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Influence of Electrophoresis of Antler Mass on Restorative Processes in Young Athletes during the Preparatory Period of a One-Year Training Cycle

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Abstract

We investigated the influence of electrophoresis of antler mass (according to Vermel's method) on the peripheral blood and indicators of cardiac function in elite athletes during intensive exercise during the preparatory period. This study included 27 male athletes, aged 16-17 years old. Application of electrophoresis of antler mass led to improvement of hemoglobin level and hematocrit, mean corpuscular hemoglobin concentration, normalization of hormonal status and myocardial metabolism, and promoted increased fitness and adaptability to physical stress. **(Int J Biomed. 2016;6(1):78-81.).**

Keywords: *athletes; intensive exercise; blood test; myocardial metabolism; antler mass; general electrophoresis.*

Introduction

The human body is designed to thrive under conditions of regular physical exertion because the process of adaptation arising from different training stimuli ensures an optimal function of various systems of the organism. On the one hand, its backup capabilities increase at the cellular, system and intersystem levels. On the other hand, response to a load decreases over time, which leads to stopping the improvement in sporting performance. Intensive physical exercise in athletes leads to overstraining the musculoskeletal system, hypoxia, and the formation of an excess of free radicals [1]. Given this circumstance, many experts believe that all qualified athletes need to be in functional rehabilitation during training and competition [2].

Currently, rehabilitation and treatment measures in sports are mostly of pharmacological orientation. However, the restrictive list of approved pharmaceuticals narrows the possibilities of sports physicians to ensure effective recovery and treatment of athletes. To prevent fatigue and mitigate its consequences, new, largely alternative, pharmacological and non-pharmacological measures of influence on key mechanisms of athletes' performance are being required today [3,4].

To solve tactical and strategic objectives in the training process and competitive activities without fear of sanctions in connection with the use of anabolic doping in elite sports, the use of antler products is a priority choice for remediation after intense exercise.

In extreme conditions of the Far North in the struggle for survival in the short polar days, a deer generates the greatest amount of biologically active substances. This unique phenomenon explains the burst of vitality among the indigenous peoples, who use deer blood in food. At the same time, the vital biological substance in the body helps a person to survive in the harsh conditions of the north. Products from reindeer antlers combine centuries-old traditions and the latest scientific developments. The indigenous people of the north for many centuries used the antlers of reindeer to overcome the most difficult climatic conditions and the highest exercise stress [5]. It is generally known that extracts from deer antlers are primarily tonic medicines. More than two thousand years

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in the traditional medicine of East Asia, the antlers have being used as a means of relieving fatigue and increasing the efficiency of the organism. Currently, the domestic industry produces the following products from deer antlers: Pantocrinum, Rantarin, Velkornin [5], Epsorin, and Cigapan [6-9]. Numerous clinical studies have identified three main properties of antlers: tonic effect on the body, stimulation of sexual function, and acceleration of tissue regeneration [8].

In the literature, there are sporadic reports on the effect of drugs from deer antlers during intensive physical exercise in athletes. In the I.M. Sechenov Moscow Medical Academy, an extract from deer antlers, Velkornin, was clinically tested in athletes. As a result, it was found that Velkornin is an effective means of enhancing physical performance and stimulation of humoral immunity for athletes in sports that require endurance in the preparatory period of training. Velkornin does not cause side effects and allergic reactions and can be recommended for use in practice [5].

The effect of intravenous administration of the powder of deer antlers, Pantovital, stimulates erythropoiesis and helps to improve the oxygen-transport function of blood, thereby increasing the adaptive capacities of the athletes' organisms and tolerance to training loads [10].

In the Republic of Sakha (Yakutia), the dietary supplement Epsorin from deer antlers is widely used. Using Epsorin can significantly improve the functional state of athletes, ensure fast adaptation when moving across time zones and in different climatic zones in precompetitive and competitive periods, and achieve a significant increase in the functionality of the organism. It should be noted that Epsorin increases only the positive reactions of the organism to physical stress and thus enhances adaptation to the increasing intensity of training loads in the precompetitive period, maintains the optimal fitness during the competition, and accelerates the process of recovery during rehabilitation [9].

Deer antlers have been used in traditional *medicine* for a long time, but, unfortunately, we could not find any information on the non-invasive method of the introduction of antler mass by general electrophoresis in athletes during intense exertion.

The aim of this study was to investigate the effect of electrophoresis of antler mass by Vermel's method on the condition of the peripheral blood, antioxidant protection, hormone status, and indicators of cardiac performance in athletes at the preparatory stage of the training cycle.

Materials and Methods

The study included 27 elite athletes in wrestling, males aged 16-17 years old, having qualifications from the first sports category to the candidates for Master of Sports. Sports experience was 5-7 years. Young athletes have been involved in the study on a voluntary basis. The studies were conducted in the period of intensive training. Athletes were randomly divided into 2 groups. Group 1 (n = 13) received antler mass by electrophoresis for 20-30 minutes during 5-7 days. The procedures were carried out at the preparatory stage of sports cycle. Group 2 included 14 athletes without intervention.

All athletes underwent a physical examination, ECG, general blood test (HGB, RBC, MCV, HCT, MCH, MCHC), and determination of blood testosterone and cortisol, malonic dialdehyde (MDA), low molecular weight antioxidants (LMAO) and catalase. MDA content in serum was determined by spectrophotometric method by reaction with thiobarbituric acid at λ=532 nm [11]. The content LMAO was determined by by ortho-phenanthroline colour method [12]. o-phenantroline quantitatively forms complex with Fe^{2+}, which get disrupted in the presence of chelating agents. The antioxidant interfered with the formation of ferrous-ophenantroline complex which is spectrophotometrically read at 510 nm.

Testosterone and cortisol levels were determined in the blood serum using automated EIA and the chemistry analyzer ChemWell (Awareness Technology, Inc.). The collection of blood specimens was performed from 8:00 a.m. to 9:00 a.m.

To determine the influence of electrophoresis of antler mass on athletes' organisms, we used an antioxidant protection coefficient (C_{AOP}) [6]. The activity of the antioxidant blood systems of healthy people served as the normalizing parameters (n=50). The activity of blood antioxidant systems (C_{AOP}) and coefficient of antioxidant-prooxidant balance (C_{AOP}/C_{LPO}) were calculated according to the formulas (1) and (2):

$(C_{AOP})N= \Sigma$ (parameters AO systems)$_N$ /quantity studied AO systems (1),

where: AO system $_N$ - parameters of LMAO, superoxide dismutase (SOD), and peroxidase, normalized to the control values;

$(C_{AOP}/ C_{LPO})_N=(C_{AOP})_N$ /[activity LPO]$_N$ (2),

where activity LPO$_N$ - level of MDA, normalized to the control vakues.

ECG was recorded on an electrocardiograph, Shiller AT-101, in the morning the day before the training event.

Electrophoresis method for antler mass application according to Vermel's procedure

For galvano-mud therapy [13], antler mass was heated on a steam bath to 38°-40°C and placed in gauze baggies (300 cm^2 in size); the thickness of an antler mass layer was 2cm-2.5cm. The baggies were placed on the interscapular region. The current-carrying electrodes were placed on the baggies and connected to the anode. Bifurcated electrodes were used as the cathodes that were placed on the rear surface of the calves of both legs using pads of 150 cm^2.

Electrophoresis was performed by using the apparatus for galvanization, Potok-1. The current density with galvano-mud therapy was 0.05 mA/cm^2 for 20-30 min. Electrophoresis was scheduled for 5 to 8 sessions per course on alternate days. After each procedure, the athlete rested for 30-40 minutes. Antler mass has normative and technical documentation (Specifications TU 9219-003-00549163-06).

Statistical analysis was performed using SPSS Statistics v.19.0. The mean (M) and the standard error of the mean (SEM) were calculated. The Wilcoxon criterion was used to compare the differences between the paired samples. A probability

value of *P<0.05* was considered statistically significant.

Young athletes have been involved in the study on a voluntary basis. Written informed consent was obtained from all participants.

Results

Despite the fact that the red blood parameters in both groups conformed to generally accepted standards, as a result of the analysis of the dynamics of the studied parameters during the course of electrophoresis of antler mass, we found statistically significant differences between groups. The most pronounced changes were found in oxygen provision mechanisms. The increase in hemoglobin in the blood reflects the body's adaptation to physical stress in hypoxic conditions [14].

During intense workouts, differences in red blood parameters were detected in the studied groups (Table 1). The number of erythrocytes decreased in Group 2 an average of 2.33% (from $4.72*10^{12}$/l to $4.61*10^{12}$/l; *P<0.05*), whereas in Group 1 this parameter increased by 1.96% (from $4.59*10^{12}$/l to $4.68*10^{12}$/l; *P<0.05*). More significant changes were obtained in the study of hemoglobin and hematocrit. In Group 1, the hemoglobin level and hematocrit significantly increased by 2.88% (from 147.9 g/l to 152.2 g/l; *P=0.001* and 2.74% (from 41.97 to 43.12; *P=0.001*), respectively, after a course of electrophoresis with antler mass. The opposite pattern was obtained in Group 2, where we observed a statistically significant reduction in hemoglobin level by 3.99% (from 150.44 g/l to 144.44 g/l; *P=0.005)* and hematocrit by 2.43% (from 42.30 to 41.27; *P<0.05*).

Table 1.

Red blood parameters of athletes during intense workouts preparatory stage of sports cycle

Variable	Group 1			Group 2		
	Initial data	*P*	10th day AT	Initial data	*P*	10th day AT
HGB, g/l	147.87±5.96	*0.001*	152.25+6.98	150.44+6.69	*0.005*	144.44+8.39
RBC, mln/mm^3	4.59±0.17	*0.032*	4.68+0.22	4.72+0.22	*0.033*	4.61+0.24
MCV	91.38±2.49	*0.001*	92.15+2.21	89.73+1.69	*0.408*	89.62+1.72
HCT,%	41.97±2.09	*0.011*	43.12+2.10	42.30+2.00	*0.035*	41.27+2.32
MCH, pg	32.12±0.78	*0.006*	32.56+1.02	31.82+0.79	*0.001*	31.27+0.59
MCHC, g/l	351.87+5.08	*0.429*	353.00+5.34	355.11+4.98	*0.001*	349.33+3.74

AT - after training

During intense exercise, there was a destruction of RBCs and a decrease in hemoglobin concentration. Increasing the concentration of hemoglobin in Group 1 was accompanied by an increase in RBC concentration by 1.92% (from $4.59*10^{12}$/l to $4.68*10^{12}$/l; *P<0.05*) and hematocrit by 2.67% (from 41.97 to 43.12; *P=0.011*).

We also noted that in Group 2, a decrease in RBC concentration was accompanied by a significant decrease in MCHC by 1.63% (from 355.1 g/l to 349.3 g/l; *P=0.001*). In Group 1, on the contrary, there was a statistically insignificant increase in MCHC by 0.32% (from 351.9 g/l to 353.0 g/l; *P>0.05*).

The training loads were accompanied by increasing hormonal activity [15]. An increase in blood cortisol level in response to physical exercise reflects the activation of a stress-realizing system due to the need to mobilize energy reserves [16].

We detected a high cortisol level in athletes of Group1 in the preparatory phase of the training cycle. After electrophoresis, blood cortisol level in that group significantly decreased by 41.17% *(P=0.001)*, whereas in Group 2 the level increased by 22.95% *(P=0.001)*. Blood testosterone level significantly increased by 18.5% (P=0.001) in Group 1, but decreased by 9.5% *(P=0.008)* in Group 2 (Table 2).

Table 2.

Blood levels of cortisol and testosterone in athletes during intense workouts preparatory stage of sports cycle

Variable	Group 1			Group 2		
	Initial data	*P*	10th day AT	Initial data	*P*	10th day AT
Cortisol, ng/ml	769.9+230.2	*0.001*	452.9+96.7	318.8+106.0	*0.001*	392+93.2
Tes, ng/ml	23.45+3.18	*0.001*	27.80+3.85	16.23+6.33	*0.008*	14,68+5.1

AT - after training; Tes- testosterone

According to the criterion of binomial distribution, a trend to improvement of ECG parameters was identified in Group 1: a decrease in the incidence of early repolarization syndrome (ERS) by 15.4%, incomplete RBBB by 30.77%, and full correction of metabolic changes (Table 3). In Group 2, we observed an increase in metabolic changes in the myocardium by 7.14% and incidences of sinus arrhythmia by 21.43% on the background of intense exercise.

Table 3.

Dynamics of ECG in athletes during intense workouts preparatory stage of sports cycle

ECG data	Group 1		Group 2	
	Initial data	10th day AT	Initial data	10th day AT
ERS	5 (38.5%)	3 (23.1%)	7 (50%)	7 (50%)
IRBBB	5 (38.5%)	1 (7.7)	5 (35.7%)	4 (28.6%)
Metabolic changes in the myocardium	3 (23.1%)	-	1 (7.14%)	2 (14.3%)
Sinus arrhythmia	3 (23.1%)	1 (7.7)	1 (7.1%)	4 (28.6%)

AT - after training;

A course of electrophoresis had a positive impact on antioxidant status. We identified an improvement of antioxidant–pro-oxidant balance with an increasing C_{AOP}/C_{LPO} ratio only in Group 1 (Table 4).

Table 4.

Antioxidant status in athletes during intense workouts preparatory stage of sports cycle

Vaiable	Indicators	Group 1		Group 2	
		Initial data	10th day after training	Initial data	10th day after training
∑ LMAO	Indicators (mgeq/ml Erith)	0.419±0.09	0.832±0.01*	0.718±0.03	0.374±0.01*
	The ratio normalized to control	0.58	1.15	0.92	0.52
Catalase activity	Indicators (mcat/l)	1.921±0.18	2.77±0.19*	2.775±0.18*	2.347±0.11*
	The ratio normalized to control	0.69	1	1.0	1.1
LPO	Indicators (MDA, nmol/l)	0.131±0.05	0.108±0.04*	0.180±0.02	0.165±0.05*
	The ratio normalized to control	0.79	0.65	1.0	0.84
C_{AOP}		0.92	1.65	0.96	1.07
C_{AOP}/C_{LPO}		1.45	2.68	1.0	1.8

**- p≤0.05, statistically significant differences relative to initial data*

Conclusion

The results obtained indicate that after a period of intense exercise on the background of electrophoresis with antler mass, the recovery processes aim at maintaining the oxygen-providing system, hormonal status, and normalization of metabolic processes.

Competing interests

The authors declare that they have no competing interests.

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