Characteristics of the level of athletes' sports preparedness in freestyle wrestling

Características del nivel de preparación deportiva de los atletas en la lucha libre

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How to cite in APA

Konakbayev, B., Bekembetova, R., Bekturganov, O., Yeskaliyev, M., & Zhunisbek, D. (2025). Characteristics of the level of athletes' sports preparedness in freestyle wrestling. *Retos*, *64*, 576–588. https://doi.org/10.47197/retos.v64.107183

Abstract

Introduction: This article deals with the issue of a comprehensive approach to researching the level of athletic fitness of freestyle wrestlers based on the results of competitive activity, in the laboratory and training process.
Objective: Using a comprehensive research approach to assess the technical and tactical skills, as well as the level of functional capabilities of athletes in freestyle wrestling.
Methodology: Competitive activity was analyzed to evaluate technical and tactical skill. The heart rate and lactate concentration level were recorded during the preparation for competitive wrestling and the recovery period. An in-depth complex examination was performed, which included assessment of anthropometric indices, registration of the main parameters of external respiration and gas exchange, cardiovascular system.
Results: The indicators of recovery processes during the training process and competitive activity were obtained to assess the level of preparation of freestyle wrestlers, where a number of shortcomings of their training were revealed.
Discussion: Criteria for evaluating competitive loads on the basis of determining the concentration of lactate in the blood were developed. The obtained information allowed to determine the level of preparedness of athletes in freestyle wrestling, as well as the readiness to conduct the next competitive bout.
Conclusions: Comparative analysis of competitive activity has shown that it is necessary to correct the algorithm of modes of training processes. When conducting training of low aerobic power to perform the necessary volume while observing the individual mode as for the level of lactate and heart rate.

Keywords

Competitive activity; competitive loads; freestyle wrestling; lactate determination; training loads.

Resumen

Introducción: Este artículo aborda la cuestión de un enfoque integral para investigar el nivel de aptitud atlética de los luchadores de estilo libre basado en los resultados de la actividad competitiva, en el laboratorio y el proceso de entrenamiento.
Objetivo: Utilizar un enfoque de investigación integral para evaluar las habilidades técnicas y tácticas, así como el nivel de capacidades funcionales de los atletas en la lucha libre.
Metodología: Se analizó la actividad competitiva para evaluar la habilidad técnica y táctica. Se registraron la frecuencia cardíaca y el nivel de concentración de lactato durante la preparación para la lucha competitiva y el período de recuperación. Se realizó un examen complejo en profundidad, que incluyó la evaluación de los índices antropométricos, el registro de los principales parámetros de la respiración externa y el intercambio de gases, el sistema cardiovascular.
Resultados: Se obtuvieron los indicadores de los procesos de recuperación durante el proceso de entrenamiento y la actividad competitiva para evaluar el nivel de preparación de los luchadores de estilo libre, donde se revelaron una serie de deficiencias de su entrenamiento.
Discusión: Se desarrollaron criterios para evaluar las cargas competitivas sobre la base de la determinación de la concentración de lactato en la sangre. La información obtenida permitió determinar el nivel de preparación de los atletas en la lucha libre, así como la disposición para realizar el siguiente combate competitivo.
Conclusiones: El análisis comparativo de la actividad competitiva ha demostrado que es necesario corregir el algoritmo de los modos de los procesos de entrenamiento. Al realizar un entrenamiento de baja potencia aeróbica, se debe realizar el volumen necesario observando el modo individual en cuanto al nivel de lactato y la frecuencia cardíaca.

Palabras clave

Actividad competitiva; cargas competitivas; cargas de entrenamiento; determinación de lactato; lucha libre.

Introduction

The wrestling school of Kazakhstan once provided outstanding athletes in the arena of international competitions. However, in recent years in the lists of the worlds strongest the number of our athletes has significantly decreased. Thus, at competitions of various ranks, the men's freestyle wrestling team of the Republic of Kazakhstan did not have a gold medal at the World Championships, and at the 2016, Olympic Games remained without any award at all.

As a sport, wrestling is characterized by complex training, requiring conditionally equal attention to the development of all physical, functional, as well as psycho-emotional qualities (Kuspanov et al., 2024) of the athlete. To assess the preparedness of high-class athletes modeling of competitive activity, when the athlete's body functions in the conditions of limit mode, based on the multilevel system of regulation of adaptive processes, certain deficiencies that may be the cause of low competitive result are clearly manifested (Isaev et al., 2012). Based on the above-mentioned, there was a need to study the problems of the training process using a systemic-complex approach.

In this regard, one of the challenges facing coaches and scientists is the significance of physical and physiological factors that contribute to successful competition (Mirzaei et al., 2009). As it is known, the sports result is limited by the level of development of energy supply mechanisms of the organism. Therefore, control of power, capacity and efficiency of anaerobic and aerobic energy supply mechanisms in the process of training is carried out. To achieve a high level in competitive activity, wrestlers must have a high level of aerobic efficiency (MOC 60-62.5 ml/min/kg) and a developed share of oxidative muscle fibers (Podlivaev, 2010), as well as the anaerobic potential (Begidov et al., 1998; Bekembetova et al., 2020), which contributes to the production of more energy and resist physical fatigue, that is, the development of endurance, the measure of which is the stability of technically correct execution of wrestling bouts, which is most fully manifested in competition conditions. Consequently, the athlete, conducting a bout at a fast pace, while maintaining high performance throughout the competition, lasting 2 days, must have great endurance, which is determined solely by the problem of regulation of energy pathways both in the initial state of the body and for the realization of competitive loads (Lukyanov, 2003). Achievement of such a level of energy supply of various physical loads is based on the results of studies of adaptation mechanisms (Meerson & Pshennikova, 1998; Gabrys, 2005; Verkhoshansky, 2005). An athlete must have not only a high level of technical and tactical preparedness, but also good performance, which is determined by the level of functional capabilities and the development of different ways of energy supply of the body. Moreover, changes in the rules and regulations of the competition in 2013, aimed at increasing its spectacle, led to an increase in the density of technical actions and their high tempo. Accordingly, the conditions of competition dictate the need to constantly make quick and effective technical and tactical decisions, changing the direction and level of effort from maximum to complete relaxation, without losing the highest level of accuracy. These qualities, in addition to techno-tactical skill, also depend on the level of both aerobic and anaerobic-alactate energy supply systems. To assess the preparedness of high-class athletes modeling of competitive activity, when the athlete's body functions in the conditions of the limit mode, based on the multilevel system of regulation of adaptive processes, vividly manifest certain deficiencies that may be the cause of low competitive result (Mirzaei et al., 2009). In this connection for revealing the reasons of low results of competitive activity of wrestlers the complex approach which includes not only pedagogical aspects, but also methods of an estimation of functional and energetic possibilities of an organism of the athlete was chosen.

Objective of the study

Using a comprehensive approach of research (video observation of competitive bouts, laboratory conditions and training processes), to analyze and evaluate the technical and tactical skills, as well as the level of functional capabilities of training athletes in freestyle wrestling.

Materials and methods

One of the important methods for assessing the level of athletic fitness is the analysis of competitive fights at international competitions based on video surveillance of freestyle wrestling. The scientific

base of the Kazakh Academy of Sport and Tourism was used for laboratory research. In accordance with the program of in-depth comprehensive examination of leading athletes, the study included an assessment of anthropometric indicators characterizing the physical development of athletes, registration of the main parameters of external respiration and gas exchange (Douglas-Holden method), cardiovascular system (electrocardiogram, heart rate). All these indices were measured at rest, as well as after dosed and maximum physical loads. For stress tests related to the determination of physical performance, we used a bicycle ergometer "Ergoreiser". All load testing procedures were performed according to the generally accepted standard methodology in the course of stage complex examinations of professional athletes. In stadium conditions, a positive moment is the approximation of different characteristics of sports loads with the training process of the athlete, while using portable equipment. Examination in competitive conditions, due to the high level of motivation, gives the opportunity to determine the limit level of adaptive capabilities of the athlete, manifestations of different components of his functional state in extreme conditions of activity. The results of these studies will make it possible to assess the level of athletes' preparedness.

Physical performance and functional indices were assessed in the laboratory and in the sports arena, and competitive bouts were analyzed using video observation at international competitions.

The scientific base of the Kazakh Academy of Sport and Tourism was used for laboratory research. In accordance with the program of in-depth comprehensive examination of leading athletes, the study included assessment of anthropometric indicators characterizing the physical development of athletes, registration of the main parameters of external respiration and gas exchange (Douglas-Holden method), cardiovascular system (HR by electrocardiogram). To determine the general physical performance, we used the PWC170 test according to Karpman V.L. (1974), while the load on a bicycle ergometer was set stepwise-increasing power until failure. When performing such a load, the dynamics of functional changes at all stages were recorded, including the limits of the organism's capabilities, as well as the level of aerobic and anaerobic performance.

2. One of the important methods of assessing the level of athletic fitness of wrestlers is to hold competitive bouts during the training process in the conditions of the gym, keeping the usual atmosphere, as well as imitating the conditions of the official tournament. At the end of the bout we determined the pulse palpatorily, and also determined the lactate content in the blood using a portable lactometer Lactate-plus Nova-Biomedical. Blood sampling was done immediately after the end of a competitive bout, as well as 3 min, 5 min, 7 min of the recovery period. When it was possible, similar studies were conducted during official competitions. In these conditions, due to the high level of motivation, it is possible to determine the limit level of adaptive capabilities of the athlete, as well as the manifestation of different components of his functional state in extreme conditions of activity.

3. A standard rostometer and a TANITA DC-360 body composition analyzer were used to measure height and body weight, a spirograph SMP-21/01-“r-d” was used to determine the vital capacity of the lungs (VC) and to calculate the vital index (VI).

4. The method of pedagogical observation provided for recording the time of performance of each training means and heart rate (HR), which was registered palpatorily during the first 10 seconds after the end of exercises. Control over the intensity of training loads was carried out according to the method developed by Sytnik V.I. et al. (1974), which is used in wrestling, as well as according to the scale of Sorvanov V.A. (1978).

5. Video observation of official competitions. The analysis of competitive activity provided for the registration of technical and tactical actions during competitive bouts. The method of stenographic recording was used to record technical and tactical actions. The formulas developed by E.M. Chumakov et al. (1999) were used to calculate the indicators of technical and tactical preparedness (activity, efficiency of offense and defense, effectiveness of offense and defense, etc.). The video analysis of 567 competitive bouts of the World Championships in freestyle wrestling 2017-2019, including 165 bouts - 2017 in 8 weight categories, 196 bouts - 2018 and 206 bouts - 2019 in 10 weight categories, as well as a comparative analysis of the technical and tactical actions of the winners and prize-winners who took 1-3 places at the World Championships in freestyle wrestling 2017-2019, including Kazakhstan wrestlers.

Competitive activity and sports performance were assessed by the following indicators:

a) ranking, number of wins and losses;

b) number of performed and evaluated technical and tactical actions;

c) the number of points won and lost;

d) "Activity" (A) - an indicator of the number of actions of a fighter in offense and defense. It is expressed in the average number of actions per bout or per unit of time and is determined separately for defense and offense:

$$A = \frac{\sum Oa + \sum Da}{t} \quad (1),$$

where $\sum Oa$ is the sum of offense attempts, $\sum Da$ is the sum of defense attempts, t is the total time of the bout in minutes;

e) "Efficiency of offensive technique" (Eo) - the percentage of successfully executed techniques from the total number of recorded technical actions:

$$Eo = \frac{\sum Sr}{\sum r} \times 100\% \quad (2),$$

where $\sum Sr$ is the sum of successful receptions, $\sum r$ is the total sum of attempted receptions.

f) "Efficiency of Defense" (Ed) - the percentage of successfully repelled techniques of the opponent from the total number of his attempts.

$$Ed = \frac{\sum Sm}{\sum m} \times 100\% \quad (3),$$

where $\sum Sm$ is the sum of successful defensive moves, $\sum m$ is the total sum of attempts of offensive moves by the opponent.

g) indicators of competitive activity of wrestlers - activity of fight (ACF) and reliability of technique (%) (RT) - were determined according to standard formulas accepted in wrestling.

$$ACF = \frac{\sum Oa + \sum Da}{t} \quad \text{and} \quad RT = \frac{\sum eh \times 100}{\sum r + \sum eh} \quad (4),$$

where $\sum r$ - total number of attempts to conduct the reception, $\sum eh$ - total number of evaluated holds, t - fight time (min).

h) efficiency of technical actions (in points).

These indicators reflect technical and tactical skill of wrestlers and features of competitive activity that allowed to determine the level of wrestlers' preparation and to apply this information in further work.

6. Content analysis of the final protocols of the competitions. This analysis allowed to supplement the information about the technical and tactical actions of competitive activity and the results of bouts at the 2017-2019 World Championships in freestyle wrestling.

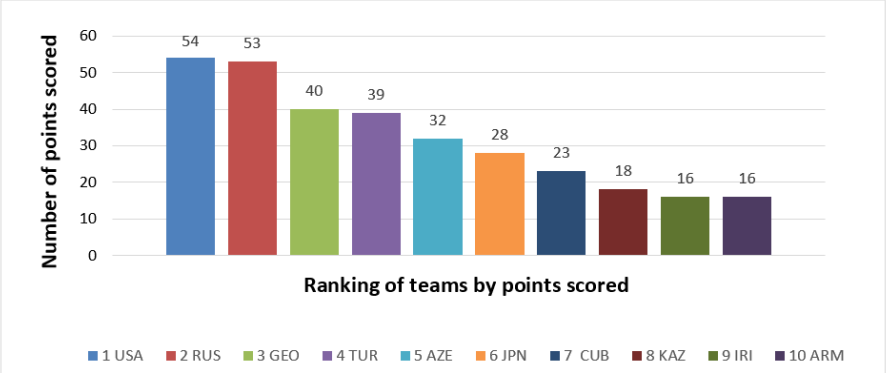
7. Statistical processing of the obtained results is presented as arithmetic mean (X), sample size (n), coefficient of variation (V%), ± mx - representativeness error (standard error of the mean), σ - mean square (standard) deviation, variance P - degree of reliability of changes in the averages (statistical significance).

Results

The results of the study of competitive activity

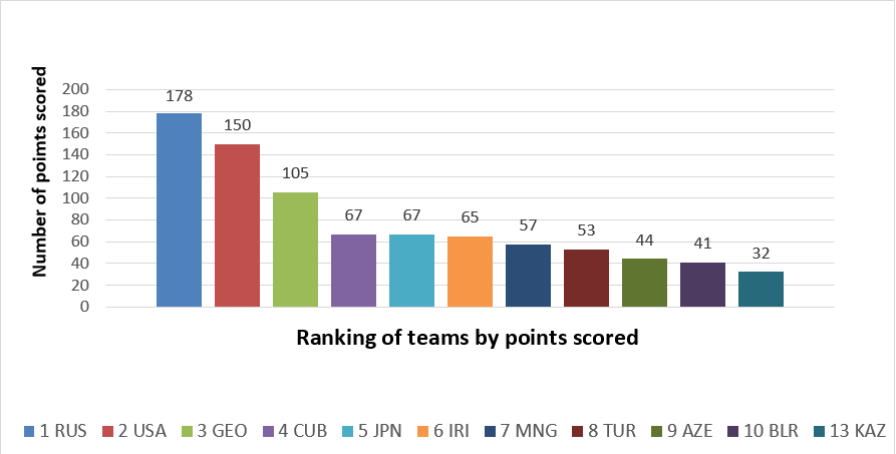
A comparative analysis of the results of competitive activity of wrestlers of the national team of the Republic of Kazakhstan in freestyle wrestling at the World Championships in 2017 and 2018 is presented in Figures 1 and 2. As shown (Figure1) the 2017 national team ranked eighth out of 63 participating countries with 18 points. In these competitions in each weight category points were determined as follows: 1st place - 10 points, 2nd place - 9 points, 3rd place - 8 points, 5th place - 6 points, etc.

Figure 1. Rating indicators of participating countries at the 2017 World Freestyle Wrestling Championship (Paris).



In 2018, the United World of Wrestling made changes to the definition of the team standings of the competition, namely, it was increased almost 2.5 times the number of points in the prizes were awarded for 1st place - 25 points, 2nd place - 20 points, 3rd place - 15 points, 5th place - 10 points, etc. in each weight category. In this regard, in 2018, the RK national freestyle wrestling team scored 13th place out of 56 participating countries, earning 32 points compared to the winning country, which scored 178 points (Figure 2).

Figure 2. Rankings of the participating countries at the 2018 World Freestyle Wrestling Championships (Budapest).



If we compare the number of points won by the athletes of the national team of the Republic of Kazakhstan, they are more than 4 times less than the winners, which generally indicates a low level of technical and tactical preparedness of the representatives of the national team. It should be said that technical and tactical training is an integral indicator reflecting the main aspects of sportsmanship and fitness of an athlete. The main parameters of competitive activity of wrestlers of the RK national team are presented in Table 1.

Table 1. Comparative characteristics of competitive performance of freestyle wrestlers at the World Championships (2017 -2018)

Characteristics	Athletes of the RK national team (n=8)		Winners and prize-winners (n=32)	
	2017	2018	2017	2018
Duration of the fight (min., s)	5,30±0,13	4,88±0,22	5,05±0,81	5,21±0,60
Number of fights	2,38±0,46	1,9±0,4	4,65±0,10	4,5±0,08
Number of attacks per fight	4,14±0,56	3,68±0,32	4,41±0,18	4,66±0,14
Number of successful attacks per fight	2,8±1,53	2,47±0,47	3,36±0,19	3,47±0,15
Number of unsuccessful attacks per fight	1,34±0,56	1,21±0,26	1,03±0,16	1,21±0,09
Number of points won per fight(points)	5,73±1,03	4,89±0,91	6,89±0,27	7,21±0,29
Number of points won in min.	0,96±0,19	0,95±0,19	1,42±0,08	1,42±0,10
Number of points lost per fight	6,33±0,96	6,05±1,10	2,44±0,22	2,99±0,27
The effectiveness of protection in the rack, %	49,38±6,46	42±4,78	57,88±5,65	63±3,11
Defense efficiency in mat wrestling, %	83±6,02	83,4±4,89	92,94±1,26	94,25±1,32
Effectiveness of technical actions (points)	1,95±0,25	1,76±0,23	2,05±0,05	2,13±0,05

As can be seen from the presented data, the studied indicators reflecting the level of development of certain qualities of Kazakhstani wrestlers are significantly inferior to the prize-winners. It follows from this that the indicators of activity and reliability of competitive equipment, defensive actions, effective attacks, as well as a significant number of lost points for the duel indicate a reduced level of both technical and tactical training and speed-strength readiness (Novikov et al., 2016). The protracted nature of attacking actions indicates a low level of functionality of domestic freestyle wrestlers (Ryabinin & Shumilin, 2007). Moreover, from a comparative analysis of similar indicators of the 2018 World Cup competitions, it follows that many results remained at the same level or deteriorated somewhat. It follows from this that the program of training sessions of the national team of the Republic of Kazakhstan has certain disadvantages and requires a significant revision and correction of the algorithm of training cycle modes.

The results of the study in the laboratory

Competitive activity of wrestlers reflects not only technical and tactical skill, but also the level of development of adaptation processes of various functional systems (Platonov, 2019; Solopov et al., 2010). In this case, testing in the laboratory conditions of athletes of acyclic sports (wrestlers) while performing non-specific physical load (bicycle ergometry) can be considered as an additional method to assess the level of general physical performance (Kharitonova et al., 2005). On the other hand, when performing a step cycling ergometric load to failure, not only the maximum physical performance of the athlete is revealed, but also the limits of functional systems (cardiovascular, respiratory systems), as well as the level of aerobic and anaerobic performance (Korzhenevsky et al., 2014). Members of the RK national team of masters of sports in freestyle wrestling (n-12) participated in the testing, the results of which are given below (Table 2). In laboratory tests, which are considered a mandatory part of the training of qualified athletes, the data obtained are compared with model characteristics. Thus, the mass growth index (MGI), widely used in the theory and practice of modern sports is a marker of athletes' fitness (Martirosov, 1998; Abramova et al., 2010). As can be seen from the obtained data (Table 2) (Bekembetova & Konakbayev, 2022) the average level of the studied parameter was inferior to the model indicators of high-class wrestlers (350-400 g/cm). It is known that excessive body weight not only limits the achievement of high competitive results (Krikukha et al., 2014), but also indicates the need to adjust the training program. The external respiratory system is an important part of the functional state of the organism as a whole, and the vital capacity of the lungs (VCL), as well as the vital capacity index (the ratio of VCL in ml to body weight) is an informative indicator of the capacity of the respiratory system of the athlete. The comparative analysis with the model ones indicates a significantly reduced level of these indicators of the RK wrestling team (Ivanov & Turlykhanov, 2009) (Table 2).

Table 2. Indicators of physical development and respiratory apparatus capabilities of freestyle wrestlers of the RK national team

Biometry	Age, years	Body weight,kg	Height, cm	MGI, g/cm	VCL, ml	VCI, ml/kg
X	23,4	78,7	171,9	454	4672	59
$m_{(x)}$	0,40	4,27	2,76	18,6	309,7	1,70
S	1,32	14,16	9,14	61,51	1025	5,64
C%	5,6	17,9	5,31	13,5	21,9	9,54

In qualified martial arts athletes, the performance of extreme nonspecific load simulates the organism's reaction characteristic of adaptation in the conditions of competitive activity (Korzhenevsky et al., 2014). In this regard, it is advisable to use bicycle ergometric load associated with high energy

expenditure to determine the functional capabilities of the cardiorespiratory system, as well as significant physical strain, reflecting the overall performance, on which in general can depend on the effectiveness of special motor skills (Platonov, 2019). Table 3 shows the results of the studied parameters during bicycle ergometric exercise of maximum power, reflecting the overall functional preparedness.

Table 3. Indicators of reaction to bicycle ergometric load of maximum aerobic power in freestyle wrestlers of the RK national team

Biometry	Indicators						
	Load, kg/m		Heart rate, beats/min	MVB, l	HL, mmol/l	VO2, ml	
	min	kg				min	kg
X	2033	26,42	178	161,66	12,8	4077	52,42
$m_{(x)}$	87,39	1,32	3,24	7,08	1,3	181,6	1,68
S	289,2	4,38	10,74	23,46	3,57	601	5,56
C%	14,22	16,57	6,02	14,51	27,8	14,74	10,60

When comparing the model and actual indicators of physical performance at maximum HR in the studied wrestlers are more than 10 and more percent inferior to those (Ivanov & Turlykhanov, 2009). At that time, according to other authors' data, model indicators of physical performance of maximum aerobic power of wrestlers are much higher (38.0+3.9 kgm/min/kg) (Krikukha et al., 2014). Physical activity requires energy expenditure, which is provided by biochemical processes occurring in organs and tissues as a result of oxidative reactions, requiring not only constant but also maximum oxygen delivery (MOC- 52.42+ ml/min,kg), depending on the potential adaptation capabilities of the cardiovascular and respiratory systems (MVB -161 l), which in this survey are estimated as average. Hence, the assumption that one of the reasons for this fact is the insufficient attention paid to the low-intensity training regimen, which a significant part of the annual is training cycle (Platonov, 2019). This mode is allocated about 25-30% of the annual volume and is fundamental or basic, providing the restructuring of the respiratory system, which is expressed by an increase in alveolar surface, growth of lung volumes (VCL up to 7000 ml), pulmonary ventilation (200-270 l/min), while increasing the endurance of not only respiratory muscles (Breslav et al., 2013), but in general affects the level of both physical and technical fitness. If the appropriate amount of training loads is not performed at this stage, those elements necessary for competitive activity will be unrealized (Platonov, 2019; Novikov et al., 1985).

If laboratory conditions make it possible to standardize the examination and use a wide range of high-precision measuring equipment, then in the conditions of training activity it is positive to bring different characteristics of test loads closer to competitive exercises, use of portable measuring equipment, harmonious integration of examinations with the training process of the athlete. Examination in competitive conditions, due to the high level of motivation (Bekbossynov et al., 2024), gives the opportunity to determine the limit level of adaptive capabilities of the athlete, manifestations of different components of his functional state in extreme conditions of activity. The volume and completeness of performance of any function is determined by the possibility of energy metabolism (Kondrashova, 1978; Mayevsky et al., 2000). At the same time, it should be emphasized that the effectiveness of the regulatory effect of the nervous and endocrine systems is also closely related to the mobilization of energy metabolism (Mayevsky et al., 2000). According to the authors, the control signal (nerve impulse, hormone) at the level of the organism or in the intracellular signaling system simultaneously involves specific executors and the use of fuel-energy resources, and in most cases even preemptive supply of substrates necessary to activate the energy metabolism of the executor (Mayevsky et al., 2000). One of the parameters that most accurately reflects the state of energy processes in the body (aerobic, anaerobic, anaerobic-alactate) is the metabolite of glycolysis – lactate (Brooks, 1985; Gladden, 2004; Gillium & Kravitz, 2008). Lactate indices are used to control the mode of training loads, the level of training, the effect of competitive activity, also reflects individual characteristics, and by the dynamics of lactate recovery after bouts indirectly assess the aerobic capacity of athletes.

Below are presented the results of the study in the conditions of training camps in the performance of competitive wrestling bouts by athletes. The study involved 12 wrestlers, among them 2 Masters of Sport International Class, 6 Masters of Sport and 4 Candidate Masters of Sport. The minimum age of the subjects is 20 years, the maximum is 29 years. The body weight of the athletes ranged from 61 to 97 kg. Blood sampling for analysis was performed before the start, in the first half of the bout (3 min), after the

end of the 6-minute bout, as well as in the recovery period up to the 7th minute. The results are presented in Figure 3. The indicators show a significant strain on the cardiovascular system both in the first half (3 min, HR -193 beats/min) and at the end of the 6-minute bout (HR-204 beats/min), and the lactate level reached 15.3 mmol/L.

Figure 3. HR and blood lactate dynamics in athletes during competitive wrestling bouts and during the recovery period.

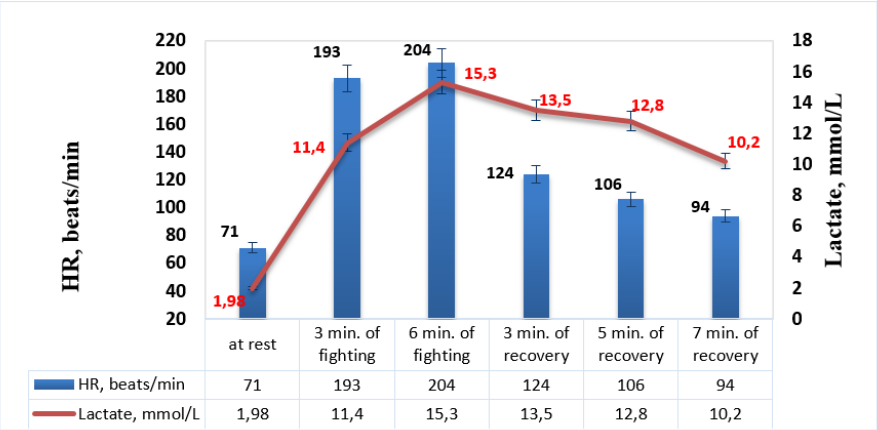
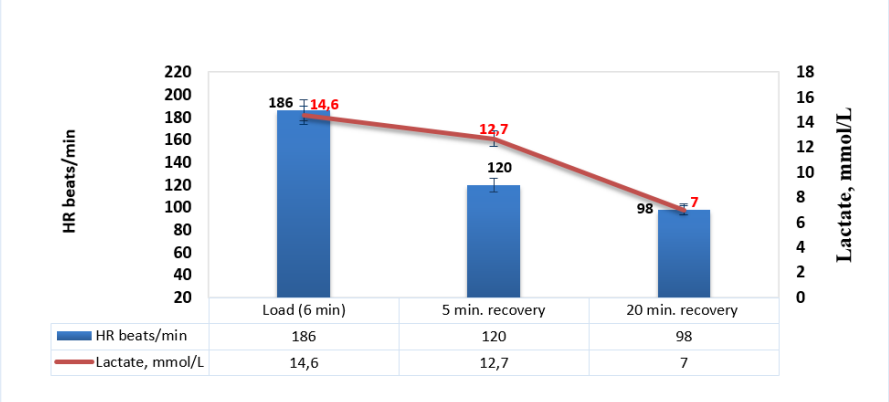


Figure 4. HR and blood lactate dynamics in freestyle wrestlers at the Championship of the Republic of Kazakhstan.



According to the physiological classification of training tasks, the load of competitive bout of qualified wrestlers is quite high intensity and belongs to the loads of glycolytic anaerobic character (Podlivaev, 2010). Anaerobic glycolysis during muscular activity reflects a complex of autonomic shifts inherent in the first stage of stress, when the energy resources of the organism are mobilized to implement urgent actions and the integral criterion of which is either oxygen debt or maximum accumulation of lactic acid in the blood (lactate) (Volkov et al., 2000; Kharitonova et al., 2005). The numerical parameters presented in Figure 3, both on the hemodynamic and metabolic sides correspond to the performance of wrestling bouts of competitive intensity (Podlivaev, 2010). It should be noted that for the first time in our practice, when performing a 6-minute bout, blood for lactate determination was taken in the first half (3 minutes) and in the second half (6 minutes), and HR was also recorded (Fig.1). As can be seen from the presented data, if HR increases from 193 to 204 beats/min, i.e. increases by 5.4%, the level of lactate increases by 25.4%. This indicates that for the realization of competitive bouts anaerobic ways of energy supply are used largely due to the insufficient level of development of aerobic capabilities in the athletes of the national team (Table 2). The increase in lactate causes metabolic acytosis and the efficiency of wrestling bouts can significantly decrease (Robergs et al., 2004). An additional method of assessing the conjugation of cardiovascular function and metabolic systems is the indices of the same functions during the period of urgent recovery (Kharitonova et al., 2005). From the presented Figure 3, the dynamics of HR and lactate recovery is characterized by unidirectionality, but the degree of lactate

utilization is significantly lower. Such a reaction, when HR normalizes faster than the homeostasis indices of muscle function, indicates that the athlete will not be able to effectively perform the next bout due to the high concentration of lactate (Kharitonova et al., 2005), which can block the activity of enzymes involved in the production of energy aerobically. Studies conducted under the conditions of official RK freestyle wrestling competitions indicate a similar picture (Figure 4). It should be noted that a 6-minute bout was accompanied by an increase in HR up to 186 beats/min, while the lactate level corresponded to 14.6 mmol/L.

Discussion

Comparative analysis with the data of literature sources (Yarigin & Yushkov, 1983; Hrvoje et al., 2009) showed that elite wrestlers have higher lactate values (from 17.1 to 20.0 mmol/l), which is associated with greater energy reserves, as well as factors of technical and tactical skill. Comparative analysis of the studied parameters during the period of urgent recovery indicates that if by 5 minutes HR is restored by 35%, then the level of lactate in the blood only by 16.3% and moreover, full recovery does not occur even by 20 minutes. The obtained results indicate an imbalance of intracellular metabolism and functional systems, both when performing competitive bouts in the preparatory period, and when participating in official competitions, which is generally characterized by a low level of both aerobic and anaerobic capabilities of wrestlers, and this feature is definitely stable. When the system "lingers" in some dynamic equilibrium, which is not able to realize an effective bout (Isaev et al., 2012), the reason lies in the neuromuscular link (Myakinchenko & Seluyanov, 2005) and to get out of this state it is necessary to influence this structure (Myakinchenko & Seluyanov, 2005; Isaev et al., 2012), especially it concerns martial arts, where it is necessary to repeatedly show maximum efforts of explosive character, which requires recruitment of high-threshold i.e. glycolytic motor fibers. Muscle tissue is unique in that the rate of glycolysis in it can vary largely than in any other tissue (Meerson, 1986), and the rate of blood circulation increases 20-30 times compared to the initial state and this is due to the abrupt relaxation of resistive vessels in them (Trabold et al., 2003). There is no doubt that the rate of energy production due to glycolysis is higher than that of aerobic ATA resynthesized and the share of anaerobic glycolysis in short-term work is about 49 % (Gabrys, 2000). One of the important conclusions of scientists is that the increase in physical performance in many sports will be due to the stimulation of anaerobic energy generation (Ozolin, 1984; Bacer et al., 2010). Lactate is practically recognized as a coordinator not only of cellular metabolism of organs and tissues, but of the organism as a whole (Brooks, 1985; Gladden, 2004; Hashimoto & Brooks, 2008). In this regard, there was a need to revise the structure of the training process wrestlers of the national team where, while maintaining the basic training program, certain changes were made in the zones of intensity of training sessions wrestlers in particular, equally required the appropriate amount of basic training, the importance of which is undeniably great (Platonov, 2019), as well as strengthening the attacking grabs in the rack with instant execution of the reception.

Training was directed, taking into account the individual characteristics of athletes, as well as the fight in different competitive situations. Improvement of technical and tactical actions was performed with different opponents by level of preparedness, in different competitive situations and positions, with given time intervals and intensity. During the training the coaching staff together with the athletes analyzed various competitive situations and positions, improved the technique of fighting in the parterre and in the rack. They worked on their own mistakes, analyzing previous competitions. Developed the tactics of fighting individually for each athlete, taking into account their style of fighting with different opponents. The coaching staff controlled the correction of errors in technical actions, and gave recommendations for effective execution and realization of holds, grabs, defensive actions and holds.

Systematic training bouts within the training session have a positive effect on the improvement of the athlete's fighting technique and the development of special endurance. At the training session we determined blood lactate in athletes. Such an approach to planning allowed athletes to fulfill training loads in full without damage to the health of athletes.

Thus, the volume of general developmental exercises amounted to 40%, and the share of special training amounted to 60%. Approximately such a ratio of general and special training at the pre-competition stage is typical for many types of combat sports. At this stage of training by intensity aerobic work

amounted to 35%, mixed work 50% and anaerobic work 15% of the total volume of work performed. As a result, a considerable volume of training loads was performed, including the use of various means and methods of training.

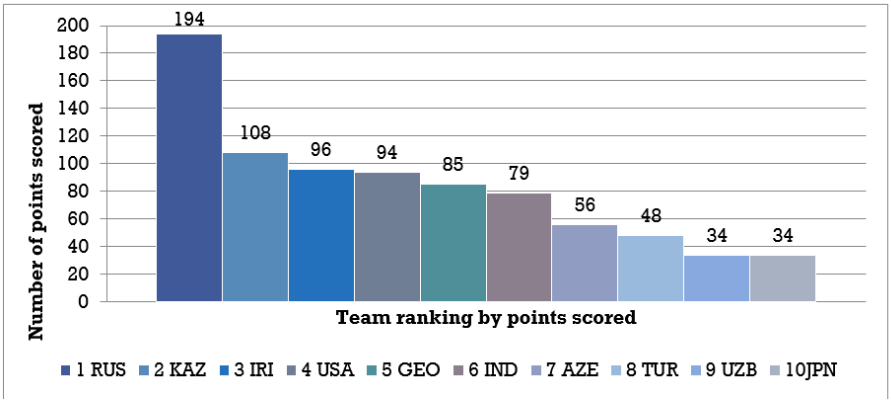
Because of such correction, Kazakhstani wrestlers at participation in official competitions slightly increased the number of fights, increased activity, effectiveness of attacks, as well as the effectiveness of defensive actions both in the rack and in the parterre. (Table 4).

Table 4. Comparative characteristics of competitive performance of freestyle wrestlers at World Championships (2017-2019)

Characteristics	Athletes of the RK national team		
	2017	2018	2019
Duration of the fight (min., s)	5,30±0,13	4,88±0,22	4,47±0,24
Number of fights	2,38±0,46	1,9±0,4	4,28±0,36
Number of attacks per fight	4,14±0,56	3,68±0,32	4,7±0,39
Number of successful attacks per fight	2,8±1,53	2,47±0,47	3,3±0,37
Number of unsuccessful attacks per fight	1,34±0,56	1,21±0,26	1,45±0,22
Number of points won per fight(points)	5,73±1,03	4,89±0,91	6,35±0,69
Number of points won in min.	0,96±0,19	0,95±0,19	1,52±0,26
Number of points lost per fight	6,33±0,96	6,05±1,10	4,14±0,45
The effectiveness of protection in the rack, %	49,38±6,46	42±4,78	49±6,26
Defense efficiency in mat wrestling, %	83±6,02	83,4±4,89	85±2,85
Effectiveness of technical actions (points)	1,95±0,25	1,76±0,23	1,65±0,17

Despite the fact that the RK national freestyle wrestling team took 2nd place at the 2019 World Championships (Figure 5), but the points scored (108) are 44.3% lower than the champions (194 points). If positive is the increase in the number of attacks, but the number of unproductive attacks has also increased (by 11, 9%). Consequently, there are still a number of problems that hinder more successful performance of RK wrestlers at international competitions.

Figure 5. Rankings of the participating countries at the 2019 World Freestyle Wrestling Championships. (Astana)



The fact is that the change of FILA rules led to the reduction of the time of reception to 20-30 seconds (Patratyi et al., 2012; Dagbaev, 2005), which led to the importance of the development of anaerobic energy source (Podlivaev, 2010), and for the effective realization of a bout a high level of glycolysis capacity is necessary, which should be formed during the basic or basic training program (Bekembetova & Konakbayev, 2022). Long-term studies of scientists have shown that lactate is oxidized in the mitochondria of the cell (Brooks, 1985; Gladden, 2004), due to the existence of lactate-oxidizing complex, which is concentrated on the outer side of the inner membrane of the mitochondria of red muscle fibers, due to which lactate, without going into the bloodstream is converted into pyruvate, the oxidation of which in the Krebs cycle is accompanied by the formation of additional 18 molecules of adenosine triphosphoric acid (Brooks, 2002; Hashimoto & Brooks, 2008). Taking into account this adaptation mechanism it is necessary to build the training process in such a way that aerobic and anaerobic pathways of energy formation developed in a balanced way, while proceeding from the individual characteristics of each wrestler. For this purpose, it is necessary to take into account the metabolic response of the athlete to training loads that develop the necessary qualities of freestyle wrestlers to achieve high sports results.

Table 5. Abbreviations used in this article

Abbreviations	Designations
IMS	international master of sports
MS	master of sports
CMS	candidate master of sports
MOC	maximum oxygen consumption
HR	heart rate
MBC	maximum breathing capacity
VBL	vital capacity of the lungs
VI	vital index
HIW	height index weight
ATC	Adenosine triphosphate, Adenosine triphosphoric acid
RK	Republic of Kazakhstan
WC	World Cup
UWW	United World Wrestling

Conclusions

1. When conducting training sessions of low aerobic power, perform the required volume while maintaining an individualized regimen of both blood lactate levels and HR.
2. Compliance with the rules of basic training will lead to the development of respiratory and cardiovascular systems, growth of mitochondria, mobilization of lipid metabolism, growth of glycolytic capacity, the result of which is the expansion of reserve capacity of various energy generation pathways.
3. Based on compliance with the algorithm of the training program, strengthen the specific weight of intensive work.
4. During training sessions, in order to accelerate the utilization of lactate in order to reduce fatigue time and balance aerobic and glycolytic abilities, it is necessary to individualize a combination of wrestling bouts of varying intensity.
5. The completion of training sessions in general should be accompanied by the restoration of lactate levels to a state of rest.

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All the authors have read the text, they are jointly responsible, and that the authorship is shared by all.
The ethical and deontological principles in relation to the people participating in the referred study have been complied with.

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