

Oxidative stress is a phenomenon caused by excessive production of reactive oxygen species with insufficient antioxidant capabilities of the organism. It is accompanied by many commonly occurring and dangerous disease (hypertension, diabetes, atherosclerosis, cancer, various inflammatory conditions, etc.), and increases with age.

The use of cryogenic temperatures on whole body, causes a number of physiological responses i. e.: analgesic, anti-edema, anti-inflammatory, endocrine, circulatory and immune effect. The results of a whole body cryostimulation associated with anti-inflammatory effect is to reduce oxidative stress. However, there are no research that unequivocally would confirm the optimal number of treatments in the series, leading to an increase in antioxidant capacity of the body. Other studies indicate an important role of sirtuins in enhancing antioxidant defenses of the organism, but there is no research on the effects of cryogenic temperatures on the concentration of sirtuins. Therefore, the aim of the proposed project is to evaluate the effect of repeated whole body cryostimulation treatments, at a temperature of -130°C , applied on young and elderly, trained and untrained men on changes in the concentration of selected proteins: sirtuin 1 and sirtuin 3 in the blood and to assess the relationships between the concentration of these proteins and indicators prooxidant-antioxidant balance depending on an age and level of physical activity.

Forty healthy men will participate during the research who differ in age and physical activity: 20 elderly men (between 55 and 65 years) and 20 young men (between 18 and 25 years). In both age groups there are going to be 10 physically active people and 10 sedentary. The project will be implemented in three consecutive years and will consist of 5 stages (STAGE I - qualification for the project, evaluation of physical activity, nutritional recommendations, STAGE II - control examinations: prior to the start of whole body cryostimulation treatments, STAGE III - proper research: whole-body cryostimulation treatments, biochemical analysis of blood, STAGE IV - control examinations: after series of whole body cryostimulation treatments, STAGE V - statistical analysis of the results). Men will be subjected to a total 24 treatments of systemic cryostimulation (WBC), which will be applied in the certificated medical center in Krakow. Treatments will be held every other day (Monday - Wednesday- Friday). Whole body cryostimulation treatment will be as follows: half-minute adaptation phase in the atrium of the cryogenic chamber at a temperature of -60°C , followed by 3 minutes of exposure in a target chamber at a temperature of -130°C . During the execution of experimental tests the blood will be collected to mark the selected indicators of blood biochemical parameters (lipids, glucose, blood count). The protein concentration: Sirt1 and Sirt3 in blood serum, the antioxidant enzymes activity: SOD, CAT, GPx and the concentration of GSH and GSSG in erythrocytes, total antioxidant capacity (TAC), total oxidative status (TOS) in blood plasma and oxidative stress index (OSI) will be measured. The measurements will be performed before starting treatments and after 1st, after the 12th, and after 24th whole body cryostimulation treatment. In addition, before and after a series of whole body cryostimulation treatments body composition and quality of a life of patients will be defined. To exclude the impact of various supply of antioxidant vitamins that may affect the plasma antioxidant capacity, participants will get guidelines for a unified, balanced diet, the use of which will begin 14 days before the start of whole body cryostimulation treatments and will continue to the end of the tests. The diet will be verified by analyzing the nutritional diary. Biochemical assays will be performed in the laboratory of the Department of Physiology and Biochemistry, University of Physical Education in Krakow and in certified laboratories engaged in biochemical research.

In the scientific literature there is a lack of detailed data on the effects of whole body cryostimulation treatments on healthy people. Implementation of the proposed research will provide updates on the direct impact of whole body cryostimulation treatments on the human body depending on the age and level of physical activity. In particular, it gives the opportunity to answer the following questions:

- whether an exposure to cryogenic temperatures (-130°C) change the concentration of sirtuins (Sirt1 and Sirt3) in blood?
- whether the use of whole body treatments influence indicators of prooxidant-antioxidant balance (associated with oxidative stress) based on the differences in age and physical activity?

The research results will also contribute to a better understanding of the impact of whole body cryostimulation on changes associated with the harmful effects of free radicals in the human body and the aging process.