

Influence of chronic hypobaric hypoxia exposure and lycopene administration on the tissue oxidant/antioxidant balance in physical exercise

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Abstract

Background. The antioxidant effects of lycopene, evidenced in vitro and in vivo under pathological conditions, led us to study in an experimental model of complex combined stress (exposure to moderate hypobaric hypoxia and physical exercise) the changes in the tissue oxidant/antioxidant (O/AO) balance following lycopene supplementation.

Aims. The influence of chronic hypobaric hypoxia exposure and lycopene supplementation on tissue redox homeostasis under physical exercise conditions was studied in the brain, myocardium, lungs and striated muscles.

Methods. The research was performed in 3 groups of white male Wistar rats: group I – control group, sedentary rats under normoxia conditions; group II – animals exposed to hypobaric hypoxia for 42 days (corresponding to the altitude of 2500 m), followed by exercise under normoxia conditions; group III – animals exposed to moderate hypobaric hypoxia for 42 days, followed by lycopene administration and daily exercise. Exposure was simulated in the hypobaric chamber for 42 days, 20 hours a day, at 2500 m. Groups II and III were trained daily for 42 days under normoxia conditions, using the swimming test. Group III received 0.0375 mg/kg body weight lycopene by oral gavage, before exercise, daily. In order to measure the indicators of the oxidant/antioxidant (O/AO) balance, tissue samples were taken from the brain, myocardium, lungs and femoral quadriceps muscle. On day 3, the following were determined: malondialdehyde (MDA), protein carbonyls (PC), glutathione (GSH) and total sulfhydryl (SH) groups.

Results. Our results support the protective effect of lycopene against OS, with a significant PC decrease in the myocardium and lungs and an insignificant PC decrease in the brain and muscles after chronic exposure to hypoxia and exercise. Antioxidant defense shows an insignificant decrease on account of GSH in the brain, myocardium and lungs and a significant decrease on account of the same indicator in the muscles of the group exposed to hypoxia, lycopene supplementation and exercise.

Conclusions. Chronic hypoxia exposure and lycopene supplementation followed by physical exercise for 42 days has protective effects on the O/AO balance at muscular level, with a significant decrease in GSH and induces redox changes with a decrease in PC at myocardial and pulmonary level, and the maintenance of OS on account of a significant increase in MDA in the myocardium.

Keywords: chronic exposure, hypobaric hypoxia, lycopene, oxidant/antioxidant balance, physical exercise.