

**EFFECTIVENESS OF A SERIES OF HEAT AND WHOLE-BODY
CRYOSTIMULATION TREATMENTS ON THE PHYSIOLOGICAL RESPONSES
AND THE TOTAL TIME (DURANCE) OF EXERCISE IN ELITE CROSS-COUNTRY
SKIERS**

The purpose of this study was to determine the effectiveness of a series of regular Finnish dry sauna baths and whole-body cryostimulation on the physiological responses to an endurance exercise and the recovery processes in cross-country skiers.

The study was carried out in 25, men elite cross-country skiers, championship-class athletes of the Academic Sports Association in Katowice. The study was performed during the transition period (TP) of the cross-country skiers' training macro-cycle as a part of the research project No. 0050/RS4/2016/54. All the subjects participated in a series of ten cryostimulation (WBC) treatments and a series of 10 dry sauna baths (WBH) to show the effects of these treatments on the features of physiological responses, biochemical and hormonal changes during and after the exercise test. Participants performed two exercise tests before and after a series of 10 whole-body cryostimulation (WBC) treatments and before and after a series of 10 Finnish dry sauna 10 baths (WBH), respectively. The inclusion of subjects to the experimental protocol (WBH or WBC) was randomized. Before and after the application of WBH and WBC, as well as before and after the completion of exercise test in each study series, anthropometric characteristics, physiological variables, activities of selected enzyme markers, selected stress hormones and electrolyte concentrations were evaluated. The obtained results in this study indicated that a series of whole-body cryostimulation (WBC) and series of ten sauna baths (WBH) lead to develop the adaptation to stressors, which were revealed at rest. After a series of heat sauna baths, there was an increase in plasma volume, a decrease of systolic blood pressure and heart rate, but these changes were not accompanied with significant changes of internal, skin and body temperatures. After a series of 10 whole-body cryostimulation (WBC), there were no significant changes in cardiovascular characteristics such as: heart rate, blood pressure, body temperatures compared to control, however changes in the behavior of tested metabolic indicators were noted. Mainly a series of repeated heat exposures to was capable to influence on physiological responses to exercise. This effect was evident in a trend toward greater reductions in body weight in the group using a series of 10 sauna baths. There were no significant differences in plasma volume and mean body mass response to exercise performed at the similar, submaximal workload before and after the different thermal interventions. The increase heart rate and blood pressure during exercise tests were different and depend on the

type of heat intervention applied before exercise. The features of systemic responses to exercise after the application of different heat interventions further indicated that both types of thermotherapy strongly influence on the behavior of body and, skin temperature: local and mean, cardiovascular functions, during exercise. The features of cardiovascular and thermoregulatory responses highlighted the presence of differences in cardiovascular load, skin temperature and heat accumulation during the exercise test, after different heat interventions, which did not result in significant differences in absolute changes in plasma volume and body weight. There was no significant difference in the total time of exercise TTE after any of the heat interventions used compared to the control study. Neither the use of a series of 10 sauna baths nor a series of 10 whole-body cryostimulation significantly improved the TTE of elite cross-country skiers in the submaximal running test performed in the thermoneutral conditions. Both of thermal treatments applied in this study improved post-exercise recovery and influenced on body fluid, although their effectiveness depended on the nature of thermal therapy and the changes accompanying the effect of relevant thermal stimulus. It can be assumed that application of heat or cold interventions and changes achieved after its treatment associated with metabolic, cardiovascular and thermal responses to exercise may be factors determine the effectiveness of a given type of thermotherapy in supporting post-exercise recovery. In the collective evaluation of the studied systemic, metabolic and hormonal parameters in response to exercise and during recovery, a stronger effect of the applied WBH series was observed in the systemic functions /the circulatory system and temperature characteristics/ during exercise, while the cryostimulation treatments in the behavior of the parameters studied in early post-exercise recovery .