

Disease from excess or deficiency of nutrients

Diseases caused by a lack of nutrients can also be called **malnutrition**. Malnutrition is a condition in which an individual **lacks the nutrients** necessary for the functioning of the organism. It can be a lack of **basic nutrients** (sugars, fats, proteins) or a lack of some **parts of food** (for example, vitamins, trace elements, essential fatty acids, etc.).

Lack of essential nutrients

Marasmus

Simple starvation is primarily caused by a lack of energy (energy malnutrition). It is also referred to as the Marantic type. Due to the long-term **insufficient intake** of all **nutrients**, it manifests itself in a typical gradual symmetrical weight loss. This leads to a general weakening of the organism, so-called cachexia. Fat and glycogen stores are broken down and, in the final phase, **active muscle mass** and body proteins are also broken down. Individuals with anorexia nervosa, elderly people, but also otherwise healthy people who have a reduced energy intake suffer from it.

 For more information see *Marasmus*.

Kwashiorkor

Much more severe **stress** starvation is caused by insufficient intake and rapid **breakdown of proteins** (protein malnutrition), i.e. the kwashiorkor type. Muscle mass is broken down quickly, and fat reserves are preserved, so affected persons do not show signs of malnutrition at first glance. Lack of protein (so-called hypoproteinemia) is the cause of swelling. It is a protein-energy malnutrition with a predominant protein deficiency (in contrast to marasmus, in which a predominant energy deficiency). Kwashiorkor is a severe form of malnutrition occurring in young children in developing countries, characterized by swelling among other things.

However, the hypothesis of protein deficiency as the aetiology of kwashiorkor has been rejected by the authors of a number of studies published since 1968 because:

- the same diet with an insufficient amount of macro and micronutrients led to the development of marasmus in some children in the same area, in others to kwashiorkor;
- children recovered on diets lower in protein than thought to lead to the development of kwashiorkor, with resolution of swelling but no change in low serum albumin (which was thought to be the cause of edema);
- Kwashiorkor has also been described in breastfed children, some exclusively (that is, receiving high-quality protein), whose mothers did not show signs of malnutrition.^[1]

Several other hypotheses were then postulated about the aetiology of kwashiorkor (an excess of **free** radicals, aflatoxins, changes in the gut microflora that produce metabolites that damage cell membranes during malnutrition, vanadium deficiency, a combination of some of these factors), but none of them have been confirmed - its **etiology is still unclear**. According to the current pathophysiological concept, cell membranes are damaged throughout the body, leading to potassium and water leakage from cells of all types and dysfunction of all organ systems. Loss of glycosaminoglycans' ability to bind water is thought to be a potential mechanism of edema.^[2]

 For more information see *Kwashiorkor*.



kwashiorkor

Protein energy malnutrition

According to the FAO, 925 million people worldwide suffer from protein-energy malnutrition (PEM), most in Asia and the Pacific, most often in sub-Saharan Africa (30%).^[3] It affects a quarter of children under 5 years of age worldwide and is associated with 30% of under-five deaths in developing countries.^[4] Malnutrition is relatively rarely registered as a primary cause of death in children. At the beginning of the spiral of malnutrition is an inadequate diet and frequent episodes of common infectious diseases. During the course of the disease, the child's nutritional status deteriorates, which contributes to the increased risk of another episode of infection, which has a more severe course and during which the nutritional status will further deteriorate. The situation repeats itself when a malnourished child has a fatal infectious episode.

In our conditions, malnutrition mainly occurs in the seriously ill, the elderly and girls who suffer from anorexia nervosa.

Lack of vitamins (hypovitaminosis, avitaminosis)

Fat soluble vitamins

Vitamin A deficiency

Vitamin A is especially important for sharp vision at night. Replenishment doses of vitamin A can significantly improve vision within hours. Vitamin A deficiency is a significant problem especially in developing countries. The risk group is mainly **small children , pregnant and lactating women** .

Deficiency symptoms include xerophthalmia (dry eyes), age spots, susceptibility to respiratory tract infections, acne, eczema, loss of appetite, fatigue and loss of smell. Diseases that arise from prolonged lack of this vitamin are night blindness and conjunctivitis.

Vitamin D deficiency

If it arises during the period of growth (small children, especially infants), it manifests itself as **rickets** , **there is little** vitamin D, in the mother's milk , they are not exposed to much sunlight and they grow quickly (great need). Rickets occurs on all continents, but the global prevalence is unknown. It is most common in high latitudes - for example in Mongolia in 70% and in Tibet in 66% of children and in areas where social or religious customs prevent exposure to the sun (the Middle East, some countries in Africa, in India - it is more common in Muslim than Hindu community). In the moderate zone, there is a higher risk of developing rickets in population groups with dark skin (African Americans, the Asian community in Europe, Australia). In recent years, **subclinical vitamin D deficiency** - a low level of 25OHD - has attracted attention, especially in connection with the possible additional roles of vitamin D in the human body. Subclinical vitamin D deficiency is described in a significant percentage of the population both in North America and Europe, but the American Institute of Medicine points out the lack of a general consensus on the adequate level of plasmatic 25OHD and thus the possibility of overestimating the prevalence of deficiency in the population.^[5]

 For more information see *Rickets*.

 For more information see *Vitamin D*.

Water soluble vitamins

Vitamin B1 deficiency

Deficiency symptoms include inability to concentrate, fatigue, loss of appetite, heart rhythm disturbances, constipation, difficulty breathing, depressed mood and sleep disorders

Vitamin B2 deficiency

Deficiency symptoms include a red, inflamed tongue, small cracks in the corners of the mouth, burning, red, "tired" eyes, chapped lips, greasy hair, scaly skin on the nose, mouth, forehead, and earlobes, hair loss, and tremors in the limbs.

Vitamin B12 deficiency

Deficiency symptoms include fatigue, persistent nervousness, depression, numbness in the hands and feet, difficulty walking, and inflammation in the mouth. A frequent consequence of vitamin B12 deficiency is the development of macrocytic anemia.

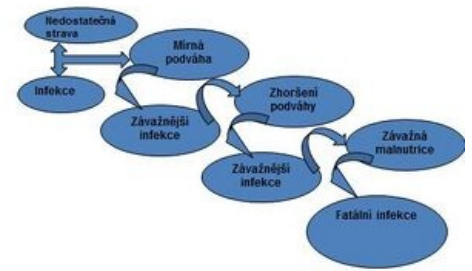
 For more information see *Vitamins*.

Lack of mineral (inorganic) substances

Iron deficiency

The most common type of malnutrition **in the world**. The main manifestation is the development of sideropenické anémie. It occurs in both developing and developed countries. In 2002, the WHO identified anemia as one of the most significant factors contributing to the global burden of disease^[6]. The association of severe anemia with increased child and maternal mortality and the negative effect of anemia on the cognitive and physical development of children and the work productivity of adults is proven.

According to the WHO assessment in 2008, anemia assessed according to the hemoglobin level affects 1.62 billion people, i.e. a quarter of the world's population, most often young children (47.4%), least often men (12.7%); the largest number of affected are women. The highest prevalence of anemia is in Africa (47.5-67.6% of the



Malnutrition spiral in children



Vicious cycle of malnutrition in adults

population), but the largest number of people affected is in Southeast Asia.^[7]

Anemia has a number of causes that can combine. On a global scale, **iron deficiency is most common due** to its insufficient intake, poor absorption of non-heme iron and increased need for iron (growth, pregnancy). Other causes are blood loss (menstruation, *Ankylostoma duodenale*, *Necator americanus*, *Ascaris lumbricoides*, schistosomiasis, minor bleeding from the GIT). Acute and chronic infections (malaria, cancer, TB and HIV) also reduce hemoglobin levels.

In developing countries, the lack of other micronutrients (vitamin A, folic acid, vitamin B2, B12, copper) and in some areas also hemoglobinopathy (e.g. sickle cell anemia) are often added to the causes.

Risk groups for the development of iron deficiency anemia are mainly newborns with low birth weight (insufficient reserves), children from six months to two years of age, **women of childbearing age**, especially **pregnant women** and the elderly.

The source of iron is meat and offal (heme iron - absorption 20-30%), as well as cereals, tuberos and root crops, legumes, nuts, eggs and leafy vegetables (non-heme iron - absorption less than 5%). Breast milk is also an important source of iron - although the proportion of iron here is small, its absorption is up to 50%. The consequence of iron deficiency is **hypochromic microcytic anemia**, which leads to a decrease in the supply of oxygen to the tissues. Its symptoms include increased fatigue, shortness of breath, pale skin and mucous membranes, hair loss, and koilonychia.

 For more information see *Sideropenic anemia*.

Iodine deficiency

Worldwide, iodine deficiency is **the most important preventable cause of brain damage**. People living in areas with severe iodine deficiency may have an IQ up to 13.5 points lower than in areas without iodine deficiency. This mental deficit has a drastic effect on children's ability to learn, women's health, the quality of life of the community, economic productivity, and animal agriculture (even livestock are iodine deficient).

Until the 1990s, **goiter prevalence** was used as the primary indicator of the occurrence of iodine deficiency in the population - it usually occurred in mountainous areas and in areas far from the coast. **Urinary iodine excretion** and other methods, however, have shown in later years that insufficient iodine intake is very extensive and occurs not only in areas where goiter is endemic, but also in industrialized countries.



Since 1991, the World Assembly adopted the goal of eliminating iodine deficiency worldwide. In 1993, the WHO and UNICEF, recommended universal salt iodination (for both humans and livestock) as the main strategy for eliminating iodine deficiency.^[8] The number of countries where iodine deficiency is a problem has decreased, but still **2 billion people in 47 countries suffer from iodine deficiency** in the world: most often in Europe (52% of the population) and in the eastern Mediterranean (47% of the population). The largest number of affected individuals is in Southeast Asia and Europe. The smallest percentage and number of people with insufficient iodine intake is on the American continent.^[9]

In the Czech Republic, salt has been iodized since 1947 and the Czech Republic is one of 19 out of 40 European countries with a sufficient iodine intake and 9 countries where $\geq 90\%$ of households use iodized salt.^[10]

 For more information see *Trace Elements in Human Nutrition*.

Zinc deficiency

The importance of zinc for the nutritional status of populations has only recently been recognized. Severe zinc deficiency is rare, but **mild deficiency is estimated to affect about 20% of the world's population** (9% in the US and Canada, 33% in Southeast Asia). The risk of deficiency is highest in infants and young children, pregnant and lactating women. It is estimated that 80% of pregnant women globally and 100% in developing countries have zinc intakes below what is considered necessary.^[11]

Mild zinc deficiency is associated with reduced immunity, failure to thrive and growth retardation. Clinical studies in developing countries demonstrate that zinc administration reduces the morbidity and mortality of common childhood infectious diseases (gastroenteritis, pneumonia, malaria) and improves the growth of malnourished children. The WHO recommends the administration of zinc as part of the therapy of diarrheal diseases..^[12]

 For more information see *Zinc*.

In general, there are many possibilities in the categorization of pathological conditions, and the choice of a particular one depends on the purpose for which it is to be used. In the international classification of diseases^[13] used for epidemiological purposes, diseases caused by a lack or excess of nutrients are classified into different groups:

Diseases of the blood, blood-forming organs and some disorders related to the mechanism of immunity

- *Template:MKN anemia*

Endocrine, nutritional and metabolic diseases

- *Template:MKN thyroid glands (iodine deficiency disorders)*
- *Template:MKN – malnutrition(kwashiorkor, nutritional marasmus, marasmic kwashiorkor and protein energy malnutrition)*
- *Template:MKN anemia - Other nutritional deficiencies (deficiency of vitamins, minerals and trace elements)*
- *Template:MKN and other hyperalimentation (obesity, excess of vitamins)*

Links

- ws:Onemocnění z nadbytku nebo nedostatku živin

Related articles

- Nutrient excess disease
- Vitamins and their importance in nutrition
- Mineral substances and their importance in nutrition

Reference

1. GOLDEN, MHN. The development of concepts of malnutrition. *Journal of Nutrition*. 2002, y. 7, no. 132, p. 2117S-2122S, ISSN 1541-6100.
2. MANARY, MJ. , et al. Kwashiorkor: more hypothesis testing is needed to understand the aetiology of oedema. *Malawi Medical Journal*. 2009, vol. 21, no. 3, p. 106-107, ISSN 1019-1941.
3. UNITED NATIONS FOOD AND AGRICULTURE ORGANIZATION (FAO),. *Media fact sheet : September 2010* [online]. FAO, ©2010. [cit. 2011-08-02]. <http://www.fao.org/fileadmin/user_upload/newsroom/docs/2010_hunger_facts.pdf>.
4. BLACK, RE. , et al. Maternal and child undernutrition: global and regional exposures and health consequences. *Lancet*. 2008, vol. 371, no. 9608, p. 243-260, ISSN 0140-6736.
5. ROSS, AC, et al. *Dietary Reference Intakes for Calcium and Vitamin D*. 1. edition. Washington D.C : Institute of Medicine (IOM); National Academy of Sciences, 2011. 1132 pp. ISBN 978-0-309-16394-1.
6. WORLD HEALTH ORGANIZATION,. *The World Health Report 2002 : Reducing risks, promoting healthy life* [online] . 1. edition. Geneva : WHO, 2002. 248 pp. Available from <http://www.who.int/whr/2002/en/whr02_en.pdf>. ISBN 9789241562072.
7. DE BENOIST, B - (EDITORS),, et al. *Worldwide prevalence of anaemia 1993-2005 : WHO global database on anaemia* [online] . 1. edition. Geneva : WHO, 2008. Available from <http://apps.who.int/iris/bitstream/10665/43894/1/9789241596657_eng.pdf>. ISBN 978 92 4 159665 7.
8. WHO,. *Assessment of iodine deficiency disorders and monitoring their elimination: A guide for program managers* [online] . 3rd edition. Geneva: WHO, 2007. 97 pp. Also available from <http://www.who.int/nutrition/publications/micronutrients/iodine_deficiency/9789241595827/en/>. ISBN 978 92 4 159582 7 .
9. BENOIST, B, et al. Iodine deficiency in 2007: Global progress since 2003. *Food and Nutrition Bulletin* [online] . 2008, vol 29, no. 3, pp. 195-2002, also available from <<http://www.who.int/nutrition/publications/micronutrients/FNBvol29N3sep08.pdf>>. ISSN 0379-5721.
10. ANDERSSON, M, et al. *Iodine Deficiency in Europe: A continuing public health problem* [online] . 1st edition. 2007. 70 pp. Also available from <http://www.who.int/nutrition/publications/micronutrients/iodine_deficiency/9789241593960/en/>. ISBN 978 92 4 159396 0 .
11. (EDITOR), Richard D. Semba, et al. *Nutrition and Health in Developing Countries : [object Object]*. 2. edition. Totowa : Humana Press, 2008. 931 pp. ISBN 978-1-934115-24-4.
- 12.
13. Světová zdravotnická organizace. . *Mezinárodní klasifikace nemocí a přidružených zdravotních problémů 10. revize* [online] . 2. edition. Geneva : WHO, 2004. Available from <<https://old.uzis.cz/cz/mkn/index.html>>. ISBN 9241546492.

References

- BENCKO, Vladimír, et al. *Hygiena : Učební texty k seminářům s praktickým cvičením*. 2. edition. Praha : Karolinum, 1998. ISBN 80-7184-551-5.
- HAINER, Vojtěch – KUNEŠOVÁ, Marie, et al. *Obezita : Etiopatogeneze, diagnostika, terapie*. 1. edition. Praha : Galén, 1997. ISBN 80-85824-67-1.