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CHANGES IN COPPER METABOLISM UNDER THE INFLUENCE OF HELMINTHS

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Abstract: The article presents information about changes in copper metabolism under the influence of helminths and their consequences. Trace elements, like vitamins, have high biological activity and even in small doses exert a powerful influence on the regulation of various physiological functions of the body. The high activity of trace elements is due to their close interaction with biologically important and active organic substances [1].

It is known that copper participates in oxidative and hematopoietic processes, converting iron into an organically bound form and actively contributing to the formation of the main respiratory pigment, hemoglobin, which increases oxygen uptake by tissues [9].

Animal deviations in normal metabolism can be caused by an imbalance of trace elements in the body. A deficiency of trace elements leads to various reproductive disorders, resulting in the birth of weak, non-viable animals with low vitality. Changes in the balance of trace elements in animals can contribute to the development of numerous endemic, physiological, and genetic diseases [4].

During our research, we observed the development of signs of microelementosis at the stages of parasitic invasion in all groups of experimental animals, which led us to analyze the dynamic changes in copper levels in the blood, as one of the most important trace elements playing a significant role in the functioning of the body.

Keywords: Trace elements, vitamins, helminthiasis, cytochrome, oxidative stress, antioxidant system, hematopoiesis.

Objective: To study and analyze changes in copper metabolism and their consequences in living organisms under the influence of various helminths.

Materials and methods of the study. Karakul lambs of the "Karnab" factory type were used as the object of the experiment. All lambs used in the experiment were isolated and raised in conditions not affected by natural helminths, healthy from other infectious and non-infectious diseases. Initially, clinical, hematological and biochemical parameters of the body of all control and experimental lambs were determined 3 times, and then the lambs allocated

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for the experiment were infected by introducing a pure culture of motile and viable invasive strongyllate larvae (Marshallagia, Nematodirus, Chabertia) into the abdominal cavity through the mouth using a rubber probe. For the experimental study of marshallagiasis, nematodirosis and chabertiosis, 20 karakul lambs aged 3-4 months were selected and divided into groups. The selected lambs were divided into groups by sex, weight and physiological parameters.

Group 1: 5 lambs, served as a control group

Group 2: 5 lambs infected with invasive larvae of marshallagia.

Group 3: 5 lambs infected with invasive larvae of nematodires.

Group 4: 5 lambs infected with invasive larvae of chabertia.

For this, 5000 samples of invasive larvae per lamb were used.

The material for infecting karakul lambs were invasive larvae of strongylates obtained from donors. The eggs and invasive larvae of Marshallagia, Nematodirus and Chabertia were collected and cultured using the standard method of "Helmintholarvoscopy" by Fulleborn. All lambs used in the experiment were taken and raised in conditions not affected by natural helminths, healthy from other infectious and non-infectious diseases.

During the entire experiment, physiological parameters of experimental and control lambs were measured twice, in the morning and in the evening: body temperature (by rectum), heart rate (by anterior pulse artery), respiratory rate (by expansion and narrowing of nasal openings). All experimental animals were slaughtered in the last 70-75 days of observation (after invasive infection) and subjected to a complete helminthological study using the method of Academician K.I. Scriabin. The obtained results were analyzed in detail, physiological, pathological and biological changes in the condition of each lamb were described.

Before invasive infection with parasites, blood was taken from the upper vein of all experimental and control animals and preliminary parameters were identified. The following parameters were obtained 5, 10, 15, 25, 30, 40, 50, 65, 70 days after invasive infection and were analyzed. The concentration of copper ions in the blood was determined by ion-selective ((A.A. Ostroushko, M.Yu. Sennikov).) and atomic absorption spectrometric (AAS) methods. The differences between the mean values in the control and experimental groups were calculated using the Student method, and the data obtained were processed using the methods of variation statistics. The arithmetic mean of each sign (M) was calculated with its error (m) and the coefficient of variability (C%). The degrees of reliability (P) of differences between the group indicators were determined. Before the experimental infection, the copper content in the blood of the experimental and control sheep averaged 1.07±0.06 mg/l, which corresponded to the norm. From the 10th day of invasive marshallaghiasis infection, the copper level in the blood decreased significantly and amounted to 0.97±0.02 mg/l, and on the 15th day - 0.81±0.04 mg/l, which was significantly lower than the initial values. In the following days of the disease, the copper content continued to decrease sharply, and by the 50th day of invasion (on the 50th day) its level

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was 0.51±0.01 mg/l, which was two times lower than at the initial stage and in the control sheep.

In experimental nematodosis, the copper content in the sheep's blood did not differ from that in marshallaghiasis. From the 10th day of invasion, the copper level began to decrease and amounted to 0.92±0.04 mg/l. From the 20th day, the decrease intensified, and the low copper concentration remained until the 65th day of invasion (see Figure 1).

In the first days of invasion, the copper content in the lambs' blood significantly decreased, reaching 0.67±0.05 mg/l by the 10th day. However, unlike marshallaghiasis and nematodirosis, the copper level in the blood decreased moderately, i.e., no sharp drop was observed, and throughout the disease it remained significantly lower than the initial and control values. Therefore, based on the above, it can be concluded that the hematological and clinical changes that occur in helminthiasis are directly related to changes in the copper concentration in the blood. In addition, against the background of a decrease in the concentration of copper in the blood, lambs experience symptoms such as shortness of breath, first hyperemia, then anemia, weakness, diarrhea, discoloration of wool, and hematologically - a decrease in the number of red blood cells and hemoglobin levels.

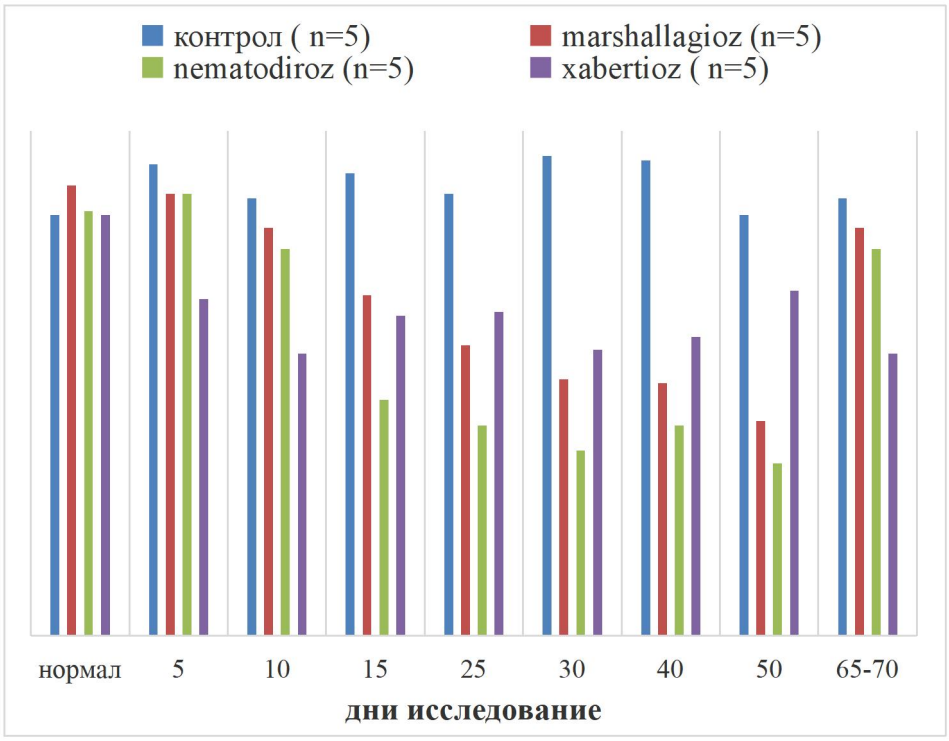

Figure. The amount of copper (mg/l) in the blood of black sheep, M±m. (n=5).

Some physiological and clinical signs that occur before death, such as impaired motor coordination, paresis and paralysis of the limbs, are probably associated with a decrease in the level of copper in the blood. Helminths, feeding in the host organism, also absorb copper. For example, parasites in the gastrointestinal tract directly absorb copper, which can lead to its deficiency in the host organism.

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Helminths affect the host immune system, causing the production of various cytokines and other immunological factors that affect copper metabolism. Some cytokines can lead to the redistribution of copper and its accumulation in tissues.

Impaired antioxidant defense and oxidative stress: Helminths cause oxidative stress in the host organism, which increases the need for copper. Oxidative stress reduces the effectiveness of antioxidant systems, which also increases the need for copper. There are a number of enzymes in the body that require stable copper activity.

Helminths can affect the activity of these enzymes directly or indirectly. For example, enzymes such as cytochrome C oxidase play an important role in the process of energy production, and helminth infestation disrupts this process. The consequences of copper deficiency in helminth infestation can be varied. Copper plays a key role in the synthesis of hemoglobin. Helminth infestation can lead to copper deficiency, which in turn can cause anemia (lack of blood). Copper is also essential for the immune system. Its deficiency can lead to a weakened immune system and decreased resistance to disease. Copper is important for growth and development. Copper deficiency can disrupt normal growth and development in children and adolescents.

Conclusion

Helminth infestation has a serious impact on copper metabolism in the body. These effects can negatively affect various physiological processes in the body, which can lead to deterioration in health. In order to prevent parasitic helminth infestation and to effectively treat it, it is important to study copper metabolism theoretically and practically.

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