The effect of high molecular weight carbohydrates supplementation in the sustaining mesocycle of the training period on swimmers' exercise capacity and selected indicators of antioxidant/pro-oxidant balance

Introduction: Despite the still limited data on the effect of training periodization on exercise capacity, most of the research results obtained indicate an improvement in exercise variables after the application of periodization in the training process and, consequently, in sports performance. In recent years, data have begun to emerge suggesting that the beneficial effects of periodization can be enhanced by dietary manipulations, the most beneficial of which is the use of a carbohydrate-rich diet. It is known that glycogen resynthesis after exercise is prolonged, lasting at least 24 hours. In sports where training is done twice in one day, muscle glycogen may not be fully regenerated. In addition, the reduction in glycogen concentration in skeletal muscle negatively affects the pro- and antioxidant balance. Few data in the literature indicate a beneficial effect of high molecular weight carbohydrate supplementation on the rate of muscle glycogen resynthesis. However, their effectiveness on the redox status has not yet been proven.

Background: The purpose of this study is to evaluate changes in selected indicators of prooxidant/antioxidant balance and metabolites in blood and exercise capacity during the maintenance mesocycle after supplementation with high molecular weight carbohydrates in swimmers.

Methods: The study included 12 athletes (8 males and 4 females) of the swimming section of AZS AWF Katowice (age 20±0.67 years, body weight 72.89±11.56 kg, height 181.17±9.75 cm), who were at least sport class II (FINA = 732 points). All participants gave written informed consent to participate in the study. The study was approved by the Bioethics Committee of the Jerzy Kukuczka University of Physical Education in Katowice. During the training micro-cycle, athletes consumed a high-carbohydrate diet supplemented with a high- molecular-weight carbohydrate supplement at a rate of up to 8 g of carbohydrate per kg of body weight per day. Anaerobic capacity of the upper and lower extremities was assessed using the Wingate test both before and after the microcycle. During each test, blood lactate levels and blood acid-base balance indicators were measured in addition to the mechanical variables. On the day before the 3-day training microcycle, subjects participated in an 8 × 100-m swim test of increasing intensity. During the field test, changes in enzymatic and non- enzymatic antioxidant

concentrations, markers of membrane lipid damage, total antioxidant potential, acid-base balance, and morphology were evaluated.

Results: The study showed that the anaerobic capacity of swimmers improved after a high-carbohydrate diet combined with a carbohydrate supplement. In the study, there was no improvement in average swimming speed during a test in water of increasing intensity; however, after the nutritional supplementation intervention, there was a tendency to improve performance on the last two legs swum at near maximal intensity. The use of a high-carbohydrate diet only affected weight gain in the swimmers (77±10.6 kg vs. 77.75±10.75 kg). The use of a high carbohydrate diet in combination with a high molecular weight carbohydrate supplement increased FRAP and MDA concentrations and decreased uric acid concentrations. These results indicate a decrease in the efficiency of the blood antioxidant defense system.

Conclusion: The results of this study indicate that the use of a high-carbohydrate diet combined with a high-molecular-weight carbohydrate can improve the anaerobic capacity of swimmers and cause a decrease in the efficiency of the antioxidant defense system, indicating that carbohydrates do not have a protective effect against oxidant-antioxidant imbalance toward the induction of oxidative stress. The use of a high carbohydrate diet in combination with a high-molecular-weight carbohydrates results in a tendency to improve swimming speed in the final sections of an increasing intensity test. An increase in dietary carbohydrates to 8 g/kg body weight per day results in an increase in body weight in men, which may indicate the accumulation of more muscle glycogen. At the same time, the increase in body weight did not result in adverse effects on high-intensity exercise.

Keywords: antioxidants, supplementation, high molecular weight carbohydrates, swimming