

VITAMIN A

Increases the resistance of our bodies against infections and provides cell renewal. It is found in green vegetables, tomatoes, cereals, vegetable oils, carrots, cabbage, honey and nuts.

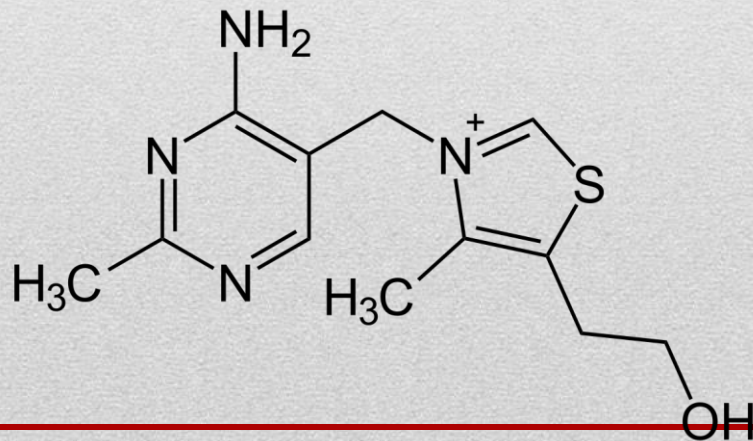
Visual problems, hypertension, breaking of the nails, dryness of the skin, weakness and being prone to infections might be seen when it is found in low amounts in the body.


- Vitamin A in foods of animal origin are usually in the form of **retinol**. Retinol can be transformed to retinal or retinoic acid in the body.
 - **Carotenoids** can also be turned into vitamin A in the body. The most common carotenoid in foodstuffs is β -carotene. α -carotene and γ -carotene are found in less amounts and can be turned into vitamin A though with a lower yield.
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*** Vitamin A is teratogenic and leads to birth defects if used in high amounts during the early period of pregnancy even for a short time. Pregnant women should avoid taking too much vitamin A supplement and avoid consuming foods rich in vitamin A (e.g. Liver). Carotenes do not lead to vitamin A toxicity so they are considered to be safe.

VITAMIN B₁

Has an important role in maintaining nervous system. Regulates blood circulation. It is abundant in cheese, eggs, fish and cereals. Vitamin B₁ deficiency leads to problems related to nervous system, digestive system and circulatory system, and also may lead to exhaustion.





Thiamin reserves of the body is low (approximately 30 mg), therefore it has to be taken regularly to avoid deficiency. It is an important vitamin of the energy metabolism. Thiamin absorbed from the diet is rapidly transformed into its active form: thiamin pyrophosphate (TPP). This active form is an important coenzyme as combined with Mg in the energy production within the cells. Thiamin also has important roles in respect to many neurotransmitters. It even functions in collagen synthesis.

Toxicity: It is not toxic, however doses above 200 mg may lead to somnolence. Thiamin may result in rare, nevertheless severe allergic reactions when administered via injection.

VITAMIN B₆

Functions in the production of blood cells. Strengthens the heart, regulates the functioning of kidneys and lower cholesterol. Boosts immune system. Found in eggs, chicken, carrots and green leafy vegetables. Kidney Stones, diseases of the nervous system, anemia and weakness may be encountered in its deficiency.

- Vitamin B₆ taken via diet (it is also called **pyridoxine**), turns into its active form: pyridoxal 5 phosphate (PLP). Activation of vitamin B₆ requires sufficient amounts of zinc and riboflavin. This coenzyme is involved in more than 100 metabolic reactions. Since total body store is only 150 mg, it has to be taken regularly.
 - It has important role in the protein synthesis, metabolism and transformation of amino acids. E.g. Collagen synthesis also requires vitamin B₆. It also functions in the maintenance of normal blood sugar levels.
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VITAMIN B₁₂


Aids in the renewal of cells. Strengthens the nervous system. Facilitates the utilization of proteins by the body. Has an important function in the health development of children. Found in offal, cheese and milk in abundant amounts. Chronic vitamin B₁₂ deficiency may pave the way for progressive nervous system disorders like **Alzheimer's Diseases**. Somnolence, getting sick easily, loss of appetite in children and not being able complete development may be seen in its deficiency.

VITAMIN C

Regulates blood circulation, helps in the renewal of cells, strengthens gums. It is found in green pepper, strawberries, parsley, green vegetables, tomatoes, red cabbage and citrus fruits. Muscles weakness, rheumatism, circulatory system problems, decaying of the teeth, cellulitis may be seen in its deficiency.


VITAMIN D

Responsible for the development and strengthening of the skeletal system. It is found in green vegetables, fish and olive oil. The sun is also an important source for vitamin D. It directs calcium into the bones, therefore rickets is seen in its deficiency. Growth problems in children, decaying of the teeth and gum diseases, bone deformation in advanced age may also be seen.




Vitamin D is the only vitamin having a hormone as its biologically active form. Vitamin D₃, i.e. **cholecalciferol** is the form that is synthesized in the skin from cholesterol when exposed to the sun.

For healthy children and adults, exposing the hands, face and arms to sun for 10-15 minutes for a couple of times provides sufficient amount of vitamin D.




Vitamin D₃ is the natural form that is found in animal originated foods like eggs, fish and liver.

Another form of vitamin D is vitamin D₂, i.e. **ergocalciferol**. This vitamin is synthesized by some fungi and is being used in many food supplements.




Major function of vitamin D is to regulate the levels of calcium within the blood and the tissues. Low levels of blood calcium will trigger active vitamin D productions, calcium absorption from the diet will be stimulated, calcium release from the bones will be increased and renal excretion will be slowed.

Vitamin D is essential for normal bone development during childhood and also to maintain the bone density and strength. Vitamin D increases calcium absorption from the foodstuff and accumulation of calcium and minerals in the bones.



Since vitamin D is essentially found in animal originated foodstuff, if sun exposure is not sufficient, vegetarian diets may add to the risk for deficiency. In geriatric population vitamin D synthesis in the skin is not so efficient (half the amount of an adult). In addition, babies can not activate the stored forms of vitamin D completely.

If people living in countries in the north do not get enough vitamin D with their diets in the winter, then they are under the risk of developing deficiency. In addition, sunscreens having a SPF above 15 block vitamin D synthesis in the skin by 99%.



Toxicity: If taken above 100 mg/day, hypercalcemia in children and accumulation of calcium in soft tissues may occur. Chronic intake above 1000 mg/day leads to renal calcification and calcification of other soft tissues.

VITAMIN E

It is a natural protector against cancer due to its antioxidant activity. Aids in the renewal of cells and delays aging process. It is also necessary for reproductive functions. Found in vegetable oils, cereals, almond, walnut, sunflower seed and green leafy vegetables.

- Vitamin E is the general name of a group of compounds which bear vitamin E activity to certain extents. The most abundant and most active form is α -tocopherol. β -, γ - and δ -tocopherols are also present in the diet. Their relative activities vary significantly and they are important in evaluating the vitamin E content of foodstuff and supplements. For example, soy oil contains more tocopherol compared to sunflower seed oil, however sunflower seed oil contains α -tocopherol; thus vitamin E activity of sunflower seed oil is more. In addition, the liver metabolizes γ -tocopherol more rapidly.
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Toxicity: It is not toxic for healthy people in doses of 400-800 mg/day; daily intake of 1600- 3200 mg has been tolerated for a long period without any important side effects.


However, patients on anticoagulant therapy should be careful about high doses since vitamin E may increase the affect of anticoagulants and decrease the levels of coagulation factors that are dependent on vitamin K.

Diabetes patients should be careful when using vitamin E in high doses since it may increase the effectiveness of insulin and lead to hypoglycemia.

VITAMIN K

Provides coagulation of blood during injuries and prevents excessive blood loss. Protects against cancer due to the antioxidant compounds that it possesses. Aids in cell renewal. Strengthens bone structure. It is found in cauliflower, cabbage, Brussels sprouts. Immune system suffers from its deficiency and also small cuts and wounds would take longer time to heal. May result in premature aging.

Vitamin K is the general term that is used for a couple of related compounds that have vitamin K activity. Vitamin K₁ (phylloquinone) is found in plants, Vitamin K₂ (menaquinone) is found in intestinal bacteria. And vitamin K₃ (menadione) is the synthetic form.



Vitamin K is the part of coagulation cascade in the blood and is an important cofactor in the production of proteins.

It is active in the production of structural and regulative proteins in the bones and osteocalcin (the protein that is dependent on vitamin K) is important in calcium metabolism and regulated vitamin D activity.

Toxicity: Phylloquinone toxicity has not been reported even in high doses such as 4000 $\mu\text{g}/\text{day}$.
