive layer) as a result of synthesis under the influence of solar radiation from 7-dehydrocholesterol. Vitamin D synthesis is effective only from April to September, between 10 a.m. and 3 p.m., when clouds do not obscure the sun. The amount of vitamin D is expressed in International Units IU. In people with fair skin, 15-minute exposure to the sun is enough to create the right amount of vitamin D, corresponding to 2000-4000IU / day.

Vitamin D plays a key role in the regulation of phosphate and calcium homeostasis, which is commonly called calcemic action. Active metabolites of vitamin D act on the intestines, kidneys and bones, which are the main effector organs associated with calcemic activity. Under the influence of calcitriol in the intestines occurs increased calcium absorption by increasing the synthesis of a protein that binds calcium. Both vitamins are

transformed into biologically active compounds: calcidiol [25(OH)D<sub>3</sub>] and calcitriol [1,25(OH)<sub>2</sub>D<sub>3</sub>]. The speed of conversion to calcidiol depends on the supply of vitamin D with diet, drugs and supplements.

**THE PURPOSE OF THE REASERCH WORK:** The purpose of the reaserch work was to describe the positive and negative aspects of vitamin D supplementation and the effects of deficiency.

**MATERIALS AND METHODS:**Scientific publications in the Pubmed database were used to write the article.

**RESULTS AND DISCUSSION:**

#### Action of vitamin D

The main role of vitamin D is the regulation of calcium and phosphate homeostasis by affecting parathyroid hormone (PTH), calcium absorption and bone metabolism. Calcitriol, i.e. the active form of vitamin D, is involved in the immune response, differentiation of monocytes into macrophages, stimulating the activity of phagocytes, maturation and differentiation of keratinocytes, neuromuscular coordination, insulin production by the pancreas, and also inhibits the proliferation of cancer cells.

Vitamin D deficiency causes rickets, osteomalacia and osteoporosis. It may promote the occurrence of myopathy and increase the risk of metabolic syndrome, leading to the development of type 2 diabetes and myocardial infarction. Increases susceptibility to infections caused by viruses, bacteria or fungi. Vitamin D also affects the development of autoimmune diseases, including type 1 diabetes, lupus erythematosus, rheumatoid arthritis, multiple sclerosis, inflammatory bowel disease, psoriasis, vitiligo and scleroderma. There is also a relationship between the deficiency of vitamin D in the body and an increased risk of neurodegenerative diseases (Alzheimer's disease) and psychiatric disorders (schizophrenia, depression).

#### Principles of prevention and treatment of vitamin D deficiency

In Poland, due to insufficient supply in the diet and insufficient skin synthesis of vitamin D, its supplementation is necessary. Direct sun exposure is not recommended for infants under 6 months of age and people with pale skin, red hair and blue eyes (people with I skin phenotype).

We observe many diseases related to vitamin D deficiency, where supplementation of a certain concentration of 25(OH)D is necessary: malabsorption syndrome or in people using elimination diets, chronically taking glucocorticosteroids, anticonvulsants, drugs in the treatment of AIDS, in people with obesity, liver failure or cholestasis, with chronic kidney disease, or in kidney recipients.

It is also recommended to determine the concentration of vitamin D in hyperthyroidism, diseases of the skeletal system, granulomatous diseases and malignant neoplasms.

Cholecalciferol is recommended to be taken with a meal, as it is a fat-soluble compound. Monitoring of calcaemia, calciuria, phosphataemia and alkaline phosphatase may be necessary when treating vitamin D deficiency.

## Vitamin D dosage

- in pregnant women, supplementation is recommended under the control of serum 25(OH)D concentration, which will keep the concentration between >30-50ng/ml. When it is not possible to determine 25(OH)D, it is recommended that a woman use vitamin D in a dose of 2000IU/day throughout pregnancy and lactation.
- in newborns born prematurely - <32 weeks of gestation, it is recommended to start supplementation with a dose of 800IU/day, and then supplementation under the control of 25(OH)D concentration
- in newborns born prematurely - 33-36 weeks of pregnancy, supplementation at a dose of 400IU / day is recommended, there are no indications for routine determination of 25(OH)D concentration
- in full-term newborns and infants - for the first 6 months, vitamin D supplementation at a dose of 400 IU / day, and from 6 to 12 months of age - 400-600 IU / day
- in children, adolescents and adults - in the period from May to September, in healthy people staying in the sun for at least 15 minutes from 10 a.m. to 3 p.m., without using sunscreen, vitamin D supplementation is not necessary, although it is still recommended. When the condition is not met, it is recommended:
- in children from 1-10 years of age - supplementation at a dose of 600-1000 IU / day
- in adolescents from 11-18 years of age and adults - 800-2000 IU / day

In children, adolescents and adults struggling with obesity, supplementation at a dose of 1600-4000 IU / day is required.

- in the elderly, vitamin D supplementation is recommended throughout the year at a dose of 800-2000 IU / day

## Side Effects of Vitamin D Supplementation

Hypercalciuria and hypercalcemia may occur during vitamin D supplementation, which is observed at calcidiol concentrations exceeding 88ng/ml.

In acute poisoning, the symptoms of hypercalcemia are: confusion, polyuria, polydipsia, vomiting, anorexia, muscle weakness, and in chronic poisoning: kidney stones, decalcification, which is caused by increased osteoclast activity, and bone pain.

Side effects of vitamin D supplementation can be observed in patients:

- with diseases with the formation of granulomas (tuberculosis, sarcoidosis), because extrarenal synthesis of calcitriol occurs in them, which is not regulated by PTH,
- primary hyperparathyroidism
- and in infants with idiopathic hypercalcaemia.

A general review of vitamin D studies found some evidence of reduced risk of colorectal cancer, non-vertebral fractures, cardiovascular disease, hypertension, ischemic stroke, high body mass index, metabolic syndrome, type 2 diabetes, decreased alkaline phosphatase imbalance in patients requiring dialysis and parathyroid hormone levels in patients not requiring dialysis.

CONCLUSIONS: Currently, vitamin D is not associated only with the regulation of calcium and phosphate metabolism. It is increasingly used in the prevention and treatment of certain diseases. This is especially important in high-risk groups (premature babies, children, people over 70, people with diabetes, cardiovascular disease, obese). 25OHD is the best indicator of vitamin D levels. Toxic effects of vitamin D can occur with excessive doses, but they are extremely rare. The exception is people with hypersensitivity to vitamin D, including idiopathic hypercalcemia of childhood, Williams-Beuren syndrome, some lymphomas or granulomatous diseases.

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