

The influence of different stress conditions on some parameters of erythrocyte oxidative metabolism

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It is well-known that organism response on any negative influences is associated with stereotype complex of different molecular, cellular and tissue transformations, which are including in the term “adaptation syndrome” (Maslova, 2005). That is why study of general laws of adaptation processes has a constant relevance is causing by necessary of improvement of its theoretic basis and methods of targeted correction and prophylaxis (Krylov et al., 1998). Crucial role in implementation of adaptation plays the different components of blood, first of all erythrocytes, participating in homeostasis keeping in whole organism (Krylov et al., 1998). It is necessary to assume the existence of a universal stereotype of changes of the structural and functional state of erythrocytes and its environment in response to the action of stress factors.

That’s why the **aim of this work** is study of the influence of physical exercises and adrenaline injections on oxidative metabolism of the rats’ erythrocytes.

Material and methods

The study was conducted on 30 white Wistar rats weighing 200-250 g. The animals conformed to the rules for the design, equipment and maintenance of experimental biological clinics (vivarium).

Rats were divided into three equal groups. First group of animals was control (n=10; without any manipulations). Rats of second group were subjected to physical load in the form of a sailing duration of 15 minutes with a cargo amounting to 10% of animal body weight (water temperature – 26-28⁰C). Rats of third group were intraperitoneally injected with adrenaline hydrochloride (0,1 mg/kg).

Blood sampling was made from the sublingual vein in 15, 30, 60, 120 minutes and 24 hours after exposure. We estimated the dynamics of the concentration of malonic dialdehyde (MDA) and the state of the glutathione system. Erythrocytes is using in our experiments was washed three times with a 0,85% solution of sodium chloride and centrifuged during 10 min at 1500 rpm. The MDA concentration was determined photometrically by the reaction with thiobarbituric acid. For the characterization of the glutathione system we evaluated the concentration of total, oxidized and reduced glutathione (Sedlak, Lindsey, 1968).

Statistical analysis of the data was performed with Statistica 6.0 program. Data were expressed as means \pm SE, the Student’s t-test was used for detection of statistical difference.

Results

Our experiments shown that dynamics of oxidative metabolism parameters has a stereotype character as under physical exercises, as at intraperitoneal

injection of adrenaline. Both of these conditions associate with primary decreasing of the parameters with its subsequent normalization.

Study of lipid peroxidation (LPO), is traditionally measuring by the formation of MDA (Matteuci E. et al., 1992), showed that level of this substance elevates in 15 minutes after the action of stress factors. At other side the restoration time of MDA concentration depends on the factor type. In particular, we observed normalization of MDA level in one hour after the swimming, but in adrenal toxemia this period was 1 day.

Given that an important component of antioxidant protection of erythrocytes is the glutathione system, which is the buffer system that protects red blood cells from the destructive action of oxidizing agents, a study was conducted on the state of the glutathione system. In animals subjected to short-term physical activity has recorded a relatively weak increase in the concentration of total glutathione in erythrocytes, with a maximum of 60 minutes of observation and followed reduction of the level of the parameter to its original value. We fixed increasing of the total glutathione level from 15 min after the adrenaline administration. Parameter was elevated during all the experiment. It should be noted that the change in the total glutathione was observed due to the growth of its restored form.

Conclusion

The study suggests that red blood cell as a biological system is capable for realization of stress response may develop a special "alarm reaction" after action of the stress agent. This response initiates activation of free radical processes and phospholipids profile in erythrocyte membranes. This stage enhances the activity of the antioxidant system, is limiting the development of lipid peroxidation processes, and leads to the development of "adaptation stage" of the cellular system, coupled with the restoration of the electronegativity of the membrane and the mobilization of reserves of low molecular antioxidants, particularly glutathione, as well as "structural antioxidant".