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SUMMARY

Comparison of the impact of a series of 10 systemic cryostimulations on somatic, functional and selected biochemical variables at rest and in response to physical exercise in training men and women

The main aim of the study was to compare the impact of a series of 10 systemic cryostimulations on somatic, functional and selected biochemical variables at rest and in response to and after physical exercise in training men and women. 21 cross-country skiers (13 men and 8 women) took part in the research. They were players of the National Team, representing the Academic Sports Association AWF Katowice. The experiment was carried out during the transition period of the training macrocycle. Before starting the experiment, the participants underwent preliminary tests in which: somatic features were assessed, the $VO2_{max}$ was determined and the relative exercise load expressed as $\%VO2_{max}$, used in the main test effort, was determined individually for each subject. Test effort a 60-minute running test with a constant set load was performed by the tested men and women in thermoneutral ambient conditions (temperature 21-23°C, relative humidity 50%) twice: before (test C) and after a series of 10 systemic cryostimulations (CRYO). Treatments (10) took place once a day in the afternoon on working days at the Upper Silesian Center for Medicine and Rehabilitation in Katowice. The subjects stayed in a cryochamber (CR-20 model W, cryogenic chamber) for 3 minutes, where the temperature was -130°C.

Somatic features such as: mass (BM) and body composition (FM - adipose tissue mass, FFM - lean body mass, TBW - total body water content were assessed using the bioelectrical impedance method. Moreover, at rest and during exercise, in the study before and after the CRYO series, the following were recorded: oxygen uptake (VO_2), respiratory exchange rate (RER) and heart rate (HR), and in the last minutes of exercise, internal body temperature (T_{core}) and skin temperature were measured (T_{sk}) on the arm, chest and thigh. Before and immediately after the test, blood pressure (SBP, DBP) was measured. Mean blood pressure (MAP) and, using

indirect calorimetry, the rate of metabolic processes (RMR), weighted mean skin temperature (T_{SK}). Moreover, at rest, after the end of exercise, after one hour of restitution and after 24 hours of restitution, hematological variables (leukocyte count- WBC, erythrocyte count - RBC, hemoglobin concentration - HB, hematocrit index - HCT), biochemical (creatine kinase activity - CK, lactate dehydrogenase activity-LDH, malondialdehyde concentration - MDA) and cytokines (interleukin 6 concentration - IL-6, tumor necrosis factor-TNF-alpha concentration and C-reactive white protein concentration - CRP). were assessed.

After analyzing the obtained results, it was found that gender does not significantly differentiate physiological, hematological and biochemical changes assessed at rest and in response to physical exercise and restitution after a series of 10 systemic cryostimulations. However, after a series of 10 CRYO treatments, a significant decrease in the weighted average skin temperature, red blood cell counts and hemoglobin concentration in the blood at rest was found in both sexes. Moreover, the use of a series of 10 systemic cryostimulations results in a greater reduction in fat tissue content and a greater increase in creatine kinase activity at rest in men than in women. Moreover, in response to physical exercise, men showed a significantly greater increase in the rate of metabolic processes and a smaller increase in creatine kinase activity at 24 hours of restitution. In women, however, the use of a series of 10 systemic cryostimulations causes a significant decrease in the concentration of malondialdehyde at rest and a greater increase during the hour of restitution after exercise compared to men.