

6. The problem of selenium deficiency and its solution

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Introduction. Selenium deficiency is a significant problem that is increasingly affecting humanity. The effect of selenium deficiency on human health is to disrupt the synthesis of many selenium-dependent proteins that are responsible for numerous important functions in the human body. The study characterizes selenium deficiency and considers possible methods of solving the problem.

Materials and methods. A review of recent studies on selenium deficiency and its prevention was conducted.

Results. The main role of selenium is presence in key selenoproteins. The recommended dietary intake of selenium is 55 mkg per day [1]. It is established that this amount is optimal for maximum activity of the selenoprotein glutathione peroxidase. This enzyme is a key component of the antioxidant system of the human body. Glutathione peroxidase deficiency leads to an increased risk of developing chronic diseases such as cardiovascular disease, cancer, kidney disease, and others. Another selenium enzyme, thioredoxin reductase, is involved in DNA synthesis by reducing nucleotides, which then helps control the redox state of cell. One more example is iodothyronine deiodinase, which converts thyroid hormones into a more active form and regulates body's metabolism and energy balance. A deficiency of this hormone can lead to a variety of diseases, such as hypothyroidism, overweight, diabetes, fertility disorders, and others.

The growing selenium deficiency is associated with a decrease in its content in plant materials, which is due to a decrease in the selenium content in soils. Recent studies confirm the downward trend in soil selenium content in many regions of the world. In particular, the selenium content in Ukrainian soils ranges from 0.03 to 0.88 mg/kg. The most soil samples are from different regions having a selenium content of less than 0.2 mg/kg, which is a low level of selenium [2]. In addition, the problem is the availability of acidic soils in Ukraine, where inorganic forms of selenium form chelates with ferric hydroxide and are almost not consumed by plants [3].

The solution to overcome selenium deficiency can be to germinate seeds or beans in a selenium-containing solution, use selenium-containing fertilizers, or directly add selenium to food. For the latter option, biological agents such as yeast, lactic acid bacteria can be used to safely biotransform inorganic forms of selenium into organic or elemental selenium nanoparticles and use them in the preparation of functional foods.

Conclusion. Selenium deficiency leads to a number of human diseases that can be overcome by biological methods through direct compensation of selenium in soils or by specific biotechnological methods in which selenium is added directly to food using various approaches.

References

1. Ibrahim, S. A., Kerkadi, A., Agouni, A. Selenium and health: an update on the situation in the Middle East and North Africa. *Nutrients*. 2019, 11 (7): 1457.
2. Kushnir, V. M., Stadnyk, O. V., Kasiyan, O. M., Kudrinskaya, V. A., Basiuk, T. V. Assessment of selenium content in soils of different agroclimatic zones of Ukraine. *Agrokhimia*. 2019, 3: 22-31.
3. Stabnikova, O., Antoniuk, M., Stabnikov, V., Arsenyeva, L. *Ukrainian Dietary Bread with Selenium-Enriched Soya Malt. Plant Foods for Human Nutrition*. 2019, 74: 157-163.