The specifics of the components of physical fitness in student wrestlers specializing in freestyle and Greco-Roman styles

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Abstract

Objective of the study is a comparative analysis of the physical fitness of student wrestlers engaged in freestyle and Greco-Roman wrestling.

Methods and structure of the study. The study involved 81 university-trained athletes specializing in wrestling. The group consisted of 47 Greco-Roman wrestlers (average age 17.5±2.4 years) and 34 freestyle wrestlers (average age 17.5±1.6 years). All participants were students studying at physical education and sports colleges and universities. The following methods were used to conduct the study: anthropometric measurements and bioimpedance analysis, as well as ergometric tests. In addition, the strength indicators of the muscles of the upper and lower extremities were assessed.

Results and conclusions. The analysis of anthropometric data and body composition revealed no significant differences between wrestlers of different styles. However, when assessing the anaerobic power of the arm muscles, Greco-Roman wrestlers showed significantly better results compared to freestyle wrestlers. This is due to the fact that in Greco-Roman wrestling, hand actions are more important, which affects the characteristics of their physical fitness and tactics. At the same time, despite the concession in the anaerobic power of the arm muscles, freestyle wrestlers demonstrate an advantage in most speed and strength characteristics. This reflects a wider range of techniques and a balanced development of physical qualities in athletes of this style.

Keywords: *Greco-Roman wrestling, freestyle wrestling, physical condition, anaerobic and aerobic capabilities, strength, wrestlers, significant differences, anthropometry.*

Introduction. Wrestling places extremely high demands on the physical fitness of athletes. At the Olympic Games, men compete in two types of wrestling: freestyle and Greco-Roman. Freestyle wrestling allows techniques using both the upper and lower extremities, including leg holds, throws, and ground fighting. In Greco-Roman wrestling, leg holds and footwork are prohibited, and the emphasis is on throws and holds of the opponent's upper body. Wrestlers' bouts are characterized by short-term, high-intensity, and intermittent actions [4].

The specificity of the performance evaluation system, which involves the use of power techniques that can lead to an early end to the fight, makes anaerobic endurance a priority factor for success. The level of an athlete's physical fitness is highly correlated with the results of tests assessing endurance, arm strength, and trunk muscles, which play an important role in wrestling. Strength of both the upper and lower extremities is necessary for successful execution of offensive actions and countering the opponent's attacks in defense [3].

In the existing scientific literature, there is a shortage of studies devoted to comparing the level of physical fitness of athletes involved in different types of wrestling [1, 2].

Objective of the study is a comparative analysis of the physical fitness of student wrestlers engaged in freestyle and Greco-Roman wrestling. The study was based on the hypothesis that the features of these wrestling styles determine the differences in the physical fitness of wrestlers associated with the specifics of

the technique of performing techniques.

Methods and structure of the study. The experiment involved 81 student-athletes specializing in wrestling: 47 Greco-Roman wrestlers (average age 17.5±2.4 years) and 34 freestyle wrestlers (average age 17.5±1.6 years). All participants were students of physical education and sports colleges and universities. The athletes were tested after a day of rest. The testing procedure was carried out for all participants under the same conditions.

The following methods were used in the study: anthropometry (assessment of body length and weight) and bioimpedancemetry (determination of body composition, InBody analyzer), ergometric studies: determination of anaerobic power of the muscles of the upper and lower extremities (Wingat tests) on a hand and foot bicycle ergometer; determination of aerobic performance when working with arms and legs using a Cortex gas analyzer. To assess the strength capabilities of the upper and lower extremities, a Biodex System 4 Pro multi-joint dynamometer and a wrist dynamometer were used to determine the strength of the wrist. The speed-strength capabilities of the wrestlers' lower extremities were determined using jump tests: "from a squat (SJ)" and "with a squat (CMJ)", the ratio of the results of these jumps (CMJ/SJ) was calculated.

Results and conclusions. A comparative analysis of the morphological indicators and sports experience of wrestlers engaged in freestyle and Greco-Roman wrestling is presented in Table 1. The results of the data obtained did not allow us to identify statistically significant differences in the characteristics of wrestlers representing both wrestling styles.

When analyzing the data, it was found that at the statistical significance level of $p > 0.05$, no reliable differences in the values of the indicators were found.

To assess the anaerobic performance of wrestlers, the Wingate test was used in the study for both the upper and lower extremities, with the resistance value for the upper extremities being 5.0% of body weight, and for the lower extremities – 7.5% of body weight.

Table 1. Morphological indicators and experience of wrestlers in the studied samples by wrestling styles (X±δ)

Indicators	Freestyle wrestling	Greco-Roman Wrestling	p-value
Age	17,5±2,4	17,5±1,6	0,93
Body length (cm)	169±9,5	170±8,8	0,42
Body weight (kg)	66,7±12,4	70,2±14,9	0,38
% Fat mass	13,2±3,5	14,3±4,6	0,15
% Lean Mass	61,3±9,6	60,5±11,2	0,59
Body mass index	24,7±1,8	25,8±3,7	0,12
Training experience (years)	6,3±1,8	6,4±1,5	0,36

Table 2. Comparison of the performance of the muscles of the upper and lower extremities of wrestlers of different wrestling styles in the anaerobic mode (x±δ)

Indicators	Freestyle wrestling	Greco-Roman Wrestling	p-value
Lower limb muscle performance in anaerobic mode			
Maximum power of legs (W)	606±50	712±70	0,77
Maximum relative power of legs (W/kg)	9,9±1,0	10,8±1,1	0,63
Average leg power (W)	522±62	573±56	0,23
Average relative power of legs (W/kg)	8,5±0,8	8,6±0,6	0,88
Time to reach max.power (s)	9,2±2,1	7,8±2,1	0,21
% power drop, %	29,2±7,8	37,6±14,0	0,11
Upper limb muscle performance in anaerobic mode			
Maximum Hand Power (W)	366±112	437±125	0,39
Maximum relative power of arms (W/kg)	6,0±0,9	6,5±0,7	0,02*
Average hand power (W)	312±80	360±79	0,01*
Average relative power of arms (W/kg)	5,1±0,7	5,4±0,6	0,51
Time to reach max.power (s)	15,0±3,8	12,4±4,2	0,05*
% power drop, %	18,4±7,4	24,5±8,6	0,03*

* - presence of reliable differences in indicators between groups of wrestlers by wrestling style (at $p < 0.05$).

Table 3. Comparison of the performance of the muscles of the upper and lower limbs of wrestlers of different wrestling styles in aerobic mode (x ± δ)

Indicators	Freestyle wrestling	Greco-Roman Wrestling	p-value
Lower limb muscle performance in aerobic mode			
Power on AnP (W)	187,5±30,6	200,5±33,8	0,48
Relative power on AnP (W/kg)	2,7±0,2	2,4±0,4	0,30
HR on AnP (bpm)	150,6±14,4	158,5±17,6	0,31
Relative oxygen consumption at AP (ml/min/kg)	36,1±4,8	35,9±4,7	0,93
Power per MPC (W)	281,3±48,4	263,1±43,8	0,52
Relative power at MPC (W/kg)	4,0±0,6	3,4±0,6	0,08
HR at VO_{2max} (bpm)	174,6±16,6	181,8±12,3	0,40
Relative oxygen consumption at failure (ml/min/kg)	47,4±3,2	47,7±7,7	0,85
Lower limb muscle performance in aerobic mode			
Power on AnP (W)	108,3±18,3	117,8±19,7	0,30
Relative power on AnP (W/kg)	1,7±0,2	1,7±0,3	0,97
HR on AnP (bpm)	160,5±10,8	159,0±9,2	0,77
Relative oxygen consumption at AP (ml/min/kg)	32,1±0,7	33,3±0,6	0,64
Power per MPC (W)	150,0±27,6	165,7±23,9	0,24
Relative power at MPC (Вт/кг)	2,5±0,4	2,5±0,2	0,95
HR at VO_{2max} (bpm)	181,5±10,5	183,4±10,1	0,69
Relative oxygen consumption at failure (ml/min/kg)	40,5±7,5	43,8±5,4	0,07

Table 4. Comparison of indicators characterizing the speed-strength abilities of wrestlers of different styles (x±δ)

Indicators		Freestyle wrestling	Greco-Roman Wrestling	p-value
Assessment of cardiovascular system using a multi-joint dynamometer				
Muscles of the anterior thigh	Mmax (Н*м)	302,0 ± 78,5	318,8 ± 91,5	0,42
	Motn. (N*m/kg)	3,74 ± 0,49	3,91 ± 0,64	0,69
	K	0,98 ± 0,58	0,72 ± 0,26	0,22
muscles of the anterior thigh	Mmax (Н*м)	77,0 ± 16,3	85,9 ± 26,2	0,29
	Motn. (N*m/kg)	0,98 ± 0,13	1,05 ± 0,19	0,16
	K	1,08 ± 0,31	0,88 ± 0,26	0,04*
Jump test				
SJ squat jump height m		0,26 ± 0,03	0,28 ± 0,04	0,43
CMJ squat jump height m		0,27 ± 0,03	0,30 ± 0,04	0,12
CMJ/SJ ratio		1,06 ± 0,10	1,07 ± 0,07	0,88
Hand dynamometry left	right	44, 9± 7,9	52,1 ± 7,4	0,34
	40,4 ± 6,2	45,5 ± 6,6	0,27	
10 m dash (sec)		1,85 ± 0,1	1,74 ± 0,1	0,01*
30 m sprint (sec)		4,30 ± 0,3	4,39 ± 0,2	0,05*
Seated Forward Bend (cm)		31,3±6,8	26±5,3	0,01*

* – presence of reliable differences in indicators between groups of wrestlers by wrestling styles (at p<0.05).

The results of the comparative analysis of the performance indicators of the upper and lower extremities in athletes in the anaerobic mode, engaged in freestyle and Greco-Roman wrestling, are presented in Table 2.

The results of the statistical analysis presented in Table 2 indicate the presence of reliable differences (p<0.05) in favor of Greco-Roman wrestlers in terms of maximum relative arm power (W/kg), average arm power (W), time to reach maximum power (s), and the percentage of power drop (W/kg).

At the same time, the data analysis revealed statistically significant differences in the anaerobic performance of the arms of Greco-Roman and freestyle wrestlers. At the same time, the anaerobic performance of the legs was approximately equal (Table 2).

The study showed that athletes involved in Greco-Roman wrestling demonstrate a higher level of anaerobic performance of the upper limbs compared to freestyle wrestlers. The difference is 19.4% in the maximum glycolytic power of the arm muscles (W),

8.3% in the relative maximum glycolytic power of the arm muscles, and 33.1% drop in power during the test. This is probably due to the specifics of the training process and competitive conditions in Greco-Roman wrestling, which involves performing dynamic movements (lifts, throws, resistance to the opponent) with the active use of the strength of the upper limbs. Thus, the obtained results allow us to conclude that a higher level of physical fitness of the upper limbs in Greco-Roman wrestlers is not just a necessary condition, but also the result of many years of practicing technical and tactical elements during the training process.

A high level of aerobic indicators can play a key role in the successful performance of wrestlers, since it allows the athlete to maintain a high intensity of wrestling throughout the entire match and effectively recover during the break between periods.

Table 3 presents the results of a comparative analysis of the aerobic performance of the muscles of the lower and upper limbs of wrestlers of different styles.

The obtained data characterizing the performance of the muscles of the upper and lower extremities of wrestlers of different wrestling styles in the aerobic mode did not show reliable differences between the groups, only one trend was recorded for the indicator of relative power when refusing to perform leg work during the test and the indicator of maximum oxygen consumption when working with the hands.

The assessment of speed-strength indicators was carried out using a wrist dynamometer and a multi-joint dynamometer from a static position. The indicators of maximum strength of the muscles of the anterior thigh and muscles of the anterior shoulder were assessed (Table 4). Pedagogical tests in 10 and 30 m running and a jump test were also carried out using the AMTI strain gauge platform. The results of the study (Table 4) show that athletes specializing in Greco-Roman wrestling demonstrate statistically significant superiority in terms of 10-meter running time, the coefficient "K", which characterizes the ratio of the gradient of the moment of force to the maximum manifested moment of force and flexibility compared to representatives of freestyle ($p < 0.05$).

Significant differences were found in such parameters as 10 and 30 m running time and flexibility indices (Table 4). Statistical analysis showed that Greco-Roman wrestlers have a higher speed (by 6.3%) of the studied index in the 10 m run test than freestyle wrestlers. At the same time, freestyle wrestlers demonstrate higher flexibility (by 11.8%). The results of the

analysis indicate that the most significant differences between the styles are observed in the indices of relative maximum glycolytic performance of arm muscles (W/kg), 10 and 30 m running time and flexibility.

Conclusions. Freestyle and Greco-Roman wrestlers have similar anthropometric characteristics, including body length, body weight, percentage of fat tissue, muscle mass and body mass index. Their level of athletic skill is also equal. However, Greco-Roman wrestlers have a more developed upper limb performance in the anaerobic mode than freestyle wrestlers. This is due to the specifics of the Greco-Roman wrestling technique, which involves performing dynamic movements: lifting, throwing and countering the opponent. Such actions require significant efforts from the upper limbs. It is important to note that all techniques in Greco-Roman wrestling are performed mainly with the help of the upper limbs both during competitions and during the training process. The data obtained should be used when planning the training process, taking into account the features of the limiting factors of the physical fitness structures of wrestlers of different wrestling styles when implementing a model-target approach to training athletes. This approach can also be used in other types of martial arts.

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