

Water soluble vitamins

Content

- 1Vitamin B 1 - thiamin
 - 1.1Source
 - 1.2Deficit
 - 1.3Surplus
- 2Vitamin B 2 - riboflavin
 - 2.1Source
 - 2.2Deficit
 - 2.3Surplus
- 3Vitamin B 3 - niacin
 - 3.1Source
 - 3.2Deficit
 - 3.3Surplus
 - 3.4Pharmacological use
- 4Vitamin B 5 - pantothenic acid
 - 4.1Source
 - 4.2Deficit
 - 4.3Surplus
- 5Vitamin B 6 - pyridoxine
 - 5.1Source
 - 5.1.1Use
 - 5.2Deficit
 - 5.3Surplus
- 6Vitamin B 7 - biotin
 - 6.1Source
 - 6.2Deficit
 - 6.3Surplus
- 7Vitamin B 9 - folic acid
 - 7.1Source
 - 7.2Deficit
 - 7.3Surplus
 - 7.4Interaction
- 8Summary video
- 9Vitamin B 12 - cobalamin
 - 9.1Source
 - 9.2Importance
 - 9.3Deficit
 - 9.3.1Vitamin B 12 deficiency in infants
 - 9.4Surplus
- 10Links
 - 10.1related articles
 - 10.2External links
 - 10.3Reference
- 11Vitamin C - ascorbic acid
 - 11.1Source
 - 11.2Deficit
 - 11.3Surplus
- 12Links
 - 12.1related articles
 - 12.2Referenc

Water - soluble vitamins include B vitamins and vitamin C. Manifestations of the deficiency are treated by administering the appropriate vitamin.

B vitamins:

- - A common feature of B vitamins (except vitamin B 12) is their presence in yeast, but yeast is not an important source for humans if it is included in the diet only as a means of leavening bread - a small amount of yeast used does not contain nutritionally significant amounts of B vitamins.
 - Their metabolic effects are interrelated.
 - Rarely is there a shortage of only one of them.
 - They consist of the intestinal microflora - the amount created by the microflora is generally only a fraction of the daily recommended dose, no information was found on their usability.
 - Some are more often called, others. Some numbers are missing in the series because it turned out that some substances, originally considered vitamins, are not.

For more information, see Names of water-soluble vitamins .

Vitamin B 1 - thiamin

Thiamine (vitamin B 1) is a coenzyme of decarboxylases important for glucose metabolism and energy supply of nerve and muscle cells.

Source

Meat, fish, cereals, yeast, legumes.

Recommended daily dose for adults: 1-1.4 mg

Deficit

Berber -berry vitamin deficiency in the diet now occurs in very poor populations or in refugees in developing countries and in people who feed mainly on polished / husked / white rice. The typical picture consists of nerve disorders, especially peripheral nerves (dry beri beri), edema and heart disease (wet beri beri). Resorption disorders occur in alcoholics and are manifested by Wernicke's encephalopathy .

More detailed information can be found on the Beriberi page .

Suboptimal thiamine status based on biochemical criteria in Europe was found in only 4-6% of the population. Alcoholics are a risk group.

- Laboratory evaluation: urinary excretion of thiamine. In case of deficiency, the concentration of transketolase is reduced in erythrocytes, and there is a high concentration of glyoxalate in blood and urine.

Surplus

Manifestations of excess are unknown.

Vitamin B₂ - riboflavin

Riboflavin or vitamin B 2 is part of the coenzymes flavinadenine dinucleotide (FAD) and flavin mononucleotide (FMN), it plays a key role in oxidative metabolism.

Source

It is found in small amounts in many foods. The main sources are meat, milk and dairy products. Fish, offal, vegetables, eggs and whole grains are also good sources. Flour milling removes most of the vitamin B 2 , so in some countries (eg the USA) cereal foods are fortified with vitamin B 2 .

Recommended daily dose for adults: 1.2-1.5 mg .

Deficit

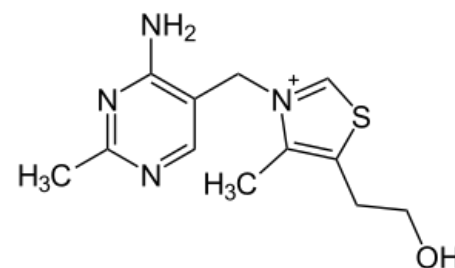
According to several population studies, the deficit is widespread in developing countries where there is little animal food, vegetables and fruit in the diet and highly ground cereals (white flour) are consumed . It often occurs secondarily as a result of resorption disorders in malnutrition , enterocolitis, celiac disease , chronic hepatitis , and often in children with broad-spectrum ATBs . Clinical symptoms may also exacerbate in some diseases (tumor, heart, diabetes mellitus) .

- Clinical picture : The description of the symptoms is somewhat inconsistent in various professional publications. Vitamin B 2 deficiency almost always occurs together with deficiency of other B vitamins, which may be the cause of some of the reported symptoms . The most commonly reported are angular stomatitis, cheilosis, atrophic glossitis, normocyte normochromic anemia and bone marrow hypoplasia . Among other reported symptoms is seborrheic dermatitis , but according to dermatological publications, its etiology is still unknown .
- Laboratory evaluation : decrease in excretion of vit. B 2 in urine (normal values are 106-638 nmol / l), decreased concentration of glutathione and glutathione reductase in erythrocytes.

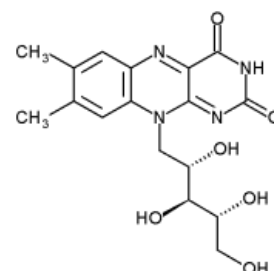
Surplus

Manifestations of excess are unknown.

Vitamin B 3 - niacin



Thiamin



Riboflavin

Niacin (vitamin B 3) is the name for nicotinamide and nicotinic acid. It is part of coenzymes (nicotinamide adenine dinucleotide - NAD + and nicotinamide adenine dinucleotide phosphate - NADP +). It can be formed in the liver from tryptophan , but its biosynthesis is very slow and requires vitamin B 6 .

Source

The source is most foods - meat, fish, cereals.

The recommended daily dose for adults is 13-17 mg according to age and sex

Deficit

Pellagra is caused by a current deficiency of niacin and its precursor tryptophan. Today, it is rare in very poor populations or refugees in developing countries. It occurs in people who feed mainly on corn. According to the symptoms, the name "three D disease" is sometimes used as a mnemonic aid - dermatitis, diarrhea, dementia.

More detailed information can be found on the Pellagra website .

Surplus

Manifestations of excess food are not known. High doses of food supplements cause vasodilation, warmth, inflammation of the gastric mucosa, damage to liver cells. Intake should not exceed 35 mg / kg / day.

Pharmacological use

Nicotinic acid (niacin) and its derivatives are used to treat hyperlipidemias . They inhibit the secretion of VLDL from the liver and increase peripheral lipoprotein lipase activity . This leads to a reduction in circulating VLDL (ie TAG) and consequently LDL (cholesterol). In adipose tissue, on the other hand , it blocks intracellular lipase , ie the release of MK from stores, which further reduces the supply of TAG to the liver and reduces VLDL synthesis.

Side effects

- harmless vasodilation (mediated by the release of prostaglandins) in the cutaneous bed associated with subjective feelings of heat - can be managed by administration of acylpyrin;
- in 1/5 treated hyperuricaemia ;
- skin rash.

Vitamin B 5 - pantothenic acid

Pantothenic acid (vitamin B 5) is part of coenzyme A.

Source

Small amounts are found in almost all foods, large amounts include yeast, liver, meat, milk, whole grains and legumes.

Recommended daily dose for adults: 6 mg

Deficit

Deficiency does not occur - described only in the administration of pantothenic acid antagonists and in extremely malnourished people together with manifestations of deficiencies of other nutrients, manifested by atrophy of the hair follicle, loss of pigment, dermatitis .

Surplus

Manifestations of excess are unknown.

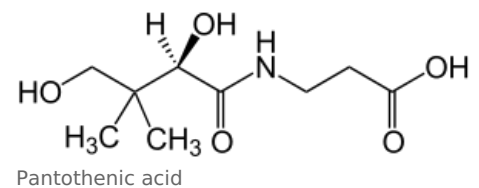
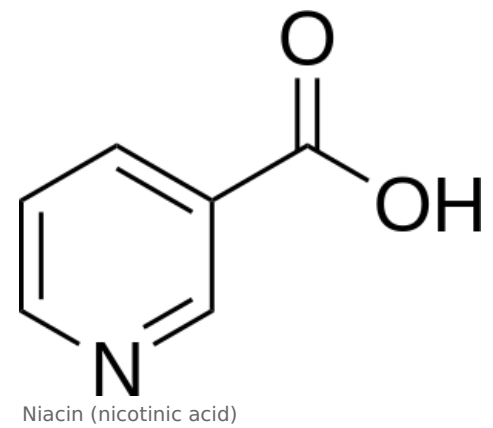
Vitamin B 6 - pyridoxine

The name vitamin B 6 includes a group of compounds (pyridoxine, pyridoxamine, pyridoxal and their phosphates). It is a coenzyme of more than 50 enzyme reactions - decarboxylase and transaminase, synthesis of nicotinic acid and arachidonic acid , affects the function of the nervous system, immune response and hemoglobin synthesis .

Source

It is abundant in food.

Recommended daily dose for adults: 1.6 - 2.0 mg



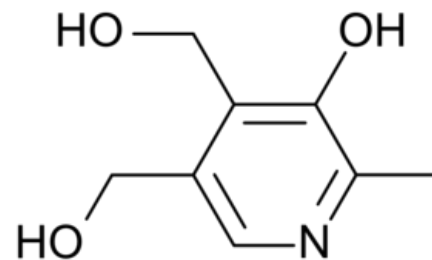
Use

It is used for the pharmacotherapy of gestational nausea 10-25 mg every 8 hours.

Deficit

Deficiency does not occur in normal eating habits (the most common cause is alcoholism). It manifests itself in skin and mucous membrane changes, ragads of corners, peripheral neuropathy .

In addition, sideroblastic anemia can occur in deficiency. Pyridoxine regulates the incorporation of iron into hemoglobin and its deficiency causes the formation of so-called siderotic granules in erythrocytes.



Pyridoxine

Surplus

There is no food surplus. Sensory neuropathies have been reported after prolonged intake of 50-500 mg.

Vitamin B 7 - biotin

Biotin (Vitamin B 7 , vitamin H, factor R - described by several scientists, it was only later found to be the same substance) is important for the metabolism of amino acids and fatty acids, it is a cofactor of carboxylases.

Source

It is found in low concentrations in many foods. Rich sources are yeast, liver, egg yolk, nuts, lentils.

Daily requirement (DDD cannot be determined): 30-60 µg

Deficit

There is no food deficit. It has been described in people who have consumed large amounts of raw eggs for a long time (biotin binds irreversibly with the avidin contained in the raw protein) and with inappropriate parenteral nutrition.

Manifestations : seborrheic dermatitis , fatigue, anorexia nervosa , nausea , hypercholesterolemia , vascular disorders.

Surplus

Manifestations of excess are unknown.

Vitamin B 9 - folic acid

Folic acid is also referred to as vitamin B 9 , folate or folacin . It includes a group of compounds: folic acid (contains pterin, p-aminobenzoic acid and glutamic acid) and folates . Together with vitamin B 12 , it is essential for the formation of nucleic acids and thus for DNA synthesis , participates in the transfer of single-carbon radicals and in all cell division processes , and is therefore important in tissues with high mitotic activity.

It is absorbed in the proximal parts of the small intestine. In excess, it is excreted in the urine.

Source

Liver, yeast, leafy vegetables, but also whole grains, meat, milk, eggs and legumes.

Recommended daily dose for adults: 400 µg . 600 µg is recommended during pregnancy to prevent congenital malformations (especially neural tube clefts).

Deficit

Vitamin B 9 deficiency occurs when there is insufficient supply, absorption or increased need during pregnancy. Megaloblastic anemia develops , which is characterized by the presence of abnormal red blood cell precursors in the bone marrow. Compared to normal erythrocytes , erythrocytes arising from these abnormal precursors have a different shape, larger size, lower viability, and limited ability to transport oxygen . Along with iron deficiency , iron deficiency is a major cause of anemia in developing countries. Deficiency in pregnancy is the cause of the neural tube cleft in the fetus .

- Laboratory evaluation: serum levels of folate, total homocysteine (increases in case of deficiency, also in case of vitamin B 12 deficiency).

Surplus

High folic acid intake can mask vitamin B 12 deficiency , so a maximum of 1000 µg / day is recommended as the upper limit of daily intake.

Interaction

The cytostatic agent methotrexate is a structural analogue of folic acid, which acts as its antimetabolite (inhibits dihydrofolate reductase).

See the methotrexate page for more information .

Summary video

<mediaplayer width = '500' height = '300'> https://www.youtube.com/watch?v=ADKz3pdf_5Q </mediaplayer>

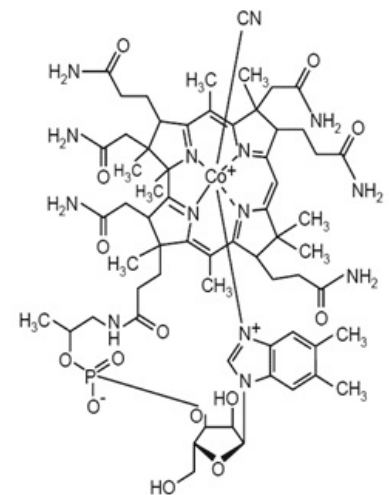
Vitamin B 12 - cobalamin

Vitamin B 12 (cobalamin) is the collective name for several compounds that have cobalt at the center of the porphyrin skeleton . Vitamin B 12 has a number of biological functions - it plays an important role in hematopoiesis , it is essential for the development of the central nervous system in childhood , it participates in the production of nucleic acids , transmethylation processes, it acts anabolic. Vitamin B 12 deficiency in adults causes macrocytic anemia , damage to the posterior and lateral cords of the spinal cord , peripheral nerves and dementia or depression . Vitamin B deficiency12 also secondarily affects the folate cycle , with consequent disruption of the synthesis of purines and pyrimidines necessary for DNA and RNA formation.

Source

It occurs in nutritionally significant amounts only in animal foods. Rich sources are liver, kidneys, meat of warm-blooded animals (1-2 µg / 100 g), fish meat, egg yolk and dairy products (milk 0.3 µg / 100 ml, cheese 0.2-0.6 µg / 100 g) . The plant diet contains trace amounts of vitamin B 12 only if it has been processed by microbial fermentation (sauerkraut, beer).

It is absorbed in the small intestine only if it forms a complex with the internal factor in the stomach . Therefore, a properly functioning gastric mucosa is needed and large amounts of vitamin B 12 produced by the intestinal flora are unusable for humans. Cobalamin with intrinsic factor binds to the specific cubilin receptor in the distal ileum, and this complex then enters the enterocyte by endocytosis . Inside the enterocyte, cobalamin binds to other transporters and passes into plasma. 75-80% bind to haptocorrin and travel to hepatocytes. Only vitamin B 12 enters the cells of other organs bound to transcobalamin II (so-called holotranscobalamin) after binding to a specific receptor via endocytosis. In the cell, cobalamin is converted to the active metabolites methylcobalamin and adenosylcobalamin, which serve as cofactors for enzymes.



Vitamin B formula 12

Recommended daily dose for adults : 3 µg.

Minimum requirement in infants: approx. 0.1-0.3 µg.

Importance

- Hematopoiesis ;
- development of the central nervous system in childhood;
- cofactor of two metabolic reactions:
 - conversion of homocysteine to methionine by methionine synthase (disorder of this reaction leads to accumulation of homocysteine);
 - conversion of methylmalonyl-CoA to succinyl-CoA by methylmalonyl-CoA mutase (impairment of this reaction leads to accumulation of methylmalonic acid and its increased urinary excretion).

Deficit

Its deficiency is manifested clinically by failure, macrocytic anemia and neurological symptoms. The adult builds up reserves (2-5 mg) of vitamin B 12 in the liver to cover his needs for 5-10 years. The stocks that the newborn builds up in utero (approximately 25 µg) will be depleted in 3-5 months.

Laboratory manifestations include macrocytic anemia, elevated aminotransferases, hyperhomocysteinemia, and increased urinary excretion of methylmalonic acid. Metabolic changes precede clinical manifestations.

Vitamin B 12 deficiency in infants

Vitamin B 12 deficiency leads to anorexia, failure to thrive , slowing down and arrest of psychomotor development as well as impaired growth of the skull circumference. Affected children develop central hypotonic syndrome , less often tremor or chorea symptoms . Breastfed infants of mothers who have reduced levels of vitamin B 12 due to vitamin B 12 absorption disorders in latent gastrointestinal diseases (such as preclinical stage of pernicious anemia

, atrophic gastritis with achlorhydria, Helicobacter pylori infection , achlorhydria during treatment) are particularly at risk.proton pump inhibitors , celiac disease , non-specific intestinal inflammation , condition after ileum resection) or on a vegetarian / vegan diet. While vitamin deficiency in mothers is often clinically silent, in infants it can cause dramatic symptoms of general (failure, anorexia), neurological (developmental delay, developmental progression, increased sleepiness, apathy with possible progression to coma, brain atrophy with growth retardation, hypotension, sometimes tremor , chorea , secondary epilepsy) and hematological (Howell-Jolly macrocytic anemia, polymorphonuclear hypersegmentation and megaloblastic rearrangement of all lines in the bone marrow). Permanent neurological impairment, especially of intellectual function, is common in late diagnosis.

The level of vitamin B 12 or holotranscobalamin (the active form of vitamin B 12) is recommended to be tested not only in children of vegetarian mothers, but also in all breastfed infants who develop failure, muscle hypotension, slowing of psychomotor development or macrocytic anemia.

Pernicious anemia is an autoimmune disease that leads to atrophy of the gastric mucosa and thus to a lack of internal factor.

Surplus

Manifestations of excess were not described even after a very high intake (5 mg) of the supplement.

Links

related articles

- Disorders of cobalamin metabolism

External links

- Case report: Apathetic infant with severe vitamin B12 deficiency

Reference

1. Deutsche Gesellschaft für Ernährung, Österreichische Gesellschaft für Ernährung, Schweizerische Gesellschaft für Ernährungsforschung, Schweizerische Vereinigung pro Ernährung. . *Reference values for fuel supply (DACH)*. 1st edition. Frankfurt am Main: Umschau / Braus, 2000. 216 pp. ISBN 3-8295-7114-3 . Wrong citation: Invalid tag <ref>; the name "DACH" is used multiple times with different content Wrong citation: Invalid tag <ref>; the name "DACH" is used multiple times with different content Wrong citation: Invalid tag <ref>; the name "DACH" is used multiple times with different content Wrong citation: Invalid tag <ref>; the name "DACH" is used several times with different contents
2. ↑ ALLEN, L, et al. *Guidelines on Food Fortification with Micronutrients* [online] . 1st edition. Geneva: WHO, FAO, 2006. 370 pp. Also available from <



1000 B 12 1000mcg in ampoule to im administration

http://www.who.int/nutrition/publications/guide_food_fortification_micronutrients.pdf >. ISBN 139789241594011 .

3. ↑ STANDING COMMITTEE ON THE SCIENTIFIC EVALUATION OF DIETARY REFERENCE INTAKES AND ITS PANEL ON FOLATE, OTHER B VITAMINS, AND CHOLINE AND SUBCOMMITTEE ON UPPER REFERENCE LEVELS OF NUTRIENTS, FOOD AND NUTRITION BOARD, INSTITUTE OF MEDICINE ., *Dietary Reference Intakes for Thiamin, Riboflavin, Niacin, Vitamin B6, Folate, Vitamin B12, Pantothenic Acid, Biotin, and Choline* [online] . 1st edition. Washington DC: National Academic Press, 1998. 592 pp. Also available from <
<https://www.nap.edu/read/6015/chapter/1> >. ISBN 0-309-59725-0 .
4. ↑ Jump up to: a b WHO, FAO ., *Vitamin and mineral requirements in human nutrition* [online] . 2nd edition. Geneva: WHO, 2004. 341 pp. Also available from <
<http://apps.who.int/iris/bitstream/10665/42716/1/9241546123.pdf> >. ISBN 924154612 3 .
5. ↑ ASCHOFF, R, et al. Seborrheic dermatitis. *Dermatologist*. 2011, vol. 62, vol. 4, pp. 297-307, ISSN 0976-4550.
6. ↑ *Laboratory values: Normal values established for laboratory tests. This database was prepared in cooperation with the Institute of Clinical Biochemistry and Laboratory Diagnostics of the General Hospital in Prague* [database]. Pears Health Cyber, sro 2012, Last revision 2012-02-21, [cit. 2012-02-21]. <
<http://www.ordinace.cz/laboratorni-hodnoty/238/#detail> >.
7. ↑ Jump up to: a b MARTÍNKOVÁ, Jiřina, Stanislav MIČUDA and Jolana CERMANOVÁ. *Selected chapters from*

clinical pharmacology for bachelor study: Therapy of hyperlipidemia [online]. © 2001. [feeling. 2010-07-05].

< <https://www.lfhk.cuni.cz/farmakol/predn/bak/kapitoly/hypolipidemika-bak.doc/> >.

8. ↑ BENEŠ, Jiří. *Study materials* [online]. [feeling. 2010]. < <http://jirben.wz.cz> >.

9. ↑ Jump up to: a b c d e f g h i j HONZÍK, T, et al. Nutritional deficiency of vitamin B 12 in breastfed infants.

Postgraduate Medicine [online] . 2008, vol. -, vol. 5, p. -, also available from < <https://zdravi.euro.cz/clanek/postgradualni-medicina/nutricni-dezpustné-v-tučích> >.

Vitamins	
Fat-soluble vitamins	Vitamin A • Vitamin D • Vitamin E • Vitamin K
Water soluble vitamins	Vitamin B 1 - thiamine • Vitamin B 2 - riboflavin • Vitamin B 3 - niacin • Vitamin B 5 - pantothenic acid • Vitamin B 6 - pyridoxine • Vitamin B 7 - biotin • Vitamin B 9 - folic acid • Vitamin B 12 - cobalamin • Vitamin C - ascorbic acid
Portal: Biochemistry	

Vitamin C - ascorbic acid

L - ascorbic acid , also referred to as vitamin C , is a water-soluble substance with strong reducing effects. Humans (like other primates or guinea pigs) cannot synthesize it because it lacks L -gulonolactone oxidase activity, so it must be ingested. L -ascorbate is involved in hydroxylation of proline and lysine in collagen , carnitine synthesis , tyrosine metabolism , acts as an antioxidant, promotes immunity, iron resorption, affects beta-oxidation of fatty acids , increases the activity of microsomal enzymes, accelerates the detoxification of foreign substances.

The reducing effects of ascorbic acid are due to its easy oxidation to dehydroascorbate:

Source

Fruits, vegetables (including potatoes), liver. The average loss in food processing is 30%.

Recommended daily dose for adults : 100 mg . In addition to the prevention of deficit manifestations, the strengthening of the immune system and the prevention of degenerative diseases are also considered in its determination. It is higher in case of considerable physical exertion, mental stress, alcohol and drug abuse, in some diseases (eg diabetes, renal insufficiency, infections). Intake of 150 mg / day is recommended for smokers.

Deficit

Ascorbic acid deficiency - scurvy (scurvy) - now occurs only in extreme conditions. We also encounter preclinical manifestations of mild deficiency in our country (fatigue, prolonged convalescence, impaired wound healing and reduced resistance to infections).

- Laboratory assessment of the condition: plasma vitamin C levels. Clinical signs appear at values $\leq 10 \mu\text{mol} / \text{l}$, values below $37 \mu\text{mol} / \text{l}$ are considered an indicator of low vitamin C intake. From the point of view of atherosclerosis and tumor prevention, values $\geq 50 \mu\text{mol} / \text{l}$ are considered desirable.

Surplus

There are no signs of excess food. Approximately 1% of unused vitamin C is converted to oxalate, but the risk of urinary stones is low in healthy individuals. As a precaution, the daily intake should not exceed 1000 mg. Administration of very high doses (5 g) may cause diarrhea .

With a high intake of ascorbate (on the order of grams per day), most of this substance is excreted in the urine. It can then interfere with a variety of clinical biochemical determinations in routine urine chemistry .

Links

related articles

- Fat-soluble vitamins

Reference

1. German society for nutrition, Austrian society for nutrition Swedish society for nutrition research, Swiss association for nutrition. . *Reference values for fuel supply (DACH)*. 1st edition. Frankfurt am Main: Umschau / Braus, 2000. 216 pp. ISBN 3-8295-7114-3 .

Category :

- Biochemistry

- Physiology
- Basic and special essential drugs according to WHO
- Hygiene
- Cardiology
- Pharmacology
- Internal Medicine
- Pathophysiology
- Pathobiochemistry
- Dictionary of physiology
- Video articles
- Gastroenterology
- Pediatrics