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STUDY OF THE LACTATE LEVEL IN THE BLOOD SERUM OF ATHLETES TRAINING IN THE CONDITIONS OF THE FAR NORTH

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The article presents the results of studies of the lactate level, physical performance and lipid peroxidation in highly skilled athletes in the Far North. We examined 85 men of Yakut nationality, including 60 highly qualified athletes (candidates for masters of sports (kmc) and masters of sports (ms)), aged 17 to 21 years old, the first group consisted of free-style wrestlers -30 people, the second - boxers 30 people.

The control group consisted of young students engaged in physical exercises at least twice a week. It was shown that the level of lactate depended on the level of physical performance of athletes and the accumulation of lipid peroxidation products. The highest values of lactic acid were noted at the recovery stage.

Keywords: lactate, lipid peroxidation, physical performance, athletes, Far North.

Introduction. The level of lactate (lactic acid) in the blood serum, and the intensity of free-radical processes in the body are one of the criteria characterizing the fitness of athletes and show their tolerance to physical exertion [3, 4, 6]. With intense physical exertion, active forms of oxygen are formed leading to a significant increase in lipid peroxidation (LPO), which has a negative effect on muscle activity [5]. In conditions of high energy production in anaerobic mode, lactate is a carrier of energy from those places in which it is impossible to transform energy, due to increased acidity, to those places in which it can be transformed into energy (heart, respiratory muscles, slowly contracting muscle fibers, others muscle groups). Lactate plays a special role in maintaining the body's ability to perform strenuous physical work.

It has been established, that with intense physical exertion in the muscles a large amount of lactic acid is formed, which inhibits their contractility and causes muscle fatigue [3, 5]. The importance of individual metabolites of anaerobic glycolysis, lactate (lactic acid), is currently being widely studied.

Material and research methods. A survey of 85 men of Yakut nationality was conducted, of which 60 athletes of high qualification (candidates for masters of sports (cms) and masters of sports (ms)), aged 17 to 21 years old. The first group consisted of free-style wrestlers -30 people, the second – boxers (30 people). The control group consisted of 25 young students, of the same age, engaged in physical education at least twice a week. All examined according to the results of an in-depth medical examination were practically healthy.

The research material was heparinized blood and serum. Blood was taken - in the morning on an empty stomach from the cubital vein. The study was approved by the decision of the local Ethics Committee at the Yakutsk Research Center for Complex Medical Problems.

The intensity of lipid peroxidation was determined by spectrophotometric method [8]. The level of lactate in the blood serum was determined during ongoing examinations in a state of relative rest, on a semi-automatic analyzer "Screen Master" (Italy).

The overall physical performance of the PWC170 was determined using a Neurosoft bicycle ergometer (Ivanovo). The subjects performed two loads of moderate intensity with a pedaling frequency of 60 rpm on a bicycle ergometer, separated by a 3-minute rest interval. Each load lasted 5 minutes [2].

Statistical processing of the obtained data was carried out using the package of applied statistical programs STATIS-

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TICA 6.0. We used standard methods of variation statistics: calculation of average values, standard errors, 95% confidence interval. Statistical data processing was carried out by the non-parametric Kolmogorov-Smirnov method. The probability of validity of the null hypothesis was taken at $p < 0.05$.

Results and discussion. According to our data, the lactate content in both groups of martial arts athletes in the blood serum is at the upper limit of the norm and has no significant differences ($p > 0.05$). The highest values of lactic acid were noted at the recovery stage, in the first group of athletes higher in 1.47 and the second -1.40 times ($p < 0.01$), respectively, compared with the control group (Fig. 1).

The increase in the level of lactate in both groups of athletes in the blood serum is due to the high rate of oxygen utilization and developing hypoxia in the working muscles. Since the high muscle demand for energy substrates in conditions of oxygen deficiency is satisfied due to anaerobic oxidation of glucose. The accumulation of lactate stimulates proteolysis and supplies glycogenic amino acids for the increasing energy needs of athletes. Fights of fighters, and fights of boxers are characterized by work of submaximal power. With submaximal power in the body, although to a lesser extent, anaerobic processes in the release of energy prevail over aerobic ones. As a result of intense glycolysis in the muscles, a large amount of lactic acid accumulates in the blood. According to published data, the level of lactate in the skin extract after exercise in untrained people rises 2 to 3 times compared with the results before exercise. For novice athletes, this indicator increased by 1.5-2 times. The quantitative content of lactate in the skin extract in professional athletes before and after physical activity remained unchanged [6]. It was also shown, that it saliva the lactate content increases by 2–3 times after prolonged training [6]. The results of the study revealed significant increases in the concentration of lactate in the blood of athletes in response to competitive loads (at $p \leq 0.01$). In this case, the maximum concentration of lactate after competitive fights for mas-wrestling was recorded in the region of 10-12 mmol / l, which corresponds to the level of anaerobic (An1) physical activity [1].

In the athletes physical performance considered low at PWC_{170} 870 ± 41 kgm, lower than average –1160 ± 31, average - 1305 ± 22 and good - 1614 ± 82 kgm.

Correlation analysis showed that there is a positive relationship between the PWC170 value and the lactate level ($p < 0.01$). It is known that the concentration of lactic acid (lactate) in venous blood is an indicator of anaerobic performance.

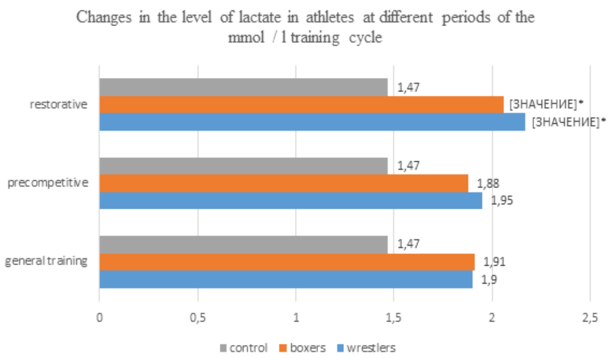

Fig. 1. Note: * p <0.01 compared with the control group

A low level of lactate was observed in martial arts athletes, with low working capacity, with an increase in the level of training and working capacity of athletes, the lactate content increased 1.1, 1.3 and 1.4 times (Fig. 2). In wrestlers with excellent physical performance after the maximum load was fulfill, the lactate content was 1.1 times higher than in in the athletes with average and good physical performance, which is consistent with the literature data [7]. A comparative analysis of the level of lipid peroxidation products at rest, before the test load showed that athletes with low working capacity and with working capacity lower than the average concentration of thiobarbiturate-active products (TBA - AP) (was 1.87 and 1.96 times higher ($p < 0.01$), compared with athletes with good performance. High aerobic performance among athletes with good working capacity is explained by the fact that aerobic performance is most manifested under those loads where it is possible to fully satisfy the oxygen demand and where a steady level of oxygen consumption is maintained for a long time.

Anaerobic performance, in which it is not possible to provide the working muscles with an adequate amount of oxygen, plays a decisive role in short-term high-intensity exercises.

Conclusion. Thus, a higher concentration of lactate in athletes, compared with a group of people engaged in physical education at least twice a week, indicates that during physical exertion, anaerobic glycolytic processes are significantly accelerated. A comparative analysis of the data we cited among athletes of the martial arts group showed that these processes are more intense in wrestlers. Possibilities of anaerobic oxidation in athletes with medium and good performance are higher than in athletes with low performance and lower than average groups, as evidenced by higher rates of lactate. Despite the higher level of lactic acid in the blood serum, the body of these athletes is characterized by greater resistance to work in conditions of oxygen deficiency, which indicates the fitness of their body.

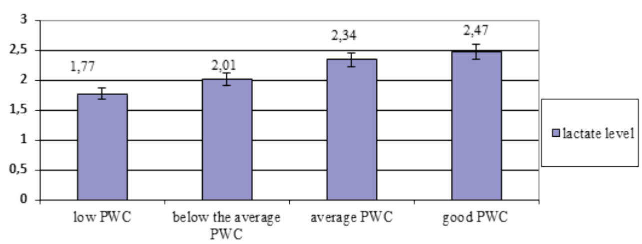

Fig. 2. Serum lactate level (mmol / L) in athletes with different physical performance PWC

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DNA DIAGNOSTICS IN CLINICAL PRACTICE APPLIED TO TRANSLATIONAL MEDICINE

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The review presents examples of the translation of genomic studies into practical medicine of two common European hereditary diseases - autosomal recessive cystic fibrosis and autosomal dominant Huntington’s chorea. With the development of genetic technologies in the Republic Sakha (Yakutia), translational medicine is becoming a reality, and it is necessary to outline the approaches and problems in this field of research using the examples of type 1 spinocerebellar ataxia and type 1A autosomal recessive deafness which are frequent in the republic.

Keywords: translational medicine, hereditary diseases, DNA diagnostics, patient.

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Introduction. So-called translational studies are becoming increasingly more developed as of lately. Translational medicine is a modern multidisciplinary science that will have a leading role in the development of genomic medicine. Translational medicine can be considered as a process involving the transfer of discoveries made as a result of fundamental research in biomedicine into medical practice in order to improve diagnosis and treatment [11, 38].

The National Institutes of Health (USA) proposed the following definition of translational medicine: “translational research includes two areas of translation, the first of which is to bring the results of discoveries made in laboratories and preclinical studies to the stage of clinical research and human studies; the second area of translation is associated with research aimed at increasing the efficiency of introducing advanced technologies into wide medical practice”[22]. In accordance with this definition, translational studies are part of a unidirectional continuum in which research results move from the experimenter's laboratory table to the patient’s bed and to society as a whole [17].

In turn, translational genomic research can be included in translational medicine. Translational genomic research is centered around the development of evidence-based guidelines [32]. The whole process includes at least three phases. The first phase is fundamental genomic research carried out by qualified specialists in specialized molecular genetic laboratories at research centers or universities. The second phase is the translation of the discoveries and achievements of genomic research and the development of approaches to the application of the results of genetic research in practical medicine, the assessment of their effectiveness and safety, as a rule, is done with the help of clinical trials conducted in specialized medical centers associated with research institutions [36]. The third phase is the conclusive step for the implementation of translational genomic research into the healthcare system, and, very importantly, this process also includes the revision and development of legal and bioethical norms, taking the application of genomic technologies in practice into account. The final stage establishes adequate recommendations for the optimal, safe and efficient use of new medical technologies in order to improve public health [12].

In this review, we **aim** to display examples of the translation of genomic studies into practical medicine of two common European hereditary diseases - autosomal recessive cystic fibrosis (CF) and autosomal dominant Huntington’s chorea (HC). With the development of genetic technologies in the Republic of Sakha (Yakutia), translational medicine is becoming a reality, and it is necessary to outline the approaches and problems in this field of research using the examples of type 1 spinocerebellar ataxia (SCA1) and type 1A autosomal recessive deafness (DFNB1A) which are frequent in the republic.