

The physical and biological constraints that hinder the development of physical abilities and energy reserves in elite kayakers and canoeists

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Abstract

Objective of the study was to investigation of medical and biological factors that could impede the enhancement of the training performance among elite kayakers and canoeists.

Methods and structure of the study. The results of 18 series of own monitoring of the current functional state of highly skilled kayakers and canoers over six years (2019-2024) are summarized. In total, 43 male rowers aged 18 to 36 years (5 HMS, 8 MSIC, 27 MS, 3 CMS) and 23 female rowers aged 18 to 33 years (2 HMS, 4 MSIC, 15 MS, 2 CMS) took part in the research. Current changes in the morphological, protein and biochemical composition of blood were analyzed (antistreptolysin-O content, hemoglobin concentration, total protein content, albumin concentration, glucose, lymphocyte content at leukocyte levels from 4,5 to 7,5*10⁹/l, hemodynamic parameters and electrocardiogram (total number of records 1360), criteria for the functional state of the autonomic nervous system, as well as sleep disorders according to a simplified scheme of the SAN questionnaire (assessment of athletes on a 5-point scale of sleep status, appetite and desire to train).

Results and conclusions. It was discovered that a significant number of athletes in the selected group experienced negative shifts in their parameters, with these shifts occurring in 20 to 80% of measurements. These shifts were often associated with underlying conditions such as chronic infections, central nervous system fatigue, pre-anemic states, protein deficiencies, and more.

Therefore, to address the issue of personalizing and enhancing the training process for elite kayakers and canoeists, it is crucial to identify and address their individual medical and biological risk factors.

Keywords: *morphological and biochemical composition of blood, highly skilled canoeists and kayakers, training process, negative changes, detection rate.*

Introduction. The current model of individualization of the training process for highly and highly qualified athletes is based, as a rule, only on the results of a comparative analysis of its main characteristics with those of either leading domestic and foreign athletes, or of a selected athlete in successful and unsuccessful seasons. We are talking about the organization of the training process, the content of training tools, as well as their distribution and ratios in each of the mesocycles of the annual training cycle. As for the analysis of other pedagogical, as well as psychological and medical-biological factors, which even against the background of adjusted training loads may not allow the fully realized physical qualities and energy poten-

tial of the body to be developed, the question remains open.

Objective of the study was to investigation of medical and biological factors that could impede the enhancement of the training performance among elite kayakers and canoeists.

Methods and structure of the study. The results of 18 series of our own monitoring of the current functional state of highly qualified kayakers and canoeists over a period of six years (2019-2024) were analyzed. A total of 43 male rowers aged 18 to 36 years (5 HMS, 8 MSIC, 27 MS, 3 CMS) and 23 female rowers aged 18 to 33 years (2 HMS, 4 MSIC, 15 MS, 2 CMS) took part in the research. The current changes in the param-



eters of the morphological, protein and biochemical composition of the blood (antistreptolysin-O content, hemoglobin concentration, total protein content, albumin concentration, glucose, lymphocyte content with a leukocyte level of 4.5 to $7.5 \cdot 10^9 / l$), hemodynamic parameters and electrocardiogram (total number of records 1360), criteria for the functional state of the autonomic nervous system, as well as sleep disorders according to a simplified scheme of the SAN questionnaire (assessment by an athlete on a 5-point scale of sleep, appetite and desire to train) were analyzed.

Blood analysis was carried out at the bases of the consultative and diagnostic center of the Research Institute-KKB No. 1 named after Ochapovsky (Krasnodar) and the State Budgetary Healthcare Institution "Center for Public Health and Medical Prevention" of the Ministry of Health of the Krasnodar Territory.

Negative shifts in blood parameters were determined by several gradations presented in the works [4, 6, 9]. In two of them [4, 6], the results were based on data obtained during examination of highly and highly qualified kayakers and canoeists.

The determination of the frequency of myocardial repolarization disorders in athletes was based on the criteria presented in the work of L.A. Butchenko and V.L. Butchenko [2].

Results of the study and discussion. As shown by the analysis of literary sources and the results of our own long-term observations, the following can be primarily attributed to the medical and biological risk factors for a decrease in the effectiveness of the training process in the selected contingent of athletes: the presence of insufficiently sanitized foci of

chronic infection; chronic physical overstrain of the central nervous system; chronic physical overstrain of the cardiovascular system; insufficient consumption of carbohydrates and/or proteins, iron deficiency (and, as a consequence, a decrease in the hemoglobin content in the blood); violation of the drinking regime (chronic fluid deficiency); borderline states of the digestive and urinary systems; stable hypertonicity of certain muscles and muscle groups (training conducted against the background of hypertonic muscles generates greater physiological stress during submaximal loads); long-term registration long before the competitive period of the adaptation phase of reactivation by the percentage of lymphocytes in the blood, etc. [10, 11].

The data obtained in this work regarding a number of the above-mentioned risk factors are presented in the table.

As follows from the presented results (see table), in 31,2% of measurements an elevated level of antistreptolysin-O is recorded (from 211,0 U/l to 1930,2 U/l in men, from 205,1 U/l to 1029,2 U/l in women), which, as is known, is a criterion for sensitization of the body to streptococcal antigens (the titer of antibodies to group A beta-hemolytic streptococcus increases a week after the onset of infection, reaches a peak after 3-5 weeks and in some cases decreases to normal only after six months to a year) [14]. That is, a significant number of athletes train against the background of intoxication associated with foci of chronic infection (most often in the ENT organs), which, naturally, cannot but have a negative impact on the effectiveness of

Frequency of detection of negative shifts in registered parameters in highly qualified rowers on kayaks and canoes

Registered parameters (number of measurements)	Parameter values related to negative shifts	Percentage of violations
Hemoglobin concentration, men (324), g/l	< 138	21,3
Hemoglobin concentration, women (40), g/l	< 129	20,0
Lymphocyte content, men (50), %	> 45	22
Total protein content, men (293), g/l	<70,4	26,2
Total protein content, women (43), g/l	< 69,7	58,1
Albumin concentration, men (21), g/l	< 44, 6	33,3
Glucose concentration, men and women (55), mmol/l	< 4,5	80
Antistreptolysin-O content, men	> 200	31,2
and women (93), U/l	< 4	32,3



the training process. 32,3% of measurements indicated sleep disturbances in rowers, which is, according to modern concepts [10, 11], one of the most informative markers of central nervous system overstrain.

Of the 28 rowers, 14 people (55,0%) had a stable normal electrocardiogram, 6 (21,5%) had a stable pathological one, and 8 (21,5%) had one with periodic improvement or deterioration. Among women, out of 18 athletes, 10 people (55,5%) had a stable normal electrocardiogram, 3 (16,7%) had a stable pathological one, and 5 (27,8%) had one with periodic improvement or deterioration. That is, it is reasonable to assume that only 55% of athletes have a high level of tolerance to physical activity, which is a necessary condition for improving athletic skills. As for the results of monitoring the fairly stable morphological and biochemical blood composition indicators in this contingent of athletes (hemoglobin concentration, white blood cell count and total protein content recorded after 40 hours of the post-load period), the following data are noteworthy. In 21,3% of measurements of male athletes, the hemoglobin content in the blood was below 138 g/l, while in females, its values below 129 g/l were observed in 20,0% of cases.

Total blood protein content below 70,4 g/l was recorded in 26,2% of measurements in males and below 69,7 g/l in 58,1% of cases in females. Blood albumin concentration below 44,6 g/l was recorded in 33,3% of measurements in male athletes

Blood lymphocyte content above 45% (which corresponds to one of two variants of the adaptation phase of reactivation [3, 12]) 1.5 months before the first competition of the season was noted in 22% of measurements in males.

Blood glucose concentration below 4,5 mmol/l was recorded in 80% of male and female rowers. In one series, it was below 4,1 mmol/l in 22,6% of men and 33,3% of women.

The influence of hemoglobin content in the blood on the level of aerobic capacity of the body, and primarily aerobic efficiency, has long been generally recognized [8, 12]. Regarding the significance of albumin concentration indicators in this regard (unfortunately, this parameter is not always recorded), total protein content and, accordingly, the albumin-globulin coefficient, they are convincingly proven in the work [5] from the standpoint of maintaining (especially when it comes to the albumin level) oncotic pressure and, accordingly, the volume of circulating blood, the transfer of a number of substances and, in particular, carbohy-

drates and lipids, which are the main energy substrate for muscle activity, regulation of hormonal functions, etc. The authors of the work [16] pay special attention to the diagnostic significance of repeated decreases in blood glucose levels, who, in an attempt to find a possible cause for the occurrence of a state of non-functional overstrain / overtraining syndrome, analyzed 6 metabolic schemes and came to the conclusion that only the theory of carbohydrate metabolism disorder is most relevant, and the trigger in this regard can even be single workouts against the background of a clear tendency to hypoglycemia.

As for the functional state of the musculoskeletal system in kayakers and canoeists, its dynamics (in the absence of complaints) are practically not assessed within the framework of current monitoring today, although, judging by the works [1, 13], representatives of these sports specializations have fairly frequent disorders in the form of muscle imbalances, stable muscle hypertonus, skin-fascial fixations, painful muscle compactions, functional blocking. In addition, the vast majority of rowers have microalbuminuria [15] and pathology of the digestive system, [7]).

Conclusions. Thus, according to the data obtained, the solution to the problem of individualization and increasing the effectiveness of the training process for highly qualified kayakers and canoeists should begin with the identification and subsequent elimination of their individual medical and biological risk factors that prevent them from reaching the desired level of feasibility of the physical qualities and energy potential of the body.

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