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ACTIVITY OF ANTIOXIDANT DEFENSE ENZYMES IN RATS BLOOD WITH EXPERIMENTALLY INDUCED DIABETES UNDER INFLUENCE OF VANADIUM CITRATE

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Diabetes is a state of chronic hyperglycemia, which is characterized by impaired formation of insulin and its action. The disease is autoimmune in nature and causes loss of beta-cells by apoptosis.

Experimental and clinical studies show that oxidative stress, which is an indispensable part of metabolic disorders, plays an important role in pathogenesis of diabetes. The formation of free radicals during diabetes is proportional to hyperglycemia, non-enzymatic glycosylation of proteins, and their further oxidizing destruction. Oxidative effect of diabetes on blood cells is manifested through deviations in some of their biochemical parameters.

The studies of animals with experimentally induced diabetes of first or second types revealed that vanadium compounds have anti-diabetic properties, but the mechanism of action of this element is not thoroughly understood. There are reports of normalization of glucose in the blood under the influence of vanadium salts, therefore they are suggested as regulators of glycemic control.

The aim of the research was to assess the effects of different amounts of organic vanadium citrate compound on the activity of antioxidant enzymes in the blood of rats with alloxan induced diabetes.

The research was conducted on 40 white laboratory rats that were kept in the vivarium at the Institute of animal biology NAAS, had a weight of 100 to 120 grams, and were divided into five groups: group I — control, II, III, IV and V — research. The rats from the II experimental group drank clean water without additives and the rats from the III, IV and V groups drank water with a solution of vanadium citrate in an amount of 0.125, 0.5 and 2.0 mcg V/ml of water for a period of one month. After 24-hour fast, animals of all four groups have developed experimental diabetes due to intraperitoneal administration of 5 % alloxan monohydrate solution ("Synbias") in an amount of 150 mg/kg body weight. Hyperglycemia was detected by measuring glucose in the blood collected from the tail vein using a portable glucometer («Gamma-M»). On the 40^{th} day of research, animals were taken out of the experiment by light ether anesthesia. Experiments on animals were conducted in accordance with the "European Convention for the Protection of Vertebrate Animals used for experimental and other scientific purposes", "General ethics of animal experimentation," adopted by the First National Congress of Bioethics.

We investigated the effect of vanadium citrate on the activity of antioxidant enzymes in the blood of rats with experimentally induced diabetes. It was found that the experimentally induced diabetes led to a decrease in superoxide dismutase ($P<0.001$), glutathione reductase ($P<0.001$) and the content of reduction glutathione in the erythrocytes. However, the activity of glutathione peroxidase increased ($P<0.01$), compared to the control group. Decreased antioxidant enzyme activity can cause the modification of enzymes by reactive oxygen species under the conditions of hyperglycemia.

Vanadium citrate in erythrocytes of rats with diabetes leads to a verifiable increase in the activity of glutathione reductase in the III, IV and V of the experimental groups and to increase of glutathione content in the V experimental group by 26 % ($P<0.01$). In the IV and V experimental groups the activity of glutathione peroxidase decreased ($P>0.005–0.01$), compared to the II diabetic experimental group, providing evidence of normalization of the glutathione level of antioxidant protection under the influence of organic compound of vanadium. In addition, we have established a significant increase in the enzymatic activity of superoxide dismutase in III and IV groups, compared to the II experimental group. This can be explained by increased synthesis of the enzyme in response to the additional introduction of vanadium for the maintenance of the physiological state of the body in normal rats. During the study of catalase activity in rat erythrocytes, we found no significant difference in all experimental groups, compared to the control.

The results of the research indicate the normalization of antioxidant impact on vanadium citrate in erythrocytes of rats with experimentally induced diabetes.