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INFLUENCE OF HESPERIDIN ON SOME BIOCHEMICAL INDICATORS IN MICE IN SETTING OF EXTRACTING PHYSICAL LOADING

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***Anastasia Gerashchenko*[1]✉, *Natalia Shabanova*[1], *Andrey Voronkov*[2]**

[1] *Pyatigorsk Medical and Pharmaceutical Institute — Branch of Volgograd State Medical University, Pyatigorsk, Russia*
[2] *The Volgograd State Medical University, Volgograd, Russia*

✉ *anastasia gerashchenko@mail.ru*

ABSTRACT — A study was carried out on the effect of hesperidin, administered at a dosage of 100 mg / kg, on biochemical parameters in mice in the setting of exhausting physical exertion. The change in biochemical parameters was assessed after the «Treadmill» test, which was carried out during 5 days. After that, blood was tested for further assessment of the following markers of fatigue: lactic (LA), pyruvic acid (PA), and myoglobin. These compounds were determined using a standard set of reagents.
It was found that against the background of intragastric administration of the studied flavonoid hesperidin in relation to the negative control group, there was a significant decrease in lactate level by 2.3 times ($p < 0.05$), an increase in pyruvate by 8.8 times, a decrease in the lactate / pyruvate 21.2 times ($p < 0.05$). It should also be noted that the myoglobin level was lower at 2.0 ($p < 0.05$) in comparison with the negative control group. There were no significant differences between the group that received hesperidin during the experiment and the group of mice that received Mexidol in the above parameters (LA, PA, LA / PA, myoglobin). The results of the study obtained allow us to recommend this compound as a corrector of biochemical shifts that can occur during exhausting loads.

KEYWORDS — exercise, acidosis, pyruvate, myoglobin, mice, hesperidin.

INTRODUCTION

Today, the modern level of development of sports makes special requirements for the level of fitness of athletes [1]. It is known that extreme physical activity leads to a breakdown of adaptive capabilities, which is reflected in the manifestation of glycolysis activation and the possible accumulation of underoxidized products in the body, to the development of endothelial dysfunction, as well as changes in the cardiovascular system [2]. All these factors can both directly and indirectly affect the energy potential of the body.

In this regard, search for compounds capable of correcting the functional state of the body under conditions of exhausting physical exertion becomes urgent.

Objective:
to study the effect of hesperidin on some biochemical parameters in mice during exhausting physical exertion.

MATERIALS AND METHODS

The experiment was carried out in accordance with the "Guidelines for the conduct of preclinical studies of drugs, ed. A.N. Mironov (2012 ed.) [3]. The animals were kept in the vivarium of the PMFI-branch of the Volgograd State Medical University (Volgograd, Russia). The study was carried out on 40 outbred white mice (m = 20-24 g). The animals were divided into 4 groups (n = 10). All experimental animals, in the course of the experiment, were kept in standard vivarium conditions (natural mode of light change, temperature, relative humidity, standard diet of laboratory animals, weekly change of bedding and cages, fixed feeding and drinking times) in compliance with the International Recommendations of the European Convention on protection of vertebrates used in experimental research. Previously, the animals were randomized by weight and running speed in the «Treadmill running» test. After that we formed 4 equal experimental groups. The group of positive control (PC) mice underwent physical exertion with days of rest, the second group - negative control (NC) received 0.9% sodium chloride solution throughout the entire length. The third group of animals received hesperidin at a dosage of 100 mg / kg. The fourth group received the reference drug Mexidol in a dosage [4]. All test compounds were administered intragastrically 30 minutes before testing before animals started running.

Physical activity was assessed in the treadmill test for 5 days. After that, blood was taken from the animals for further assessment of the following markers of fatigue: lactic (LA), pyruvic acid (PA), and myoglobin. These compounds were determined using a standard set of reagents manufactured by Arbis + by the enzymatic colorimetric method. Myoglobin was determined on a Tecan Infinite F50 microplate reader

(Austria) by a highly sensitive enzyme-linked immunosorbent assay. The results were processed using the STATISTICA 6.0 software.

RESULTS

In the setting of physically exhausting loads to which the animals were subjected, by the end of the fifth day of the experiment «Running on the treadmill» in the group of negative control mice, an increase in the level of lactate, a decrease in pyruvate and an increase in the lactate / pyruvate ratio, respectively, by 4.6 times (p <0, 05) (Fig. 1), 5.7 (p <0.05), 26.4 times (p <0.05), in comparison with the group of positive control animals. It should also be noted that this group also had a significantly higher myoglobin level by 1.9 times.

Probably, the data obtained may indicate the development of acidosis in the body of mice, which is also accompanied by damage to the tissues of working muscles, which is confirmed in studies conducted earlier [5].

Against the background of intragastric use of the plant object hesperidin, a positive effect on some markers of fatigue is observed, which is reflected in a decrease in lactate levels by 2.3 times (p <0.05) (Fig. 1), an increase in pyruvate by 8.8 times, a decrease in the lactate / pyruvate ratio by 21.2 times (p <0.05), as well as a decrease in the level of myoglobin by 2.0 (p <0.05) (Fig. 3) in relation to the negative control group.

Elimination of the acidosis process and a decrease in the marker of muscle destruction was observed in the group of animals treated with Mexidol, in comparison with the group of negative control animals. This was reflected in a decrease in LA (3.1 times (p <0.05), an increase in PA (5.2 times (p <0.05)), a decrease in LA / PA ((16.3 times (p <0 ,05)) and a decrease in myoglobin (2.0 times (p <0.05)).

It is also worth noting that acute anaerobic stress in the group of animals treated with the reference drug Mexidol did not lead to statistically significant changes in lactate, pyruvate, and myoglobin as compared with the group receiving the studied flavonoid hesperidin.

CONCLUSION

Intragastric administration of the studied flavonoid hesperidin led to a significant decrease in lactate levels by 2.3 times (p <0.05), an increase in pyruvate by 8.8 times, and a decrease in the lactate / pyruvate ratio by 21.2 times (p <0.05), and to a decrease in the level of myoglobin in 2.0 (p <0.05) in comparison with the negative control group. There were no significant differences between the group that received hesperidin during the experiment and the group of mice that

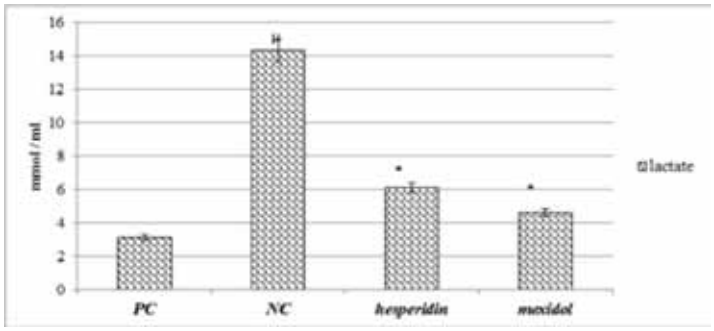

Fig. 1. *Changes in the level of lactic acid in the blood serum of mice after physical exertion.*
Note: *μ — reliably relative to the PC group (Student's t-test, p <0,05);*
** — reliably relative to the NC group (Student's t-test, p <0,05)*

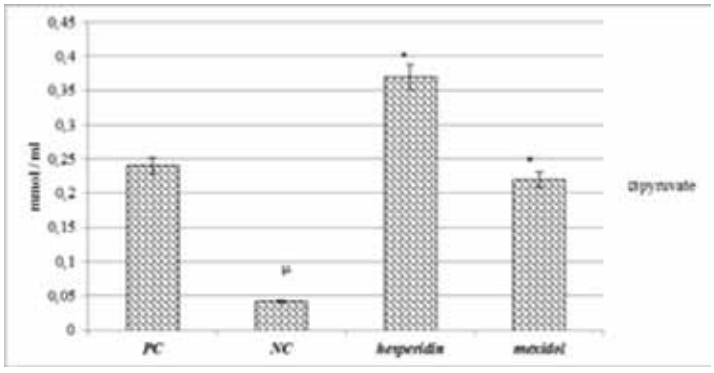

Fig. 2. *Changes in the level of pyruvic acid in the blood serum of mice after physical exertion*
Note: *μ — reliably relative to the PC group (Student's t-test, p <0,05);*
** — reliably relative to the NC group (Student's t-test, p <0,05)*

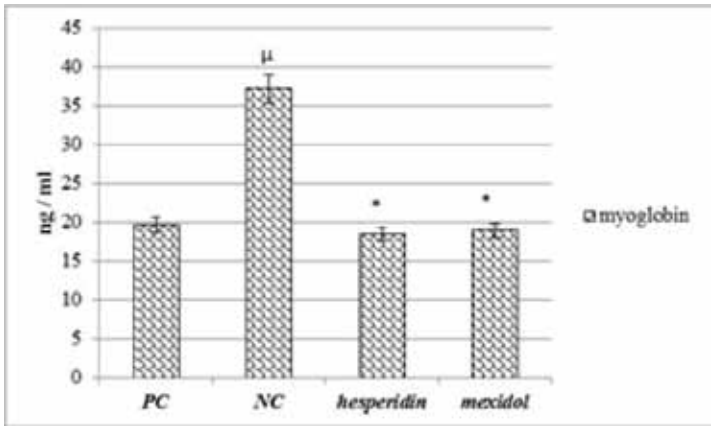

Fig. 3. *Changes in the level of myoglobin in mice after physical exertion.*
Note: *μ — reliably relative to the PC group (Student's t-test, p <0,05);*
** — reliably relative to the NC group (Student's t-test, p <0,05);*

received Mexidol in the above parameters (LA, PA, LA / PA, myoglobin).

The results of the study obtained allow us to recommend this compound as a corrector of biochemical shifts that can occur during exhausting loads.

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