SECTION VII.
BIOLOGIE ET BIOTECHNOLOGIE

DOI 10.36074/logos-01.10.2021.v1.16

ASSESSMENT OF ADAPTATION CAPABILITIES OF YOUNG PEOPLE ACCORDING TO ASCORBIC ACID ANTIOXIDANT ACTIVITY INDICATORS

RESEARCH GROUP:

ORCID ID: 0000-0003-4385-7090 **Filiptsova Kateryna Anatoliivna**
Candidate of Biological Sciences, Docent
Docent of the Department of Biology and Healthcare
South Ukrainian National Pedagogical University named after K. D. Ushynsky

ORCID ID: 0000-0003-3472-0412 **Bosenko Anatolii Ivanovych**
Doctor of Pedagogical Sciences, Candidate of Biological Sciences, Professor
Professor of the Department of Biology and Health Protection
South Ukrainian National Pedagogical University named after K. D. Ushynsky

Levchuk Antonina Mykhailivna
second-year student
South Ukrainian National Pedagogical University named after K. D. Ushynsky

Yurchenko Tetiana Oleksandrivna
second-year student
South Ukrainian National Pedagogical University named after K. D. Ushynsky

UKRAINE

Introduction. Ascorbic acid is known as a direct antioxidant that is an active participant in redox reactions (both electron donor and acceptor) it prevents the accumulation of peroxidation products in the cells of the body and it is responsible for the body's resistance to adverse effects [Шаповал, & Громова, 2003; Петров и др, 1991]. Accordingly, ascorbic acid deficiency causes a decrease in the antioxidant activity of ascorbic acid that contributes to the accumulation of peroxidation products and, as a consequence, leads to a decrease in muscle workability.

The assessment an adaptive capacity the antioxidant system of young people to dosed muscle loads is one of the components a comprehensive assessment the development of adaptive capabilities in the physical education process. There is an activation of lipid peroxidation during intense exercise and inhibition of this process by peroxidation inhibitors namely antioxidants. The excessive activation of lipid peroxidation may play a role in the development of many pathological processes, including the pathogenesis in cardiovascular disease [Valko et al., 2007; Green, 1995]. One of the stress's characteristic signs is the increase of free radical oxidation that indicates the intensity of lipid peroxidation body membranes, cellular metabolism disorders [Мартишук, 2016; Чумакова, Теплый, & Нестеров, 2009; Valko et al., 2007; Хаитов, & Лесков, 2001].

Aim. The objective of the work was to study the antioxidant activity of ascorbic acid in adolescents and to elucidate its role in ensuring the body's ability to adapt to dosed exercise with reverse.

Materials and methods. The antioxidant activity of ascorbic acid was determined using a lingual test for the availability of ascorbic acid by the rate of sodium dichlorophenolphenolate discoloration by of O. N. Voskresensky method [Воскресенский, & Туманов, 1982]. To that end a solution 0.04 ml of 0.01% sodium dichlorophenolphenolate was applied on the mucous membrane the back of the tongue, which was previously dried with a gauze tampo and using a stopwatch recorded the discoloration time applied to the tongue drop of the indicator solution (the level of tissue supply of ascorbic acid is inversely proportional to the discoloration time of the solution).

The survey involved young men aged 18 - 19 years, first-year students of the Institute of Physical Culture, Sports and Rehabilitation (n = 48) who performed cycle ergometer muscle work with reverse and were divided into two conditional groups: group of students (boys 18 - 19 years old) who did not do sports, n = 29; a group of students (boys 18 - 19 years old) who did sports, n = 19.

The antioxidant activity of ascorbic acid was determined in three stages: before exercise (at rest), immediately after the end of muscle work and at 15 minutes of rest.

Control the functional state of the examined in the research process provided a set of methods which involved the assessment of anthropophysiometric (body length, body weight, chest girth, hand strength) and functional indicators of the cardiovascular system (systolic and diastolic blood pressure, electrocardiography, heart rate) and the central nervous system (general functional state of the brain).

Statistical data processing was performed according to generally accepted methods with finding the Student's criterion [Сергієнко, 2010].

Results and discussion. Analysis the results of the study of the antioxidant activity of ascorbic acid in young people aged 18–19 years who did not do sports and athletes, showed that a decrease in the studied values in response to muscle work was probable ($p < 0.001$). So, if the initial indicators of antioxidant activity in the first group were 15.22 ± 0.45 s, then in the second group, respectively - 17,31 ± 0,37 s. The results in young non-athletes after muscle work with reverse were in the range of 17,44 ± 0,43 s and in young athletes – 19,32 ± 0,35 s. These values at 15 minutes of rest respectively, were equal to 14.63 ± 0.36 and 16.35 ± 0.40 seconds. Restoration of the studied values of young men in 15 minutes after physical activity was completely to the initial level.

Table

Antioxidant activity of ascorbic acid for adolescents 18 - 19 years old at rest and muscular work *(M ± m)

surveyed groups of young men	Stages of research				P		
	before muscular work	after the end of muscle work		in 15 minutes after work	a – b	a – c	b – c
	a (in seconds)	**b** (in seconds)	percentage of shifts	**c** (in seconds)			
First group: 18–19 years old, not athletes	15,22 ± 0,45	17,44 ± 0,43	15,6	14,63 ± 0,36	<0,001	>0,05	<0,001
Second group: 18–19 years old, athletes	17,31 ± 0,37**	19,32 ± 0,35**	12,3	16,35 ± 0,40	<0,001	>0,05	<0,001

*Note: * – the antioxidant activity of ascorbic acid is inversely proportional to the discoloration time of the indicator; ** – p<0,01.*

Thus, during the study revealed that in all surveyed groups there is a significant ($p < 0.001$) decrease in antioxidant activity of ascorbic acid in response to cycle ergometer muscle work with reverse as when comparing the results obtained at different stages of muscle work and taking into account different levels of physical preparation. The correlation between a decrease in the antioxidant activity of ascorbic acid and regular exercise was noted which may indicate a possible decrease in the concentration of vitamin C of young athletes.

Intense physical activity is a recognized stress factor that can cause homeostasis at high power or prolonged action and lead to the development of a number pathological conditions [Агаджанян, Двоеносов, Ермаков, Морозова, & Юсупов, 2005; Хаитов, & Лесков, 2001; Pedersen, & Hoffman-Goetz, 2000].

There was a pronounced vitamin deficiency in general and ascorbic acid in particular in the sense of changes in antioxidant activity in response to intense exercise and regular exercise caused by its active consumption, which confirms the results of research.

The deficit of ascorbic acid in the body causes a decrease in antioxidant activity that stresses its importance as a direct antioxidant in adaptation processes. As a result, with intense muscle activity the intensity of lipid peroxidation changes and an accumulation in the body of the concentration of free radical oxidation products and reactive oxygen species that causes a violation of the physiological balance between the processes of peroxidation and the level of antioxidant protection. Also this indicates the intensity of the compensatory mechanisms and adaptive capacity of the antioxidant system to physical activity [Valko et al., 2007; Шаповал, & Громова, 2003; Петров и др, 1991].

Therefore, the obtained data lead to a conclusion that muscle work causes a significant decrease in the antioxidant activity of ascorbic acid. Comparison of the dynamics of antioxidant activity of ascorbic acid with functional indicators of the cardiovascular and respiratory systems, with functional activity of the brain found a positive correlation between its antioxidant activity and functional indicators of the brain. However, a negative relationship was observed between the antioxidant activity of ascorbic acid and the activity of the cardiovascular system. The ascorbic acid antioxidant activity at all stages of the study was lower and its restoration was less active which is due to the systemic response of adolescent body which manifests itself in the functional activity of the brain, cardiovascular and respiratory systems, deeper mobilization of adaptive reserves in the group of young men involved in sport.

Conclusions. Based on the work undertaken it can be stated that the compliance with muscular work causes a significant decrease in the antioxidant activity of ascorbic acid, regardless of the level of young men's physical preparedness. Muscle work leads to a deeper state of stress on the mechanisms for mobilizing body reserves young men who play sports.

References:

[1] Агаджанян Н. А., Двоеносов В. Г., Ермаков Н. В., Морозова Г. В., & Юсупов Р. А. (2005). *Двигательная активность и здоровье*. Казань: Изд-во КазГУ.

[2] Воскресенский, О. Н., & Туманов В. А. (1982). *Ангиопротекторы*. Киев: Здоровье.

[3] Мартишук Т. В. (2016). Вплив оксидаційного стресу на систему антиоксидантного захисту організму щурів. *Вісник Дніпропетровського університету. Біологія, медицина*. 7(1), 8-12.

[4] Петров Ю. А., Гончарова Л. Л., Ковшик А. О., Киселева Н. Н., Макарова Н. Н., & Евстигнеев Б. Н. (1991). Влияние физических нагрузок на состояние некоторых звеньев антиоксидантной системы крови у спортсменов. *Теория и практика физической культуры*. 8, 38-40.

[5] Сергієнко Л. П. (2010). *Спортивна метрологія: теорія і практичні аспекти*. Київ: КНТ.

[6] Хаитов Р. М., & Лесков В. П. (2001). Иммунитет и стресс. *Российский физиол. журнал*. 87(8), 1060-1072.
[7] Чумакова А. С., Теплый Д. Л., & Нестеров Ю. В. (2009). Изменения свободнорадикальных процессов в различных органах крыс разного возраста при остром стрессе. *Биологические исследования*. 4, 34-37.
[8] Шаповал Г. С., & Громова В. Ф. (2003). Механизмы антиоксидантной защиты организма при действии активных форм кислорода. *Укр. биохим. журн*. 75(2), 5-13.
[9] Green K. (1995). Free radicals and aging of anterior segment tissues of the eye hypothesis. *Ophthaimic Res*. 27(1), 143-149.
[10] Pedersen, B. K., & Hoffman-Goetz L. (2000). Exercise and the immune system: Regulation, integration, and adaptation. *Physiol. Rev*. 80(3), 1055-1081.
[11] Valko M., Leibfritz D., Moncol J., Cronin M. T., Mazur M., & Telser J. (2007). Free radicals and antioxidants in normal physiological functions and human disease. *Int. J. Biochem. Cell. Biol*. 39(1), 44-84.