

A dependence of a sports result on physical development, morphofunctional and special strength preparedness data of weightlifters at the stage of preliminary basic training

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Purpose: *establishing the nature of the relationship between the sporting result of weightlifters 15–17 years and the level of their special physical and morphofunctional preparedness at the stage of preliminary basic training.*

Material & Methods: *30 athletes of the group of preliminary basic training of the second year of training were involved in the experiment. The study was conducted on the basis of the department of weightlifting and boxing of the Kharkov State Academy of Physical Culture and Children's Sports School "KhTP".*

Result: *correlation between the parameters of the morphofunctional, speed-power and special (competitive) readiness of weightlifters of preliminary basic training are identified. The conducted research shows that the result of competitive exercises of athletes specializing in weightlifting, at the stage of preliminary basic training depends on the strength and speed-strength preparedness.*

Conclusion: *it is established that the correlation between the results of competitive exercises and standing high jump, standing long jump, running at 30 m may indicate a correlation between the strength and speed-strength preparedness of athletes specializing in weightlifting at the stage of preliminary basic training.*

Keywords: *sports result, morphofunctional preparedness, preliminary basic training, competitive exercises, speed-strength preparedness.*

Introduction

Study of the dependence of the results of competitive exercises on the level of morphofunctional and special physical preparedness of weightlifters is an important condition for the construction of an effective training program for athletes at the initial stage. A number of studies have been devoted to revealing the interrelations between the indicators of physical development, the preparedness of athletes and the sport result in various power sports. V. M. Platonov, A. N. Vorobyev, I. L. Lisakovsky, V. G. Oleshko studied correlation dependence between morphological features, speed-strength qualities and sports-technical indicators in various power sports, in particular, in weightlifting [8; 1; 6]. A result of the research showed that as the sporting skills increased, the height of the jumping up increased and had an average reliable connection with the length of the body and legs, press, jerk, thrust and squats with the bar on the chest and shoulders. Based on the findings, the authors recommend jumping up from the ground as a test for selection for weightlifting. In the study of A. Dovgich, V. Y. Djim, and G. A. Roman, a reliable correlation was found between the biomechanical parameters of the projectile's movement with the level of development of motor abilities, power and speed-strength parameters when lifting weights with an index of speed-strength qualities for weight-performing classical exercises [3; 4; 11]. L. S. Dvorkin, V. A. Romanenko found the existence of interconnections between exercises in weightlifting and means of general physical training [2; 11]. Author recommends using the exercises "push-ups" and "lifting the trunk from the supine position on the back" as auxiliary to increase the level of strength in the exercises of weightlifters.

In this work, the studies of the dependence of the sports result on the data of physical development, the functional state of the cardiovascular and respiratory systems of the body, and the special strength training of weightlifters at the initial training stage.

Relationship of research with scientific programs, plans, themes. The scientific research was carried out on the theme of the Consolidated Plan of Research Work in the Sphere of Physical Culture and Sports for 2011–2015. On topic 3.7 "Methodological and organizational-methodological basis for determining the individual rate of physical condition of a person" (state registration number 0111U000192).

Purpose of the study: *establishing the nature of the relationship between the sporting result of weightlifters 15–17 years and the level of their special physical and morphofunctional preparedness at the stage of preliminary basic training.*

Material and Methods of the research

An experimental study of the nature of the relationship between the athletic result, the data of physical development, the functional state of the body of weightlifters was conducted on the basis of the Department of Weightlifting and Boxing of the Kharkov State Academy of Physical Culture and the Children's Sports School "KhTP". Experiment involved 30 athletes from the group of preliminary basic training of the second year of training. Training sessions for athletes were held five times a week for 2 academic hours on the weightlifting program for the Youth Sports School. At the end of the experiment, the indicators characterizing the state of morphofunctional,

speed-strength and special preparedness of weightlifters of the study group was determined.

Methods of research: according to the methodological approach to solving the problem and set tasks, research program included a set of research methods: analysis of scientific and methodological literature, method of anthropometry and studies of the state of the cardiovascular system, pedagogical experiment and methods of mathematical statistics.

Results of the research and their discussion

Table shows the data of physical development, functional state of the cardiovascular and respiratory systems of the body, special and strength training of weightlifters in the constant

experiment. Analysis of the values of mass-growth indicators, the length and circumference dimensions of the various parts of the body of athletes testifies to the relative homogeneity of the vast majority of the studied indicators within the group. The variability of the series for the length body size of weightlifters was negligible.

Coefficient of variation in terms of body length is 3,89%, body length at sitting is 4,02%, lower limb 4,15%, upper limb 4,5%, shoulder width 6,04%, transverse diameter of the chest – 8,36%. For circumference sizes, the coefficient of variation was higher. For example, the variation in chest circumference at rest was 4,58% of chest circumference (exhalation) – 4,95%, chest circumference (inspiration), 4,59%, shoulder – 6,19%, hip – 7,29%. Highest coefficient of variation is noted

Indicators of length and circumference dimensions, the state of the cardiovascular and respiratory systems, testing of special physical qualities and competitive exercises of weightlifters of the study group (n=30)

Indicators	$\bar{X} \pm m$	V, %
Length and circumference dimensions		
Body length, cm	170,35±1,99	3,89
Body weight, kg	72,60±2,17	8,48
Body length at sitting, cm	92,10±0,32	4,02
Length of lower limb, cm	78,05±0,51	4,15
Length of upper limb, cm	70,91±0,32	4,35
Shoulder width, cm	51,75±0,36	6,04
Chest circumference at rest, cm	100,24±2,17	4,58
Chest circumference on exhalation, cm	98,07±2,17	4,95
Chest circumference on inspiration, cm	103,41±2,17	4,59
Shoulder circumference, cm	36,20±0,92	6,19
Hip circumference, cm	57,70±1,29	7,29
Transverse diameter of the chest, cm	38,15±0,34	8,36
State of the cardiovascular and respiratory systems		
HR at rest (beats·min ⁻¹)	64,32±1,33	9,52
BPs at rest (mm Hg)	121,25±1,64	5,27
BPd at rest (mm Hg)	80,35±1,98	8,53
PWC170, kgm·min ⁻¹	1343,10±48,12	13,87
PWC/kg, kgm·min ⁻¹ ·kg	20,21±1,07	21,82
MOC, ml·min ⁻¹	3979,10±126,59	12,32
MOC /kg, ml·min ⁻¹ ·kg ⁻¹	59,80±2,95	19,12
Cooper test, m	2448,3475,98±	11,74
Vital capacity of lungs, l	4,23±0,16	15,38
Vital index, ml kg ⁻¹	67,60±0,78	5,32
Breathing rate	12,80±0,55	5,96
Breathing inspiration, s	48,44±2,69	21,30
Retention of breath on exhalation, s	31,62±3,25	29,50
Special physical qualities		
Run at 30 m, s	5,30±0,35	5,19
Shuttle run 4x9 m, s	10,30±0,90	3,34
Jump up, cm	10,30±1,37	7,30
Standing long jump, cm	217,7±2,63	6,91
Lifting body, number of times per minute	51,69±1,55	9,19
Push-ups, number of times	42,46±2,58	12,49
Pull-ups, number of times	12,60±2,25	19,73
Jump over rope on 2 legs, number of times	86,23±2,80	6,46
Competitive exercises		
Snatch classic, kg	19,24±0,45	16,04
Clean and jerk classic, kg	26,73±0,41	10,56
Snatch, clean, and jerk combination, kg	45,97±0,76	11,42
Back squat, kg	43,65±0,72	11,45
Benchpress, kg	31,86±0,44	9,55
Deadlift, kg	44,36±0,55	8,57

for the athlete's body weight – 8,48%.

In athletes of the study group, the average heart rate, as seen from the table, is $64,32 \text{ beats} \cdot \text{min}^{-1}$. The values of the standard quadratic deviation and the coefficient of variation were $6,22 \text{ beats} \cdot \text{min}^{-1}$ and 9,52%. It was established that the BPs of the athletes of the study group was at rest in the dormant state, the mean value was $121,25 \pm 1,64 \text{ mm Hg}$. For BPd, the average in the group is close to the lower limit of the age limit – $80,35 \pm 1,98 \text{ mm Hg}$. Results of the submaximal test of Valund-Shestrand indicate a sufficient level of physical preparedness for the athletes of the study group. Values of the standard deviation and coefficient of variation for the PWC170 were $48,12 \text{ kgm} \cdot \text{min}^{-1}$ and 13,87%. Average value of PWC170 is $1343,10 \pm 48,12 \text{ kgm} \cdot \text{min}^{-1}$, which exceeded the standards for healthy untrained children. The average values of the MOC were in absolute terms and the calculation per kilogram of body weight, respectively $3979,10 \pm 0,126,59 \text{ ml min}^{-1}$ and $59,80 \pm 2,95 \text{ ml kg}^{-1} \cdot \text{min}^{-1}$, 12-minute Cooper test – $2448,34 \pm 75.98 \text{ m}$. and characterized a sufficient level of aerobic endurance. Indicators of the VCL of the athletes were $4,23 \pm 0,16 \text{ l}$. and were within the norm for healthy adolescents. Values of the standard deviation and coefficient of variation for this indicator were equal $0,60 \text{ l}$ and 15,38%. Vital index of weightlifters at the stage of ascertaining experiment was $67,60 \pm 0,78 \text{ ml kg}^{-1}$. Such VI values correspond to the average level of physical health. Respiration rate of athletes was within the normal range for healthy adolescents and averaged $12.80 \pm 0,55$ times, the coefficient of variation was 15,96%. Significant variability of the results was observed in the test parameters of Stange and Genci. The average values of these indicators were $48,44 \pm 2,69$ times and $31,62 \pm 3,25$ times, coefficients of variation – 21,30% and 29,50% respectively. Thus, the physiological state of the cardiovascular and respiratory systems of the body of the athletes of the study group is satisfactory, the values of the studied indicators were within the limits of the norm and characterized a sufficient level of physical performance [6].

Average result in standing long jump was $217,7 \pm 2,63 \text{ cm}$; coefficients of variation – 6,91%. In the jump to a certain height, the average result was $10,30 \pm 1,37 \text{ cm}$, coefficients of variation – 7,30%. Average results in the exercises that characterize the power capacity, namely, pull-up and push-up, were $12,60 \pm 2,25$ times and 42,58 times; coefficients of variation was 19,73% i 12,49% respectively. For the indicators characterizing speed and agility, there was a slight variability in the results. The coefficient of variation for run indicator 30 m is equal to 5,19%; shuttle run – 3,34%. For indicators characterizing endurance, there was a slight variation in the following results, the coefficient of variation in terms of lifting body – 9,19%, respectively jump over rope on 2 legs – 6,46%.

To establish the dependence of the sports result on the morphofunctional indicators and the level of special physical preparedness of the athletes, a correlation analysis is performed. It is established that all indicators correlate with each other, but the degree of these interrelations is different. A correlation was found between the result of a classic snatch and length and body weight ($r=0,70$, $r=0,85$), hip circumference ($r=0,66$), chest on inspiration, expiration, breath hold ($r=0,69$; $r=0,67$). Training weightlifters to expand the chest increase the amount of muscle involved in the work, which is confirmed by the correlation coefficients between these indicators. Relationship between the result of squatting and hip circumfer-

ence may indicate that to achieve the best result in this exercise, you should work on increasing the mass of the muscles of the hip.

Interrelationships found between the classic snatch and the maximum oxygen absorption and PWC170 ($r=0,45$ and $r=0,57$) can be explained by an increase in the indices of aerobic endurance and the level of physical preparedness of the organism that occur in the process of sports training. Noted an inverse relationship between the results in the snatch classical and run at 30 ($r=-0,63$), which can be explained by the fact that when the snatch classical and run at 30 m to the work involved various types of muscle fibers. In the snatch classical fast-contractile fibers are involved, in the run-slow-contractile fibers. Since when performing competitive exercises in weightlifting, fast-contractile muscle fibers are involved in work, their proportion in the muscles of the legs is increased and the athlete can not perform physical work for a long time, which is manifested in the negative value of the correlation coefficient between these indicators.

A correlation was found between the results in the classic jerk and long jump and at a certain height ($r=0,43$, $r=0,67$), which may indicate a correlation between the power and speed-strength preparedness of weightlifters at the initial training stage.

For the result in the clean and jerk classic, a correlation was found with the length and mass of the body ($r=0,65$, $r=0,80$), chest circumference in inspiration, exhalation ($r=0,74$, $r=0,72$), and pull-ups ($r=0,40$), push-ups ($r=0,51$). When performing the clean and jerk classic and the flexion-extension exercises on the uneven bars, the same muscle groups are involved in the work, including deltoid, triceps. The overwhelming majority of athletes in weightlifting during the jerk use a technique in which the exercise is performed with various techniques [7]. The work of the muscles using this technique of pushing is as close as possible to the work of the muscles in the push-ups exercise, as evidenced by the correlation relationship between these exercises.

For the result in a jerky thrust, a correlation was observed with the chest circumference on inspiration, exhalation ($r=0,55$; $r=0,60$). During strength training, the relationship between the result of this exercise and PWC170 and MOC, vital capacity of the lungs ($r=0,57$; $r=0,55$; $r=0,42$ respectively). In our study, a correlation was found between the result of jerky thrust and a standing long jump ($r=0,52$), which may indicate the relationship between the power and speed-strength preparedness of athletes specializing in weightlifting, at the stage of preliminary basic training.

It has been established that the most important morphological indicators for ensuring a high sport result in competitive exercises for weightlifters are the length of the lower limbs, upper limbs, chest and hip circumference [4]. The results of our correlation analysis are confirmed by the data obtained in Dvorkin study (1992), who showed that a high correlation relationship (from $r=0,6$ to $r=0,9$) with the level of achievement in competitive weightlifter exercises has the following indicators: with a snatch classic – length, body weight, chest and hip circumference, length of the lower limb, length of the upper limb. With the jerk classic – body mass, girth of the shoulder, chest, length of the upper limb, the length of the lower limb, the width of the shoulders [5].

Conclusions

It has been established that the most significant morphological indicators for ensuring a high sport result in competitive exercises for weightlifters are hip circumference, circumference of the shoulder muscles, and circumference of the chest.

A correlation was found between the results of competitive

exercises and jumps up from the place, standing long jump, running at 30 m, which may indicate a correlation between the strength and speed-strength preparedness of athletes specializing in weightlifting, at the stage of initial training.

Prospect for further research will be directed towards of determining the structure of the preparedness of weightlifters at the stage of preliminary basic training.

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