Mini Review

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The Relationship Between Physical Activity and Oxidative Stress in Athletes

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ABSTRACT

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Mini-Review

In the pathogenesis of many human diseases was incriminated the participation of the oxidative stress, a concept introduced in 1985, defined as the total oxidative damage of tissues and organs, induced by the imbalance between the formation of reactive oxygen species (excessive) and the activity of antioxidant defense systems (deficient). Starting from deciphering the pathogenic mechanisms and pathophysiological consequences of free radicals, the biomedical scientific research has also aimed at introducing potential therapies aimed at combating oxidative stress [1]. The relationship between oxidative stress and overload syndrome was found to be necessary to be studied in a number of 7 athletes (2F+5M) assessed with severe overload and 10 athletes (5F+5M) considered the control group. After processing the results, the authors conclude that the increased oxidative stress has a role in the pathophysiology of the overload syndrome. The attenuated responses of oxidative stress and the antioxidant capacity to exercise under overload state could be related to the inability to perform the exercises effectively and to the poor adaptation to exercise [2].

Also, in athletes it was found that it is necessary to perform non-invasive collections (urine and saliva) in order to determine the biochemical composition of oxidative stress and to achieve post-exercise recovery [3]. Olimpic athletes from different sports (wrestling, football, basketball) aimed to estimate the state of oxidative stress. The results showed that the type of sport has no impact on the level of oxidative stress markers, but the authors recommend the consumption of antioxidants as part of the training and preparation regime [4]. Oxidative stress and nitrite dynamics under maximum load in elite athletes related to the type of sport (aerobic, anaerobic, aerobic/anaerobic) was determined by measuring the concentration of lactates, nitric oxide and thiobarbirutic reactive substances (TBARS) as peroxide index of lipids. Its results showed that long-term training strategies establish different basal nitrites and lipid peroxidation levels in athletes, which can be explained by different mechanisms of induction of Reactive Oxygen Species (ROS) through aerobic and anaerobic exercise.

However, they did not find any statistically significant difference in oxidative stress parameters, regardless of the type of sport, although average concentrations (values proposed by test instructions) indicated a high level of oxidative stress accompanied by an increased antioxidant response in all groups [5]. Other authors monitored the changes in certain biomarkers of oxidative stress during Tae-bo training and Pilates training, where after in Tae-bo was determined a statistically significant increase in total antioxidant status, and plasma catalase activity after Pilates exercise training. The authors suggested that athletes, over a longer period of training, develop a more effective antioxidant defense, namely the natural defense of antioxidants in the body in order to respond properly to the complex training program [6]. Oxidative status was measured in professional karate players during the training session, and their results showed that prolonged scheduled exercise does not emphasize the occurrence of oxidative stress, as opposed to maximum physical exertion [7].

Along with research on oxidative stress - causes and effects - numerous studies have emerged referring to the use of antioxidant supplements [8-11]. A team of researchers conducted a study on a group of athletes (football players) where they followed the effects of zinc (Zn) and magnesium (Mg) on the oxidant-antioxidant balance (O/AO) in the training of football players. At the end of the study, they concluded that the Zn intake has positive effects on the O / AO balance [12]. Similar studies sugests that the antioxidant intake might protect oxidative stress induced by exercise [13,14]. Research investigating the effects of vitamin supplementation (vitamin C, vitamin E and co-enzyme Q10) has not yet provided substantial scientific evidence in order to confirm the ability of these supplements to improve the performance and/or recovery by reducing oxidative stress and/or inflammation [15-17]. Some studies have found that supplementation has no effect on redox sensitive signaling pathways, oxidation and reduction considered together as complementary processes [18-21] while others reported that supplementation inhibited the effects produced by the formation of reactive oxygen species [22-26].

Recent attention from scientists in exercise and sports has focused on a subset of metabolites obtained from herbal sources called polyphenols, due to their antioxidant and anti-inflammatory properties [27]. Studies have reported that interventions with this supplement improve muscle recovery after endurance events [28-30], and endurance training [31,32]. There is additional evidence to support the idea that improvements in muscle recovery may have a beneficial effect over the performance in the days following high-intensity exercise that causes fatigue [33,34]. Another group of researchers refers to changes in oxidative stress caused by physical activity. They claim that aerobic and anaerobic exercises have different effects on the muscles, but both positively influence the biomarkers of oxidative stress. Aerobic exercise increases the status of endogenous antioxidants. Moderate regular exercise produces an increase in antioxidant activity due to changes in redox homeostasis [35]. Physical activities with intensities between 50% and 80% of VO2max (maximum rate of oxygen consumption) and with a frequency of three sessions per week are indicated for the oxidative stress prevention system [36].

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