Visceral protein pool in highly skilled kayakers and canoeists

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Abstract

Objective of the study is to assess the adequacy of delayed post-exercise recovery of total protein and albumin content in venous blood as criteria for visceral protein pool in highly skilled kayakers and canoeists.

Methods and structure of the study. Summary of data from literary sources substantiating the particular importance of athletes consuming the necessary amount of protein. Monitoring of haematocrit, total protein, albumin and haemoglobin concentration in venous blood in highly skilled kayakers and canoeists. 79 male athletes aged 18 to 37 were examined (20 honoured masters of sport, 23 international class masters of sport of Russia, 36 masters of sport; 40 people were examined repeatedly). Venous blood was collected in the morning, 40 hours after the end of the last training session. Blood analysis was performed at the Regional Clinical Hospital No. 1 named after Professor S. V. Ochapovsky (Krasnodar).

Results and conclusions. All analysed indicators show significant differences at haematocrit values above and below 47%, which corresponds to the 75th centile of this parameter. The interval of mean values of total protein content in the range ±1 σ is 69.62±3.86 g/l, i.e. its upper values (73.48 g/l) are significantly lower than the upper values of the reference interval recommended for clinical practice (68-85 g/l). In 38.8% of measurements, the total protein content in athletes was below 69.62 g/l, of which 29.3% were below 65.76 g/l. In addition, four rowers had total protein levels below 69.62 g/l for two years, and two had levels below 65.76 g/l. A certain correlation between total blood protein and haemoglobin concentration was also established.

The results obtained allow us to conclude that highly skilled kayakers and canoeists may experience a marked decrease in the visceral protein pool due to globulin fractions during routine monitoring, which may negatively affect the state of the immune system and blood coagulation system, to a certain extent contribute to a decrease in haemoglobin content and, in general, to the effectiveness of the training process.

Keywords: rowing sports, highly skilled athletes, blood protein composition, total protein.

Introduction. Since the 2000s, sports nutrition experts have emphasised that the previously recommended amounts of protein in sports diets are not justified, as they can interfere with the consumption of the necessary amounts of carbohydrates in the process of meeting energy needs, and significantly increase the functional load on the hepatobiliary and urinary systems [1, 5].

Today, the view on protein content in athletes' diets has changed significantly [8, 11, 12]. The main provisions of the works devoted to this issue can be grouped as follows:

- the interaction between physical activity and nutritional elements, especially with regard to the consumption of protein and essential amino acids, is crucial in managing both the building and breakdown of muscle proteins [9];

- to promote muscle recovery, remodelling, and improved responses related to strength and hypertrophy as a result of exercise, protein intake is necessary before, during, and after training [10].

- the primary goal of protein consumption after intense exercise or competition is recovery and remodelling, involving both skeletal muscle and connective tissue [7].

- combining amino acids with carbohydrates before training can lead to peak muscle protein synthesis, etc.

Works devoted to the correction of pre-anaemic and anaemic conditions in athletes [2, 6] also note the need to increase the protein content in the diet and to use appropriate nutritional support products for this purpose.

Consuming the necessary amount of protein during intense muscular activity is important not only for maintaining its somatic pool. The visceral pool is equally important, one of the main criteria of which is

the total protein content in the blood. A decrease in this content indicates either an insufficient intake of amino acids from food or problems with their absorption, inhibition of protein biosynthesis processes, and their loss in certain pathological conditions [3].

Objective of the study is to assess the adequacy of delayed post-exercise recovery of total protein and albumin content in venous blood as criteria for visceral protein pool in highly skilled kayakers and canoeists.

The specific objectives of the study were as follows:

- to establish the reliability of differences in total protein and albumin content in venous blood at different haematocrit values (this approach is mandatory when analysing all parameters of blood biochemistry);
- if there is statistically significant reliability of their differences in hematocrit intervals above and below the 75th percentile, determine the average values of these parameters (within the standard deviation range of ±1 σ) in a selected group of athletes, after excluding the corresponding 75th percentile and above;
- determine the number of athletes with total protein and albumin levels in venous blood below the lower limit of the reference range recommended in clinical practice;
- analyse the relationship between blood protein composition indicators and haemoglobin content in venous blood in samples corresponding to a haematocrit indicator below the 75th percentile.

Methods and structure of the study. In order to solve the set tasks, data from literary sources justifying the special importance of athletes consuming the necessary amount of protein [4] were summarised, and the results of monitoring haematocrit, total protein content, albumin and haemoglobin concentration in venous blood in highly skilled kayakers and canoeists. 79 male athletes aged 18 to 37 were examined (20 honoured masters of sport, 23 international class masters of sport of Russia, 36 masters of sport; 40 people were examined repeatedly). Venous blood was collected in the morning, 40 hours after the end of the last training session. Blood analysis was performed at the Regional Clinical Hospital No. 1 named after Professor S. V. Ochapovsky (Krasnodar).

Results of the study and discussion. As the data obtained showed, all analysed indicators reveal significant differences at haematocrit values above and below 47%, which corresponds to the 75th centile of this parameter (Table 1).

When analysing the average values of the parameters studied in different haematocrit ranges (Table 1), it was found that in highly skilled kayakers and canoeists with a haematocrit of 47% and below, the total protein content in the ±1 σ range is 69.62±3.86 g/l. That is, its upper values (73.48 g/l) are significantly lower than the upper values of the reference interval recommended for clinical practice (68-85 g/l) [3]. And even at a haematocrit of 47% and above, the average values of total protein content (74.66±4.41 g/l) remain below the recommended values. At the same time, in 38.8% of measurements, the total protein content in athletes was below 69.62 g/l, of which in 29.3% of cases it was below 65.76 g/l. In addition, four rowers had total protein levels below 69.62 g/l for two years, and two had levels below 65.76 g/l.

With regard to albumin concentration, no such differences were found when compared with the reference ranges recommended by clinicians (35-50 g/l and 45-65 g/l according to various sources). In the examined group of athletes, with a haematocrit level below 47%, the albumin content was 56.69±7.12 g/l, and with a haematocrit level of 47% and above, it was 59.95±5.04 g/l.

That is, judging by the data obtained, the athletes' bodies primarily support the synthesis of albumin, which provides 80-90% of the oncotic pressure to maintain the constancy of circulating blood volume by retaining fluid in the vascular bed, as well as performing a number of other functions (transport, protein reserve of the body). As for globulin fractions, there is a tenden-

Table 1. Reliability of differences in the blood parameters studied at haematocrit values above and below 47%

Name of indicators	Haematocrit value of 47% and above		Haematocrit value below 47%		Obtained value t-criterion
	Number of measurements	Average value (M±σ)	Number of measurements	Average value (M±σ)	
Haemoglobin, g/l	37	162,59±6,58	129	147,96±6,97	11,77*
Haematocrit, %	37	48,14±1,38	129	43,23±2,05	16,94*
Albumin, g/l	30	59,95±5,04	81	56,69±7,12	2,69*
Total protein, g/l	35	74,66±4,41	117	69,62±3,86	6,10*

*Note. * – t-test values indicating the significance of differences.*
The significance of differences was determined by the critical value of the t-test corresponding to the smaller number of measurements.
M – mean value, σ – standard deviation.

Table 2. Correlation matrix of blood parameters in the sample below the 75th percentile for haematocrit

Name of indicator	Haemoglobin, g/l	Haematocrit, %	Albumin, g/l	Total protein, g/l
Haemoglobin, g/l	1			
Haematocrit, %	0,93	1		
Albumin, g/l	0,16	0,12	1	
Total protein, g/l	0,31	0,22	0,35	1

Note. With 44 measurements, the critical value of Spearman's correlation coefficient (significance level 0.05) is 0.298.

cy towards hypoglobulinaemia (based on total protein content values), either due to insufficient protein consumption or insufficient protein absorption, as well as maximum possible use to replenish the somatic pool.

The protein deficiency in highly skilled rowers within the visceral pool, as revealed in the present studies, requires special attention, since correlation analysis (even in a sample excluding values corresponding to a haematocrit of 75 centilitre and above) showed a definite relationship with the concentration of haemoglobin in the blood (Table 2).

Back in 1997, G.A. Makarova [2] noted that hyporegenerative forms of iron deficiency anaemia are usually accompanied by protein metabolism disorders. Israeli and Scandinavian authors [6], in turn, explained the occurrence of anaemia in runners at the beginning of the competitive season by the increased rate of red blood cell destruction and emphasised that this can be prevented by eating a high-protein diet. Taking iron supplements does not prevent the development of this type of anaemia. It has been suggested that this type of anaemia develops as a result of the release of a certain chemical (possibly lysolecithin) from the spleen into the bloodstream, which causes haemolysis of a sufficiently large number of circulating red blood cells. The iron released in this process should be bound by the blood plasma protein transferrin, which belongs to the globulin fractions, but when there is a deficiency of this protein, this does not happen, and the iron is excreted from the body.

Conclusions. Highly skilled athletes specialising in kayaking and canoeing often experience a marked decrease in visceral protein pools due to globulin fractions. This can not only negatively affect the immune system and blood coagulation, but also contribute to a decrease in blood haemoglobin levels and, in general, the effectiveness of the training process. With this in mind, it is reasonable to determine the protein composition of blood, including transferrin levels, as part of medical and biological examinations of athletes.

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