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# STUDY OF THE ANTIOXIDANT SYSTEM AND LIPOPEROXIDATION PROCESS IN JUDOKAS ON THE BACKGROUND OF BASIC AND COMBINED THERAPY

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## ABSTRACT

A study was conducted on the components of the antioxidant system: the content of superoxide dismutase (EC 1.15.1.1), catalase (EC 1.11.1.6) and  $\alpha$ -tocopherol was studied in judokas of different ages and qualifications with rheumatoid arthritis. The studies were performed at baseline, and after the administration of antioxidant, combined therapy. During antioxidant therapy using ibuprofen (each tablet of which contains 100 mg of ascorbic acid), an increase in the activity of the studied enzymes and the concentration of  $\alpha$ -tocopherol was noted. A positive effect of ibuprofen has been established, which is manifested, against the background of its use, by a more pronounced antioxidant effect, compared to standard, basic therapy. which helps to reduce the products of lipid peroxidation, as a result we avoid the total or partial destruction of cell membranes. We can think that due to the specificity of the training and competition processes of judokas, the optimal intensification of peroxidic oxidation of lipids occurs, and the corresponding components of the antioxidant systems are not able to completely inhibit it. Although the antioxidant therapy performed by us delays the peroxidation processes, it cannot completely inhibit the action of their toxic metabolites. In our case, this is probably due to either the low concentration of the antioxidant used or the short course of treatment with the antioxidant during the antioxidant therapy.

We express an opinion: the activity of components of the antioxidant system in judokas can be increased not only by medical intervention, but also by taking physical rehabilitation and high-calorie, protein food products containing substances with antioxidant properties.

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## KEYWORDS

Arthritis, Antioxidant System, Peroxidation, Superoxide Dismutase, Catalase, A-Tocopherol

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## Introduction.

The success of judokas during training and practice, or competition, depends a lot on their mental state. This issue is considered quite well by sports science researchers [5,19]. The methods of detecting stress components and their further study are changing [15,16,18].

Free radicals participate in many biochemical reactions in the living organism. The source of free radicals in biological systems is the active form of oxygen. The active form of oxygen is regenerated in almost every part of the cell of a living organism. The physiological importance of free radicals is very great [17]. They play a special role in maintaining the life processes of living organisms in the environment, in the course of adaptive reactions, in the functioning of the protective systems and detoxification systems of living organisms, as well as in the reliability of immune work [6]. During the oxidation of free radicals, the active form of oxygen performs many chain reactions, one of the results of which in living organisms is lipid peroxidation [7]. Activation of the lipid peroxidation process can be considered as the initial stage of lipoxidase stress, which is based on the creation of an imbalance between free radical oxidation and the components of the antioxidant system in the body. The components of the antioxidant system include: enzymatic and non-enzymatic substances, as well as vitamins. The process of lipid peroxidation is a unique mechanism of cell membrane structure pathology. At this time, damage to cell membranes and tissues may occur. At present, oxidation by free radicals, as well as the study of molecular-cellular mechanisms of lipoxidase stress, is one of the current issues of science [3,8,10,11]. The duration and excessive activation of peroxidation processes in judokas is a damaging factor for the athlete's body, because the processes involving free radicals are directly related to the physical activity and intensity of the athletes. All this is finally reflected in the athlete's sports results.

As we know, the antioxidant defense system plays an important role in the prevention of lipid peroxidation processes in the athlete's body. The antioxidant defense system aims to maintain the homeostasis of a living organism, because living organisms are always under the influence of oxidative stress. An antioxidant can be considered a substance that can significantly delay or completely stop the oxidation process of the oxidizable substrate at a concentration lower than the concentration of the oxidizable substrate [13]. Among the enzymes of the body's antioxidant system, superoxide dismutase (KF.1.11.1.6) is important, the main purpose of which is to transform the superoxide anion radical into hydrogen peroxide and oxygen. The enzyme catalase (KF1.11.1.6) is also important in its action, which decomposes hydrogen peroxide into water and oxygen. Among the non-enzymatic components of the antioxidant system,  $\alpha$ -tocopherol occupies an important place. It is a natural antioxidant.  $\alpha$ -tocopherol takes an active part in the process of peroxidation of lipids with free radicals. Protects cell membranes from oxidation.

In antioxidant therapy, special attention is paid to the inclusion of substances characterized by antioxidant activity. We considered the hormone melatonin as such. Melatonin (N-acetyl-5-methoxytryptamine) is the main hormone of the pineal gland. It is produced by the pineal gland from the amino acid tryptophan. Along with various factors, its synthesis is significantly influenced by physical training. Melatonin is produced maximally in children. Then it decreases. The rhythm of the production of this hormone regulates the entire cycle of human life [1,2]. Among the many positive biochemical properties of melatonin, we can highlight: it strengthens the immune system, has antioxidant properties, affects adaptation processes, has an anti-stress effect, and others. Because of these and other similar properties, we considered it necessary to include in our research the hormone melatonin, which has a particularly wide application in antioxidant therapy. In relation to superoxide radicals, it acts 2 times more strongly than vitamin E [12].

## Research Aim and Objectives

The aim of our study was to study the development process of lipoxid stress in judokas of different ages and qualifications, as well as the enzymatic and non-enzymatic characteristics of the antioxidant system, before basic treatment, after basic treatment and antioxidant combined therapy. In order to realize our goal, we decided: to study antioxidant enzymes: catalase and superoxide dismutase in judokas of different age and status. Also, a natural antioxidant with a non-enzymatic nature,  $\alpha$ -tocopherol.

## Research Methods

We had 30 judoka athletes involved in the research. Athletes were selected from the "VIP Judo" team of the Guram Papitashvili Judo Hall of Gori. Judokas of different ages train in the team and many of them are highly qualified.

We divided the athletes into three groups. In the first group - the control group, there were 10 athletes, practically healthy and with normal indicators of general blood and biochemical parameters. The second group also included 10 judokas who were on basic treatment. The third group also included 10 judokas, who were

treated with antioxidant therapy along with basic muscle training. In the research we used a non-steroidal medicine - ibuprofen. Active substance: the tablet contains 200 mg of ibuprofen, 100 mg of ascorbic acid. Containing other fillers as well. Patients received it 4 times a day. in the amount of 200-800 mg. Country of manufacture: Belarus, Borisov Plant of Medical Preparations. Code 1066. This medication is widely used in sports injuries. Before starting the biochemical studies, there were satisfactory assessments of the doctor about the medical health of each of them.

The judokas of the second and third groups were under the influence of rheumatoid arthritis. Some of them had damage to the anterior cruciate ligament of the knee joint, which in most cases requires surgical intervention. The main thing is to achieve a complete or partial prevention of the disease in judokas by using medical or physical rehabilitation methods, so that their joints become more mobile and they can perform their sports activities to achieve high sports results.

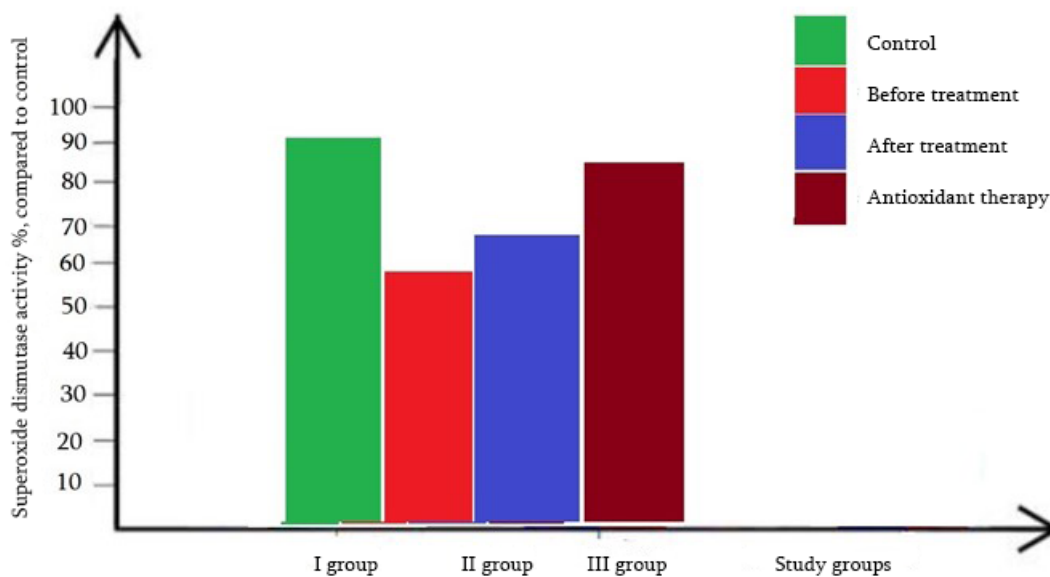
The object of laboratory research was blood serum, which was taken in the morning, on an empty stomach, always at the same time, from the cubital vein.

By centrifuging the blood of judokas at 10,000 rpm, adding an equal volume of heptane and isopropanol, we obtained a plasma, serum solution containing secondary products of lipid peroxidation of working blood. We used the obtained solution for our further studies. We determined the activity of enzymes according to the proven method [14]. Superoxide dismutase activity was determined by the oxidation of quercetin at a wavelength of 406 nm. We performed the measurement in the initial state and after 20 minutes of quercetin oxidation. Catalase activity was determined by the kinetic method, with direct registration of hydrogen peroxide. Total protein concentration was determined according to the Bradford method. Coomassie diamond blue G - 250. 0.01% (W/V), ethanol 4.7% and phosphoric acid 8.5% (W/V) were used to prepare the Bradford reagent. We carried out measurements on a spectrophotometer at a wavelength of 595 nm [4,9].

The concentration of  $\alpha$ -tocopherol was determined by spectrophotometry of the chromogenic complex compound of  $Fe^{2+}$  and ortho-Phenanthroline at a wavelength of 510 nm. Digital data were processed statistically with the help of Excel computer program and using the Student's t test.  $P < 0.05$  [20].

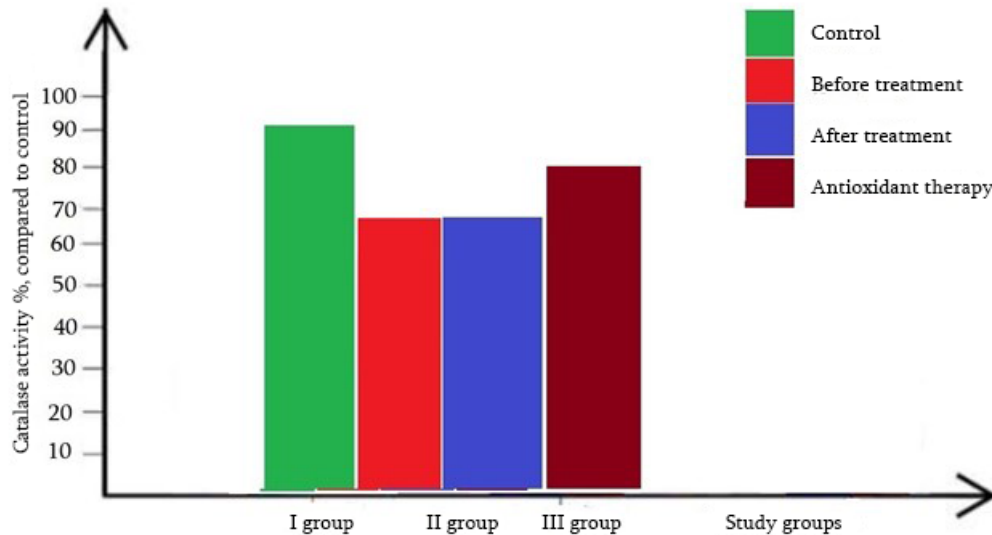
### Results and Discussion

The results of our study showed that the specific activity of the main enzyme of the antioxidant system, superoxide dismutase, in the judokas of the second group before the basic treatment was low, decreased by 32%, compared to the control group Fig.1. The low concentration of the enzyme could have been caused by the increase of antibodies against the antioxidant system or directly by disrupting the function of this enzyme, as a result of which the development of lipoxidative stress naturally took place in judokas. After the baseline treatment, there was mainly a 12% increase in the activity of the mentioned enzyme. Group 2 compared to the data we had before baseline treatment. In judokas, after antioxidant, combined therapy, the activity of enzyme superoxide dismutase increased by 15%. Fig. 1. ( $p < 0.05$ ).



Picture 1. Treatment-dependent changes in superoxide dismutase in judokas

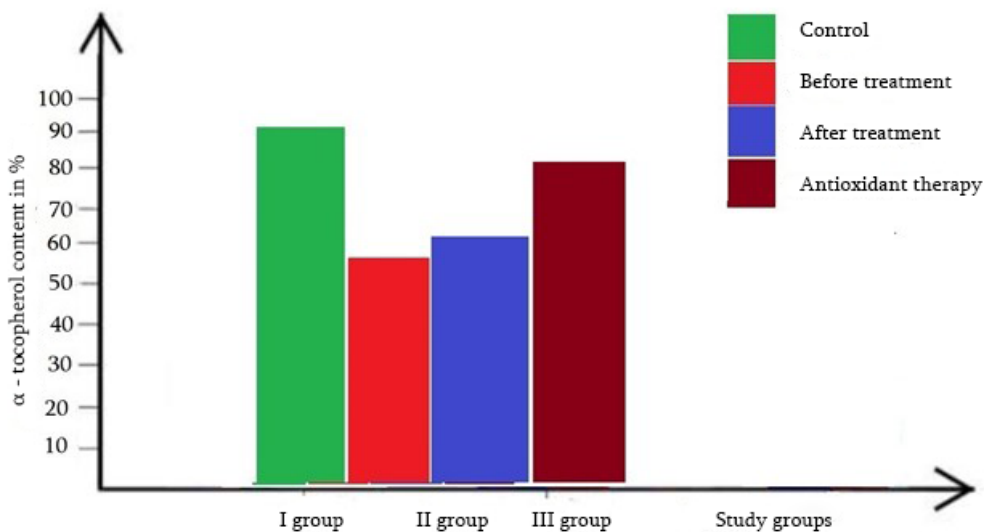
The obtained results assure us that the activity of the enzyme superoxide dismutase tends to be within the normal range. We believe that the increase in the activity of the enzyme superoxide dismutase in the background of combined therapy is somewhat dependent on the use of ibuprofen, each tablet of which contains 100 mg of ascorbic acid. Perhaps it helps to activate the antioxidant melatonin and weakens the effect of antibodies on enzymes in the antioxidant system. Naturally, all this hinders the process of oxidation of free radicals in biomolecules. The change of catalase activity in judoka before baseline treatment and after baseline treatment was insignificant, Fig 2.



Picture 2. Treatment-dependent changes in Catalase activity in judokas

After carrying out only antioxidant, combined therapy, with the use of ibuprofen, a tendency to increase catalase activity was observed, on average by 8%, Fig. 2. ( $p < 0.05$ ). In this case, we should think that the ascorbic acid included in the medicine used by us is expected to induce the enzyme. Because there is an activation of melatonin against the background of the ibuprofen we use. Thus, the inclusion of ibuprofen in the treatment of judokas led to an increase in the activity of the enzyme catalase. During pathologies, it can be the basis for correction of free-radical homeostasis in judokas. The obtained results confirm the direct influence of ibuprofen during peroxidation processes.

The study of  $\alpha$ -tocopherol, Fig. 3, showed that before the basic treatment, its content in the blood serum decreased by 1.5 times compared to the control.



Picture 3. Treatment-dependent changes in  $\alpha$ -tocopherol content in judokas

After the basic treatment, its content increased by 1.1%. i.e. The basic treatment had a positive effect on the antioxidant systems of judokas, which is manifested by an increase in  $\alpha$ -tocopherol content.

We got a special picture with antioxidant combined therapy. The concentration of  $\alpha$ -tocopherol increased by 1.4 times compared to the basic treatment Fig. 3. ( $p < 0.05$ ). Thus, increasing the concentration of  $\alpha$ -tocopherol, which is present in the lipid layer of membranes and protects the cell from the active form of oxygen, indicates the positive effect of the medicine we use - ibuprofen.

When determining the amount of protein, we used Bradford's method. To construct the corresponding calibration curve in Fig. 4, we used albumin solution.

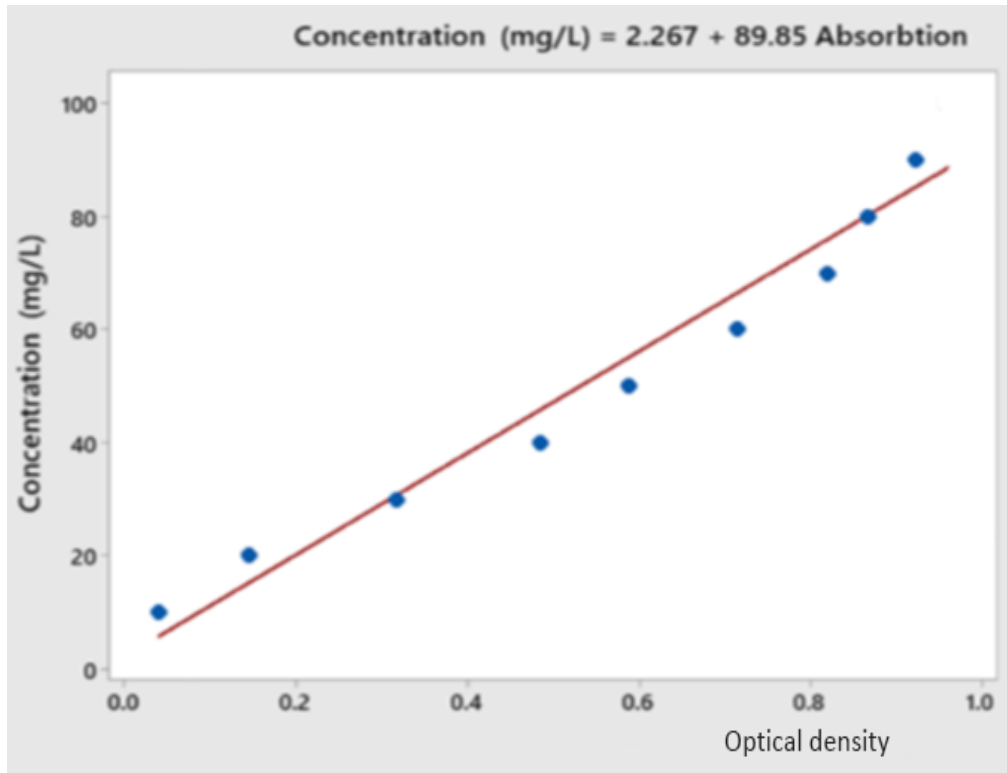


Fig. 4. Calibration curve for protein quantification by the Bradford method

As a result of physiotherapy and physical rehabilitation, muscle strengthening and stretching are an integral part of arthritis treatment. Biomechanical problems correctly assessed by a physiotherapist and exercises selected accordingly are important to make the joints more mobile.

It is also important to change the way of life, which means changing physical loads that are passive or not useful for the joints (jogging) with cycling and swimming, during which direct loads are less on the joints than during jogging. But it should also be noted that a passive lifestyle is better than any physical activity.

Thus, our research allows us to conclude that in judokas who have rheumatoid arthritis, an anterior cruciate yoga injury of the knee joint, the drug Ibuprofen, each tablet of which contains 100 mg of ascorbic acid, can be used. The studied drug has an antioxidant effect and hepatoprotective effect compared to the basic, standard treatment.

The activity of the constituent components of the antioxidant system in athletes can be increased not only by medical intervention, but also by physical rehabilitation and intake of high-calorie protein food products containing substances with antioxidant properties.

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