

EFFECTS OF MANGANESE AND ITS COMPOUNDS ON BIOCHEMICAL MECHANISMS

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Introduction. Still, manganese is the subject of research. Manganese belongs to a number of trace elements that are needed by our body. It turns out that manganese is already present in our body in the form of enzymes that provoke the formation of other essential enzymes. The effect of manganese on the body is due to the action of iron and copper. If we compare the work of other trace elements, the effect of manganese is quite complex, therefore, currently the effect of manganese is under study. Manganese is needed to maintain healthy skin and bones, to form cartilage. Improves glucose metabolism. Manganese helps to ferment important micronutrients.

The aim of the study. To find out the effect of manganese on the human body in its deficiency and excess and biochemical mechanisms in medicine and pharmacy.

Materials and methods of research. Analysis of scientific literature. Find out the toxic effects of manganese; participation of manganese in physiological processes; manganese deficiency: causes and consequences; make a diet that includes manganese; its use in pharmacy.

Results and discussion. Manganese is an important element in the life of all living organisms. Its total mass fraction in the human body is $1 \cdot 10^{-5}\%$. Contained in all organs and tissues of the body, most of it in the liver, bones, kidneys, pancreas and pituitary gland. Manganese is absorbed mainly in the small intestine, then enters the liver with the blood and is distributed to other organs and tissues. The daily requirement of manganese is 3-5 mg. Manganese is found in almost all foods. Most (over 500 mg per 100 g of edible part of the product) in rye and wheat bread, buckwheat and pearl barley, millet, beans, peas, rice, beets, horseradish, dill, parsley, raspberries, sorrel.

Biological effects on the human body are the mechanism of enzymatic catalysis (biocatalysis).

An adult's body contains 20 mg of manganese. It is especially abundant in cells rich in mitochondria and melanin. Human blood normally contains about 4-20 mcg%. One of the most important functions of manganese is its participation in redox reactions. Mn^{2+} is a component of two enzymes: phosphotransferase and arginase. In addition, it can replace magnesium in other enzymes and increases the activity of some oxidases. Its deficiency leads to the deposition of fat in the body, which causes pathological obesity. Deficiency is extremely rare: bone fragility, skin rash, vomiting, weight loss, gonadal degeneration, hypercholesterolemia. It has long been known that high doses of manganese have a neurotoxic effect. John Cooper (1937) was the first to publish dose-dependent negative effects of manganese in the scientific literature. Symptoms included muscle weakness, tremor of the extremities, paresthesia, memory loss, increased salivation, whispered speech, and stooping in workers working in manganese ore crushers in France. Cooper called this disease "a symptom of manganese crusher", later renamed manganism. Thus, it was found that chronic inhalation

of high doses of manganese induces neurodegenerative parkinson-like disorder, characterized by abnormalities of the central nervous system and neuropsychological disorders. Then the toxicity of manganese is mainly manifested in the impact on the central nervous system and can cause tremors, muscle spasms, tinnitus, hearing loss and a feeling of imbalance and coordination of the lower extremities. It affects mineral metabolism: manganese salts promote the absorption of phosphorus and calcium, participate in the absorption of iodine and the synthesis of thyroid hormones. In combination with copper salts Manganese stimulates hematopoiesis. Manganese salts are part of many multivitamins with trace elements.

Conclusions. Thus, manganese is a vital trace element that performs many functions at the macromolecular level, and is also essential for maintaining homeostasis. Excess manganese has a pronounced toxicity. With manganese intoxication, negative changes are observed in the nervous, immune, hormonal systems; there are disorders of carbohydrate, fat and homeostasis metabolism. Under the action of high doses of manganese, hepatotoxicity is observed and oxidative stress develops.