

Zinc

Zinc is needed for the activity of more than 200 Zn-dependent metalloenzymes (carbonic anhydrase, alcohol dehydrogenase, LDH, ALP, superoxide dismutase etc.), necessary for DNA synthesis and for the function of some proteins that bind to DNA (see zinc fingers) → deficiency affects growth, healing, deficiency in the fetus causes e.g. spina bifida. Zinc is a component of superoxide dismutase, forms a structural and functional component of biological membranes, stabilizes the structures of RNA, DNA and ribosomes. Zn is necessary for cell proliferation, cellular immune reactions, stabilization of the hormone-receptor complex. It is needed for proper function of male gonads.

Source

Zinc is abundant in meat and other protein-rich foods, whole grains, legumes, root vegetables. It is better utilized from animal than from plant foods, from which it is less easily absorbed because of the content of phytate, fibre and some other substances [1].

The absorption of zinc depends on its intake and the body's supply of zinc - when intake is high, absorption decreases and excretion into the intestine increases and vice versa, when intake is low, absorption increases and excretion into the intestine decreases. Unlike Cu and Fe, Zn is not stored in the liver. About 10 % is excreted in the urine, the rest is taken up in the bile via pancreatic secretions.

The recommended daily dose for adult men is 10 mg and for women 7 mg [2]

Deficit

Zn deficiency can be genetically determined or gained **primarily** (i.e. by an inappropriate diet) or **secondarily** (i.e. conditioned by a disease leading, for example, to a lack of absorption).

Zinc deficiency can be caused by insufficient intake. Zinc is also poorly absorbed from foods rich in phytate, fibre and other substances, as these substances inhibit its utilisation. Losses during diarrheal diseases, malabsorption syndromes and parasitic diseases may also contribute to zinc deficiency. Zn deficiency is one of the most prevalent malnutrition in the world.



For more information see Nutrient deficiency diseases.

To **evaluate the zinc supply of a population** the most widely used method is the determination of plasma zinc concentration. However, this indicator can be influenced by a number of factors. A concentration of 10 µl is considered sufficient.

Symptoms of deficiency

[3]

Acrodermatitis enteropathica [4] (Danbolt's disease) is a genetic disorder of Zn absorption, probably due to a defect in a ligand that normally facilitates Zn absorption in the intestine. It develops after birth, shortly after the transition to artificial nutrition. Clinical manifestations are progressive bullous-pustular dermatitis in association with paronychia and generalized alopecia; ocular symptoms (blepharitis, photophobia and corneal opacity) are often present. Gastrointestinal symptoms include chronic diarrhea, malabsorption, steatorrhea, lactose intolerance. There are also neuropsychiatric symptoms, delayed growth, hypogonadism and increased vulnerability to infections. Biochemical findings show decreased resorption of Zn in the intestine but normal excretion in faeces, urine and sweat. There is a marked decrease in plasma Zn. Therapeutically, treatment with diiodohydroxyquinoline, which forms a well absorbed complex with Zn, is effective.

Even mild zinc deficiency leads to impaired immunity and higher morbidity and mortality from infectious diseases. It is also manifested by growth delay, failure to thrive, hypogeusia (impaired appetite) and possibly atrophy of the thymus. Zinc deficiency is common in the elderly, especially the hospitalised, and may manifest itself in poor wound healing.



Food containing Zinc



Carbonic anhydrase

Significant zinc deficiency was described in 1961 in young men in Iran and was manifested by growth delay, hypogonadism, delayed sexual maturation, hepatosplenomegaly and anaemia.

Significant zinc deficiency can also occur in patients on parenteral nutrition without zinc and is manifested by alopecia, diarrhoea, skin lesions and anorexia. If zinc is not given, patients die from intercurrent infection (e.g. diarrhoea).

In pregnant women, significant zinc deficiency is associated with birth defects in their babies and spontaneous abortions. Moderate deficiency is associated with fetal growth retardation, low birth weight and birth complications.

Maternal and early infant zinc deficiency can have a negative effect on the neuromotor development of the child.

Zinc treatment

Contraindications to zinc treatment - autoimmune diseases, kidney disorders, pregnancy, lactation.

Contraindications to zinc treatment – autoimmune diseases, kidney disorders, pregnancy, lactation.

Toxicity

Acute Zn poisoning causes diarrhea, vomiting, nausea, muscle pain and fever. It may be caused iatrogenically (infusion, contamination during hemodialysis). Oral intake of Zn may lead to gastrointestinal discomfort, ulceration of gastric mucosa. High doses of Zn can cause Cu deficiency because Zn competes with Cu during absorption in the intestine. This can lead to anemia from Cu deficiency.

Acute Zn poisoning causes diarrhea, vomiting, nausea, muscle pain and fever. It may be caused iatrogenically (infusion, contamination during hemodialysis). Oral intake of Zn may lead to gastrointestinal discomfort, ulceration of gastric mucosa. High doses of Zn can cause Cu deficiency because Zn competes with Cu during absorption in the intestine. This can lead to anemia from Cu deficiency.

Poisoning:

- occupational diseases - zinc vapour fever in iron foundries - metallic taste in the mouth, irritating cough, muscle aches
- respiratory irritation, bronchopneumonia to pulmonary oedema
- skin ulceration
- after ingestion - lethargy
- the decrease in plasma levels may not be due to a decrease in body stores

Links

Related articles

- Trace elements

External links

- Zinek (česká wikipedie)
- Zinc (anglická wikipedie)

Zdroj

- BENEŠ, Jiří. *Studijní materiály* [online]. ©2007. [cit. 2009]. <<http://www.jirben.wz.cz/>>.

Used literature

- SCHNEIDERKA, Petr, et al. *Kapitoly z klinické biochemie*. 2. edition. Praha : Karolinum, 2004. ISBN 80-246-0678-X.
- BENCKO, Vladimír, et al. *Hygiena – učební texty k seminářům a praktickým cvičením*. 2. edition. Praha : Karolinum, 2002. ISBN 80-7184-551-5.
- MASOPUST, Jaroslav – PRŮŠA, Richard. *Patobiochemie metabolických drah*. 2. edition. Univerzita Karlova, 2004. 208 pp. pp. 189–190. ISBN 80-238-4589-6.

References

1. World Health Organization. . *Trace elements in human nutrition and health* [online] . 1. edition. Geneva : WHO, 1996. 160 pp. Available from

- <http://apps.who.int/iris/bitstream/10665/37931/1/9241561734_eng.pdf>. ISBN 9241561734.
2. Deutsche Gesellschaft für Ernährung, Österreichische Gesellschaft für Ernährung, Schweizerische Gesellschaft für Ernährungsforschung, Schweizerische Vereinigung für Ernährung. . *Referenzwerte für die Nährstoffzufuhr (DACH)*. 1. edition. Frankfurt am Main : Umschau/Braus, 2000. 216 pp. ISBN 3-8295-7114-3.
 3. (EDITOR), Richard D. Semba. *Nutrition and Health in Developing Countries*. 2. edition. Totowa : Humana Press, 2008. 931 pp. ISBN 978-1-934115-24-4.
 4. MASOPUST, Jaroslav – PRŮŠA, Richard. *Patobiochemie metabolických drah*. 2. edition. Univerzita Karlova, 2004. 208 pp. pp. 189–190. ISBN 93838-93930-93738.