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Concentrations of lactate and urea in the blood of rowers during intensive training at the same ambient temperature

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Annotation: the research analyzes the concentration of lactate and urea in rowers during the training process in different temperature conditions and a significant change in the concentration of these indicators when performing intense physical activity, training, especially in conditions of high temperature and solar insolation. Determination of the concentration of lactate and urea in the studied rowers during the training process in different temperature conditions indicates a significant change in the concentration of these indicators when performing intense physical activity. Carrying out training in sub-maximum and near-maximum aerobic loads in heat conditions leads to a deeper violation of blood circulation of working organs, in particular muscles. A decrease in blood supply under the influence of a double factor leads to the development of hypoxia, which leads to an increase in the anaerobic process in the energy production of muscles.

Keywords: lactate, urea acid, adaptation, metabolic processes.

Introduction. It is known that long-term intense muscle work causes an increase in the concentration of lactate and urea, both in muscles and in the blood, is a consequence of the activation of catabolic processes of protein metabolism and containing compounds under conditions of intensive work [1,3]. At the same time, protein catabolism is intense and their recovery depends on the degree of adaptation to these extreme conditions. In this regard, the content of lactate and urea in the blood of athletes is often used as a test to control the course of the training process in cyclic sports [2].

Material and methods of research. We have studied the dynamics of changes in the concentration of lactate and urea in the blood of rowers in kayaks and canoes of the national team of Uzbekistan during a two-week training process, depending on the ambient temperature. 13 rowers-boys aged 15-17 were studied. The studies were carried out before training (field data), in the middle (on days 7 and 15) and one day after the end of training (on day 16) at a temperature of 18-20°C, and 35-360C.

Discussion of the obtained data. Analysis of the obtained results showed that a two-week intense physical activity at a temperature of 18-20°C has a significant impact on the state of metabolic processes, in particular, it caused a violation of catabolic processes. This was evidenced by a sharp increase in the concentration of urea in the blood of athletes from the early stages of adaptation to intense training loads. Thus, the content of urea in the blood of young rowers on the 7th day of training significantly ($P<0.05$) increased in comparison with the initial level (initial 3.5±0.6 mmol/l. on day 7 - 6.8±0 3 mmol/l, reaching a maximum on the 15th day of training (8.2 ± 0.7 mmol/l.) However, the determination of the concentration of urea 24 hours after the end of the 15-day training showed that the concentration of this blood indicator returned to normal and even to some extent decreased not only in comparison with the previous terms of determination, but also with the initial data (3.06 ± 0.4 with the initial 3.5 ± 0.6 mmol / l., Table No. 1).

Under conditions of specific physical activity, there was a change in the concentration of lactate in the blood. For example, on the 7th day of daily intensive training, the lactate level significantly ($P<0.01$) increased to 8.8±1.1 mmol/l. at a marching level of 2.2 ± 0.3 mmol/l, a sharp increase in lactate concentration was noted on the 15th day of training, which apparently reflected the transition to aerobic-anaerobic energy supply, i.e. physical work was carried out in the aerobic-anaerobic mode, however, after the end of the 15-day training under conditions of a specific load, the lactate content gradually decreases in comparison with the previous periods almost to the initial levels.

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Table No. 1
Blood lactate and urea concentrations in rowers during intensive training

In peace condition	**Days of training**		**Days after rest**		
	7	15	1	3	5
4,3±0,5	8,6±0,9*	9,7±0,7*	7,5±0,6*	7,4±0,5*	5,9±0,4*
Lactate concentration					
4,6±0,7	14,6±1,2**	22,4±2,3**	20,4±1,9**	14,6±1,5**	9,9±0,9*
Amount of lactate and urea in blood of athletes in temperature 18-20°C					
3,5±0,6	6,8±0,8*	8,2±0,7*	3,06±0,4	3,3±0,5	3,4±0,4
Lactate concentration					
2,2±0,3	7,8±1,0*	11,3±1,3**	7,7±0,9**	4,5±0,6*	2,3±0,2

*Note: *p≤0,05, **p≤0,01,and to the group in peace condition*

As can be seen from the analysis of the data obtained under conditions of an intensive training process in young rowers at a temperature of 18-20°C, an increase in the concentration of urea in the blood is observed, followed by normalization after a day of rest after the end of a two-week training session. This indicates the effectiveness of training carried out in comfortable conditions. It is known that there is a direct relationship between the intensity of physical activity and an increase in the concentration of urea and lactate in the blood. So, at low and moderate loads, which require up to 50% of the maximum individual oxygen consumption, the concentration in the blood remains almost unchanged, while at work, which requires a maximum oxygen consumption (MOC) of 50 to 60%, the lactate content increases. Our data and the results of other authors show that physical activity, which requires from 50 to 60% of the MIC, is the upper limit, above which it causes an increase in the process of lactate production in the body. In rowers, the main load is on the muscle groups of the arms, which is confirmed by an increase in the concentration of lactate in the blood of the examined athletes. The activation of catabolic processes is associated with an increase in the function of the sympathetic-adrenal and acetylcholine systems under conditions of intense muscular work. It is possible that an increase in the concentration of lactate in the blood is associated with the accumulation of hypoxia in the cells of the working muscles under conditions of intense physical activity. It should be noted that the concentration of urea and lactate depends on the fitness and qualifications of athletes. At the same intensity and volume of physical activity, the lactate content was lower in rowers of candidates for master and master of sports than in first-class rowers. This is due to the fact that well-trained athletes always have a high IPC, even for poorly trained ones. In Candidate and MS rowers, a direct correlation was observed between the dynamics of changes in the concentration of urea and lactate and the load. In them, by morning, after a daily rest, the concentration of urea lactate is completely restored, which indicates the onset of a stable adaptation of the body to physical activity and the adequacy of the latter to the functional capabilities of the body of athletes. In 15-20% of first-class athletes, a day after rest, a decrease in the concentration of urea and lactate was noted, even lower than the original blood. This indicates the absence of a complete recovery of the body and inhibition of the formation of these indicators due to the active use of amino acids in the replenishment of skeletal muscle protein. In 8% of young rowers, the urea level remained below the marching level one day after the end of the training process. Such a reaction is typical for intense and prolonged loads of a “stress nature” for the body of young rowers, which indicates a discrepancy between the functional capacity of the body and training loads. At the same time, it should be noted that the training process using high physical loads under normal climatic conditions due to the increase in the power to cancel the energy supply of skeletal muscles does not increase the concentration of lactate in muscle tissue and urea in the blood of trained people.

However, changes in the biochemical parameters of the body under conditions of physical activity, in our opinion, depend not only on the fitness of the body, but also on environmental factors, especially on the action of high ambient temperature and solar insolation. In the latter case, there are significant changes in

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the body, even at rest, which is caused by the tension in the regulation of functional systems responsible for the adaptation of the body to high ambient temperatures. Thus, the analysis of the obtained results indicates that the level of lactate and urea concentration in the preparatory period of training can control the course of the training process, judge the adequacy of the applied training loads, the physiological capabilities of the body of young rowers, and also evaluate the effectiveness of training methods both in comfort conditions and at high ambient temperatures.

Analyzes of the obtained data show that the concentrations of urea and lactate in the blood of rowers under conditions of high ambient temperature at rest before the load were 1.5–2.0 times higher compared to the initial comfort data. During training at high temperature, there was a sharp increase in the concentration of lactate and urea in the blood and their slow recovery. An increase in the concentration of urea and lactate under conditions of high ambient temperature is possibly due to the fact that under heat conditions the expansion of skin vessels occurs, which leads to a decrease in the total peripheral vascular resistance. A decrease in peripheral vascular resistance, in turn, causes a decrease in cardiac output and a decrease in the total and central volume of circulating blood (L. Royell 1974). Performing submaximal and near-maximal aerobic loads in hot conditions leads to a more profound disruption of the blood supply to working organs, in particular muscles, as a result of a decrease in blood supply in the muscles under the influence of a double factor, deeper hypoxia develops, which leads to an increase in the anaerobic share in muscle energy production. In this regard, when performing the same load in conditions of high ambient temperature, there is a significant increase in the concentration of urea and lactate and their slow recovery compared to comfort conditions. The slow recovery of urea and lactate concentrations after training indicates that the same physical activity in terms of volume and intensity under conditions of high ambient temperature causes a more intense load (work) of functional systems and the onset of early fatigue and reduced performance.

Conclusion. Determination of the concentration of lactate and urea in the studied rowers during the training process in different temperature conditions indicates a significant change in the concentration of these indicators during intense physical activity, training, especially under conditions of high temperature and solar insolation.

Carrying out training in submaximal and near-maximal aerobic loads in hot conditions leads to a deeper violation of the blood circulation of working organs, in particular muscles. A decrease in blood supply under the influence of a double factor leads to the development of hypoxia, which leads to an increase in the anaerobic process in muscle energy production. The combination of these biochemical changes is one of the main factors in the mechanism of development of early fatigue and a decrease in the performance of athletes who train under conditions of high ambient temperature and solar insolation.

Thus, the analysis of the data obtained as a result of long-term observation on the example of kayakers indicates that rational physical training increases the functionality of all body systems.

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