The Hematological Parameters of Ukrainian National Women's Wrestle Team before the Competition

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Abstract

Preparing athletes of high-level qualification for competitions requires a continuous biochemical monitoring. This research is conducted to examine the hematological parameters of female wrestlers while preparing for the Wrestling World Cup. The study involved 10 female athletes of the national team of Ukraine aged from 21 to 23 of different weight categories.

In most studies the authors state that hematological parameters may change while doing exercises. They may indicate overstrain and overtraining, but at the same time they were not useful markers for the early detection of overreaching. According to the results of our own research, the majority of female athletes had hematological parameters within the normal range. The four female wrestlers showed the signs of inadequate recovery. Timely detection of these features allowed us to make adjustments to the training process. The best results in the competition showed a female wrestler, whose biochemical examination data were within normal limits, and hemoglobin concentration was the highest among the surveyed. At the same time, two female athletes who won prizes had deviations from the norm of hematological parameters. In our opinion, in freestyle wrestling the result is determined by many factors. The classification of the wrestler, psychological and technical-tactical readiness, the level of the development of physical qualities and individual functionality are very important.

Keywords: hematological parameters, fatigue, overtraining, women wrestlers

1. Introduction

Modern wrestling is a dynamic and spectacular sport cultivated on all continents of the globe. In 2004 the women's freestyle was first presented at the Athens Olympics. Among women this sport is considered to be relatively «young» but it is actively developing, the competition among female athletes is increasing. This, in turn, requires specialists constantly finding the ways to improve the professional level of the athletes [1, 2].

Most scientists [3, 4, 5] have pointed to the need to focus as much as possible on the individual features of the wrestlers. Stelmach Y.Y. [6] proposes to take into account the gender differences in training and preparation of women in relation to the characteristics of the female body.

The effectiveness of the process of training female athletes in modern conditions, especially in women's sports, is largely due to the use of tools and methods of integrated control as a management tool, which allows to optimize the training process during pre-race training on the basis of qualitative and timely information on the status of women wrestlers [7].

The study of the athlete's adaptive capacity that is aimed at improving sports skills, expanding functional reserves and maintaining health in the meanwhile is an genuine problem during years of sports training. Biochemical control methods are most commonly used to control adaptive changes in the state of the body's main energy systems [8]. Laboratory control, which is mainly based on the determination of blood biochemical parameters and hematologic parameters, also allows the athlete to solve some separate tasks, such as detecting the body's response to physical activity, assessing the level of fitness, the adequacy

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of the use of pharmacological and other remedies, the role of energy systems in muscle activity, the effect of climatic factors, etc.

Blood is used as one of the most important objects of biochemical research, because it reflects all the metabolic changes in tissue fluids and body lymph. The physical exercises can affect the blood parameters. Hematological parameters are necessary and important for such purposes as control, check, prevention and diagnosis in sports medicine [9]. Hematological examination is especially important for the evaluation of health and performances of the athletes in situations such as high training loads, strong psychophysiological stress during matches, changes in homeostasis and shifting of biochemical and hematological values out of physiological range [10, 11]. Changes in red blood cells and human iron metabolism are thought to play an important role in prediction of optimal physical performance by use of hematological parameters [12].

2. Method
2.1. Participants
The study involved 10 female athletes of the Ukrainian national freestyle wrestling team aged from 21 to 23 of different weight categories. The biochemical examination of the female athletes was conducted during the preparatory gathering one week before the participation in the World Wrestling Championships.

2.2. Materials and Procedure
Hemoglobin concentration, erythrocyte count, color score, and urea content of the athletes' blood were determined in peripheral blood at a rest, on an empty stomach, in the morning using a Diaglobal biochemical analyzer (Germany) with standard reagent kits of the same company.

Blood hemoglobin is one of the indicators that characterizes the aerobic capacity of the body's oxygen-transport system. This system is activated during aerobic energy supply of physical activity, as well as during the recovery of the body while resting after exercises. The concentration of hemoglobin in the blood and its fluctuations under the influence of physical activity indicate the degree of adaptation of the body of the athletes to perform specific exercises. With inadequate loading of the functional capabilities of the athlete's body, the concentration of hemoglobin in the blood is significantly reduced and such a level of hemoglobin is maintained for more than two or three consecutive days. The norm of hemoglobin in the blood for women at rest is: 125 - 150 g • l-1. [7]. As the level of training of the athlete is increasing, the concentration of hemoglobin in the blood is increasing as well and may exceed the upper limit of the rest norm, which indicates a high adaptation of the body to physical activity [8].

Erythrocytes are formed elements of blood containing hemoglobin, so a comprehensive assessment of the number of erythrocytes and hemoglobin concentration, based on the determination of color index, gives a more complete characterization of the processes of adaptation of the athletes to high physical activity and indirectly indicates the processes of erythropoiesis. Normal blood erythrocyte count at rest is $3.7–4.7 \cdot 10^{12}$ / l for women. In endurance training, this index may increase, and with inadequate training loads, it may decrease due to hemolysis [8].

The color indicator reflects the content of hemoglobin in the erythrocyte. Norm is 0.85-1.05.

In the case of increased breakdown of tissue proteins, an excess intake of amino acids in the liver in the process of binding of toxic to the body of ammonia, a non-toxic nitrogen-containing substance – urea is synthesized. From the liver, urea enters the bloodstream and is excreted in the urine [7, 8]. Blood urea is an integral indicator of the transfer of the athletes training and competitive physical activity, the course of training and recovery processes. Determination of its level in the blood (in the morning at rest) allows to estimate in general the transfer of training loads.

The norm of urea in the blood at rest is: 3.5 - 6.5 mmol/l.

If the physical activity performed is adequate to the functionality of the body and a relatively rapid recovery of metabolism has occurred, then the content of urea in the blood in the morning returns to normal. This is due to the equilibration of the rate of synthesis and disintegration of proteins in the tissues of the body, which indicates its recovery. If the content of urea the next morning remains above normal, it indicates an incomplete recovery of the body or the development of fatigue [7].

3. Results

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The medical and biological control, held in a week to attend national women team of Ukraine on freestyle wrestling competitions, provided an assessment of health status, capabilities of different functional systems, individual organs and mechanisms that carry the main load in training and competitive activities. The results of biochemical analysis of blood of female athletes were quite indicative and informative (Table 1).

Table 1. Hematological parameters of female athletes

Surname	Parameters			Erythrocytes, norm 3.7-4.7 $\cdot 10^{12}$/l	Color parameter, norm 0.85-1.05	Urea norm 3.5-6.5 mmol • l-1
	Hemoglobin, g • l-1					
	Low <125	Middle 125- 140	High >140			
Tkach Y.	115			4,30	0,80	7,3
Prokopevniuk I.		132		4,46	0,89	7,4
Shustova A.		134		4,81	0,84	6,6
Cherkasova A.		135		4,68	0,86	6,0
Bodnar S.		126		4,40	0,86	5,6
Chykhradze I.		125		4,39	0,85	6,3
Belinska A.	114			4,05	0,84	6,2
Livach O.	112			3,89	0,86	5,6
Kit T.		133		4,97	0,80	7,0
Bereza Khr.		127		4,27	0,89	4,8

According to the study, the concentration of hemoglobin and the number of erythrocytes in the blood are within normal limits of the majority of female athletes. However, the concentration of hemoglobin in the blood of such female athletes as Tkach Y., Livach O. and Belinska A. is below the physiological norm for women, which may be due to a number of reasons: the loads performed on the eve of training, the phase of the menstrual cycle, the presence of chronic diseases, unbalanced and irrational diet, etc.

The reduced level of color index of such female athletes as Tkach Y., Belinska A., Shustova A. and Kit T. may indirectly indicate a slight iron deficiency, which may be due to a number of reasons: the loads performed on the eve of training, the phase of the menstrual cycle, gastrointestinal problems, irrational and unbalanced diet, etc.

However, there are signs of under-recovery (high muscle tension body (in terms of urea)) of such athletes as Prokopevniuk I., Tkach Y., Shustova A. and Kit T.

Considering the results, the coach was amended in preparation for competitions. The following athletes as Prokopevniuk I., Tkach Y., Shustova A. and Kit T. were offered additional remedial procedures and made a correction of the training process. Tkach Y., Livach O., Belinska A., Shustova A. and Kit T. were offered to add to the diet food containing iron, vitamins C, B6, B12, folic acid. At the end of the training camp, all female athletes took part in World Championship (Table 2).

Table 2. Senior World Championships-Oct 2018

Rank	Wrestler	CP	VT	ST	TP	TP Gvn
	Seniors-50					
3	Livach O	14	1	0	29	21
	Seniors-53					
18	Bereza Khr.	1	0	0	1	6
	Seniors-55					
10	Kit T.	4	0	0	6	7
	Seniors-57					
14	Chykhradze I.	4	0	0	8	10

	Seniors-59					
10	Bodnar S.	4	0	1	11	4
	Seniors-62					
3	Tkach Y.	12	1	0	14	8
	Seniors-65					
14	Prokopevniuk I.	1	0	0	4	5
	Seniors-68					
1	Cherkasova A.	15	1	1	41	18
	Seniors-72					
13	Belinska A.	1	0	0	1	12
	Seniors-76					
21	Shustova A.	0	0	0	0	12

CP – Classification Points; VT – Victories by fall, default/forfeit/disqualification (5-0); ST – Victories by superiority (4-0 / 4-1); TP – Technical Points obtained; TP Gvn – Technical Points given

The best results in the competition showed athlete A. Cherkasova, whose biochemical examination data were within normal limits and hemoglobin concentration was the highest among the surveyed women wrestlers.

4. Discussion and Conclusion

According to the results of the majority of the studies, the dominant role of the freestyle wrestlers' physical qualities belongs to anaerobic capacity against the backdrop of a well-developed aerobic ability [13, 14, 15].

Conducted by V.V. Shian's [16] studies have also shown that a highly skilled wrestler's competition can be characterized as a glycolytic anaerobic load that results in significant shifts in the alkaline blood-alkaline equilibrium. This further emphasizes the importance of correcting the processes of recovery in the body of the wrestlers.

Kara E., et al [17] could not found any significant differences between the hemoglobin, hematocrit, erythrocyte, leukocyte, and thrombocyte levels of elite athletes involved in two different sports branches. Milic R., et al. [18] concluded that the predominant energy system required for participation in sport affects haematological parameters, sTfR and body iron proved to be reliable parameters for monitoring the dynamics of iron metabolism and could contribute to successful iron-deficiency prevention.

Saygin [19] compared the parameters of iron status of the wrestlers of different weights. The significant difference was found in values of iron. According to the author, the trainers may be offered to follow the hematological parameters and iron status, especially iron deficiency, as well as the physical performance of their wrestlers and to take the necessary measures. In our opinion, this only applies to male fighters. Iron status of women depends on the phase of the menstrual cycle. We found no difference in the parameters of iron status of women wrestlers of different weights.

Hesar Koushki et al. [20] reported the results of the study on 65 min of wrestling exercises, which showed that red cell distribution width (RDW) as one of the iron status factors was significantly decreased. This reduction was greater in the afternoon exercises as compared to the morning cycle. However, other iron indices such as haemoglobin and mean cell volume (MCV) had no significant changes.

According to the results of Morteza Tayebi [15], the study of acute response showed that wrestling exercises led to a decline of iron stores during exercises and reduced total iron binding capacity during a 24-hour recovery period.

According to the data of Beutler [21] significant force on the body can lead to traumatization of erythrocytes, their hemolysis, hemoglobinuria and/or metabolic changes, which cause an increase of plasma volume and the development of dilatory anemia, that is, an excessively large volume of plasma, even normal erythrocyte counts are not sufficient to adequately saturate the athlete's working muscles.

Ye Tian et all [22] investigated overtraining in a relatively large cohort of 114 elite women wrestlers during their normal training and competition schedules. The main finding was that the incidence of overtraining was relatively low overall but very high in a subgroup of 13 world-class wrestlers. The other

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main finding was that the blood variables creatine kinase, hemoglobin, testosterone, and cortisol were not useful markers for the early detection of overreaching.

Preparing athletes for high-level competitions requires constant biochemical control. Intense physical activity causes a number of complex adaptive reactions of the body, which are largely related to their energy supply. During training camps, in the process of adaptation of the athletes to special physical activities, a functional system is created, including metabolic indicators, which can collapse with the irrational organization of the training process. That is why, at this time, the biochemical analysis of the blood of female athletes makes it possible to assess the appropriateness and optimality of the methods and means chosen by the trainers to organize the training process of preparation for the responsible start of the year – the World Championship for Women Wrestlers.

According to the authors, we have found that hematologic parameters may change while doing exercises. They may indicate overstress and overtraining, but at the same time there were no useful markers for the early detection of overreaching. Female athletes are more likely than men to have a potential risk of iron deficiency due to their loss in the menstrual cycle, and also because of reduced food intake due to dietary restrictions in terms of quality and quantity. Timely detection of the problems with hematological analysis allows to make changes in the training process and offer the ways to successful iron-deficiency prevention.

Regarding our research: timely detection of under-recovery (high muscle tension body (in terms of urea)) of female athletes allows to make adjustments to the training process. The best results in the competition showed a female wrestler, whose biochemical examination data were within normal limits and the hemoglobin concentration was the highest among the surveyed.

In our opinion, in freestyle wrestling the result is determined by many factors. If, in cyclic sports, the result is directly dependent on the athlete's functionality, while in acyclic, which is a freestyle wrestling, the classification of the fighter, psychological and technical-tactical readiness, the level of the development of physical qualities and individual functionality are of great importance. Each wrestler has his own individual style of conducting a fight. Changing the «individual style» of performing a technical action that occurs in the case of physical fatigue, and, consequently, a decrease in the special performance of the wrestler, leads to a violation of the usual structure of the reception, which in turn reduces the possibility of its conduct in the real match.

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