The Effect of Extreme Cold on Rheological and Biochemical Indicators Blood

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ABSTRACT

The human body adapts to low temperature through thermoregulation. The most important effectors of thermoregulation in humans are: the circulatory system, sweat glands, skeletal muscles, adipose tissue, liver, heart and brain. The main effect of thermoregulation is the circulatory system. Due to the lack of scientific reports on the effects of extremely low outdoor temperatures on the functioning of the human circulatory system, the aim of this study is to evaluate complete blood rheological and biochemical blood indices in multiple Guinness world record holder Valerjan Romanovski, who was exposed to extremely cold environment from −5 °C to −37 °C for 50 days in Rovaniemi (a city in northern Finland).Valerjan Romanovski proved that humans can function in extremely cold temperatures.

SUBJECT AND METHODS

The subject of the study is a multiple Guinness World Record holder for low temperatures living in Poland (See Fig. 1). The study subject (age 47) stayed 50 days (late December/early January) in Rovaniemi, northern Finland, at the mouth of the Ounasjoki River to Kemi, a few kilometers south of the northern Arctic Circle (geographic coordinates 66º300 N, 25º420 E). The stimulating factors in this study included not only extreme cold but also physical activity and methods of keeping warm. Valerjan Romanovski proved that humans can function in extremely cold temperatures. Blood from the subject was collected before and after the expedition at

the University of Physical Education in Krakow (Poland). Were measurement rheological and biochemical parameters blood. The results of the observed patient before the expedition were treated as control results. In relation to these, the percentage (%) by which the result changed after prolonged exposure to extremely low temperatures was calculated.

FIGURE 1: multiple Guinness World Record holder for low temperatures Valerjan Romanovski

RESULTS AND CONCLUSION

The subject's testosterone concentration increased by 60.14%, which is an important exam-ple of how an organism fights for survival of the species under extreme conditions. Thesubject's RBC count decreased by 4.01% and HGB value by 3.47%, which indicates anemia,as the subject also had a decrease in iron by 26.18% and vitamin B12 by 10.10%, which indi-cates dietary errors. The 21.53% decrease in WBC count and 17.31% decrease in neutrocytes were observed in the subject due to exposure to severe and prolonged stress, associated with a drastic change in living conditions, as well as the diet specific for this period (frozen food), which was not a source of an adequate number of calories, minerals, and vitamins(selenium, zinc, iron, and vitamins A, B, and C) necessary for the proper functioning ofblood marrow-hematopoiesis. Chronic stress decreases the total number of leukocytes and impairs their activity, as confirmed by the results. Elevated PDW with decreased MPV are changes associated with anemia, which supports the theory that the subject became anemic under extreme cold conditions. The liver profile showed significantly elevated AspAT (aspartate aminotransferase) by 52.81% and AlAT (alanine aminotransferase) by68.75% (above the standard range). Most likely, the subject's diet (frozen fatty

meats and processed meats) and rapid weight loss of 10 kg in 2 months caused hepatic steatosis. Thetheory of hepatic steatosis caused by malnutrition is also supported by the de Ritis index calculated from liver parameters with a value below 1 (AST < ALT). The increase in CK by 8.61% above the normal range was caused by skeletal muscle damage after significant physical activity, where the subject, in order not to freeze in extremely low temperatures, kept moving about 20 km/day.
Long-term exposure of the subject (50 days) to extreme cold stress had no noticeable negative effect on daily functioning.

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