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Interrelation of psychophysiological indicators and physical readiness of qualified wrestlers

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Purpose: to establish the features and degree of interrelation of psychophysiological indicators and physical readiness among qualified wrestlers.

Material & Methods: analysis of scientific and methodological information, generalization of best practical experience, psychophysiological methods of research, pedagogical testing, methods of mathematical statistics. Thirty qualified wrestlers took part in the research, at the age of 19–22.

Results: the results of the study indicate the uniformity of the indices of simple and complex reactions, since the coefficient of variation lies in the range from 6,04% to 10,94%. The indicators of specific perceptions have a high coefficient of variation (from 15,56% to 48,82%), this is because specific perceptions more individually reflect the psychophysiological state of qualified wrestlers.

Conclusions: it is determined that the most informative indicators of physical readiness are the tests of the wrestler's strength abilities, which have reliable connections with 11 psychophysiological indicators, followed by tests characterizing the strength endurance, with five statistically significant interrelations.

Keywords: qualified wrestlers, correlation, psychophysiological indicators, physical readiness.

Introduction

Modern sports of higher achievements make high demands on all sides of the athlete's preparedness, in addition, the main problem of the sport of higher achievements is the impossibility of an infinite increase in training loads, which leads to the need for further searching for new, more effective pedagogical tools and methods in the system of training highly qualified athletes [4; 8; 9; 23].

Ability to conduct a large number of complex technical and tactical actions, taking into account possible actions of an opponent in a duel, making bold and instant decisions in extreme situations against the impact of confounding factors – all this is a prerequisite for success in the competitive activity of wrestlers and reflects the level of their psychological preparedness [14–16, 22].

Psychophysiological functions of a person depend on the characteristics of the higher nervous system, characterizing the process of formation and improvement of special motor skills in conditions of sports activity [3; 10; 19; 21].

Also, the physical preparedness of wrestlers is one of the most important basis for the overall structure of their preparedness, which determines the level of special working capacity, on which depends the reliability of the implementation of technical actions [2; 5; 11; 20].

Relationship of research with scientific programs, plans, themes. The work was carried out according to the plan of research of the Kharkov State Academy of Physical Culture.

Purpose of the study: to establish the features and degree of interrelation of psychophysiological indicators and physical

readiness of qualified wrestlers.

Objectives of the study:

- to determine the psychophysiological indicators and the level of physical fitness of qualified wrestlers;
- establish the degree of correlation between psycho-physiological indicators and the level of physical readiness of qualified wrestlers.

Material and Methods of the research

Research methods: analysis of scientific and methodological information, generalization of best practical experience, psychophysiological methods of research, pedagogical testing, methods of mathematical statistics.

Results of the research and their discussion

Based on the analysis of scientific and methodological information and generalization of best practical experience, it has been established that one of the main tasks of the training process of qualified wrestlers is the development of physical qualities and the enhancement of psychological resistance to confounding factors [12; 17; 18].

Pedagogical testing was carried out to determine and establish the features of the relationship between psycho-physiological indicators and physical preparedness.

Evaluation of sensorimotor reactions and specific perceptions was performed using a set of tests developed for tablet PCs [1; 21]. These tests were divided into three groups: simple sensorimotor reactions, complex sensorimotor reactions, specific perceptions.

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Table 1 presents the parameters of sensorimotor responses and specific perceptions of the development of qualified wrestlers.

The coefficient of variation was used to determine the homogeneity of the sample observations. It is believed that if the coefficient of variation does not exceed 10%, then the sample can be considered homogeneous [7]. The received data testify to homogeneity of indicators of simple and complex reactions of the examined athlete, as the coefficient of variation is in the range from 6,04% to 10,94%. The indicators of specific perceptions have a high coefficient of variation (from 15,56% to 48,82%), this is because specific perceptions more individually reflect the psychophysiological state of qualified wrestlers (Table 1).

Physical training of wrestlers has its own specific features, which must be taken into account in the construction of the training process and the distribution of the load [6; 13]. It is necessary to take into account the capabilities of the athlete's body and the development of special physical qualities when selecting the means and methods of training. Analysis of the literature [5; 6; 11] on the development of special physical qualities in wrestlers shows that the level of speed-strength preparedness of an athlete is of great importance in performing a variety of technical actions. Thus, the ability to selectively show significant muscle effort allows the wrestlers to successfully perform a combination of techniques, timely use countermeasures. With spurs, throws, and holdings, special endurance is important, as well as for quick recovery during short-term rest between periods (30 s) and between fights (the closer to the final meetings, the shorter the rest intervals).

In this regard, to assess the physical preparedness of wrestlers, we used various methods of testing the coordination abilities, power endurance, speed-strength qualities, general and special endurance. On the basis of these test methods, the following indicators of the physical readiness of qualified Greco-Roman wrestlers were obtained (Table 2).

The peculiarity and degree of interrelation of psychophysi-

ological indices and the results of physical readiness was determined by the method of correlation analysis (Table 3). According to the indicators of the table, the critical value of the sample correlation coefficient for the sample n=30 is equal to r=0,361 [7].

The correlation analysis of the relationship between psychophysiological indicators and physical readiness showed that simple motor skills interact with speed-strength abilities in the test, throwing a stuffed ball (3 kg) from behind the head forward with both hands (r=0,40).

Stability to the knocking factors has statistically significant interrelationships with the speed-strength abilities, standing long jump (r=-0.37), back arch throw (r=0.45) and throws roll (r=0.52), push-ups for 20 s (r=-0.36); with power endurance in the tests: the maximum number of sit-ups with the partner (r=-0.38), the maximum number of pull-ups on the crossbar (r=-0.43).

The selection reaction from static objects has an interrelation with the speed-strength abilities shown in the test: throwing a printed ball (3 kg) from behind the head forward with two hands (r=-0.37).

An analysis of the response rates to a moving object revealed a statistically significant relationship with the maximum amount of push-ups (r=0,39), characterizing the strength endurance of the wrestlers.

The discrimination reaction is reliably associated with the speed-strength abilities in the pull-up test for 20 seconds (r=-0,44) and with the coordination abilities shown in the test of 15 coups on the "bridge stand" (r=0,37).

The speed of reproduction of a given line is influenced by such indicators of physical readiness as speed-strength qualities (run test at 30 m (r=0,43), turn rolls (r=0,40) and deflection (r=0,46), climbing on the 5 m rope without the help of the feet (r=0,49)) and strength endurance (the maximum number of sit-ups with the partner (r=-0,40), the maximum number of pull-ups on the crossbar (r=-0,40)).

Table 1
Model parameters of sensorimotor reactions and specific perceptions of qualified wrestlers (n=30)

| No. i/o | Indicators of sensorimotor reactions and specific perceptions | $\bar{\mathbf{x}}$ | δ | V, % | m | | | | | | |
|-----------------------|--|--------------------|-------|-------|-------|--|--|--|--|--|--|
| Simple reactions | | | | | | | | | | | |
| 1. | Simple motor skills (number of clicks per 10 s) | 25,50 | 1,54 | 6,04 | 0,28 | | | | | | |
| 2. | Resistance to knock-down factors (%) | 80,00 | 6,37 | 7,96 | 1,16 | | | | | | |
| 3. | Simple visual-motor reaction (ms) | 230,00 | 15,45 | 6,72 | 2,82 | | | | | | |
| 4. | Simple auditory motor reaction (ms) | 212,40 | 14,54 | 6,85 | 2,66 | | | | | | |
| Complicated reactions | | | | | | | | | | | |
| 5. | Selection reaction from static objects (ms) | 636,30 | 63,34 | 9,95 | 11,56 | | | | | | |
| 6. | Reaction to a moving object (ms) | 26,60 | 2,91 | 10,94 | 0,53 | | | | | | |
| 7. | Reaction discrimination (ms) | 281,20 | 18,16 | 6,46 | 3,32 | | | | | | |
| 8. | Selection response from dynamic objects (ms) | 366,40 | 35,72 | 9,75 | 6,52 | | | | | | |
| Specific perceptions | | | | | | | | | | | |
| 9. | Assessment of the sense of tempo (80 beats min ⁻¹) (ms) | 38,00 | 13,34 | 35,11 | 2,44 | | | | | | |
| 10. | Evaluation of line accuracy reproduction (mm) | 0,50 | 0,12 | 24,00 | 0,02 | | | | | | |
| 11. | Playback speed of the preset line (mm s ⁻¹) | 103,50 | 50,53 | 48,82 | 9,22 | | | | | | |
| 12. | Assessment of the perception of the change in the size of the object (s) | 0,90 | 0,14 | 15,56 | 0,03 | | | | | | |

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Table 2 Model indicators of physical readiness of qualified Greco-Roman wrestlers (n=30)

| Model indicators of physical readiless of qualified Greco-Rollian wrestiers (II-30 | | | | | | | | | | | | |
|--|---|--------|-------|-------|------|--|--|--|--|--|--|--|
| No. i/o | Test | x | δ | V, % | m | | | | | | | |
| Speed-strength abilities | | | | | | | | | | | | |
| 1. | Running on 30 m (s) | 4,98 | 0,31 | 6,23 | 0,06 | | | | | | | |
| 2. | Leap in height (cm) | 50,97 | 4,79 | 9,40 | 0,87 | | | | | | | |
| 3. | Leap in length (cm) | 219,20 | 8,94 | 4,08 | 1,63 | | | | | | | |
| 4. | Throwing jerks 10 times (s) | 28,13 | 2,22 | 7,89 | 0,40 | | | | | | | |
| 5. | Throws roll 10 times (s) | 30,90 | 2,29 | 7,41 | 0,42 | | | | | | | |
| 6. | Throw the printed ball (3 kg) back with both hands (cm) | 9,89 | 0,72 | 7,28 | 0,13 | | | | | | | |
| 7. | Throw a printed ball (3 kg) forward from behind the head (cm) | 8,89 | 0,67 | 7,54 | 0,12 | | | | | | | |
| 8. | Climbing a rope without the feet (s) | 6,70 | 0,72 | 10,75 | 0,13 | | | | | | | |
| 9. | Pulling on the crossbar for 20 seconds (number of times) | 15,57 | 1,15 | 7,39 | 0,21 | | | | | | | |
| 10. | Push-ups for 20 s (number of times) | 30,90 | 2,33 | 7,54 | 0,43 | | | | | | | |
| 11. | Flexion of the trunk lying on the back for 20 s (number of times) | 18,77 | 1,33 | 7,09 | 0,24 | | | | | | | |
| | Strength endurance | | | | | | | | | | | |
| 12. | Lifting the legs on the gymnastic wall (number of times) | 18,47 | 1,50 | 8,12 | 0,27 | | | | | | | |
| 13. | Squatting with a partner of equal weight (number of times) | 22,23 | 2,38 | 10,71 | 0,43 | | | | | | | |
| 14. | Pulling on the crossbar (number of times) | 30,43 | 4,06 | 13,34 | 0,74 | | | | | | | |
| 15. | Push-ups number of times) | 64,43 | 4,34 | 6,74 | 0,79 | | | | | | | |
| 16. | Flexion-extension of hands in the rest on the uneven bars (number of times) | 49,83 | 4,44 | 8,91 | 0,79 | | | | | | | |
| 17. | Partner's uplift of the trunk from behind (number of times) | 15,90 | 1,35 | 8,49 | 0,25 | | | | | | | |
| | Coordination abilities | | | | | | | | | | | |
| 18. | Running on the "bridge stand" (5 – to the left, 5 – to the right) (s) | 15,09 | 1,35 | 8,95 | 0,25 | | | | | | | |
| 19. | 10 somersaults forward (s) | 12,15 | 1,17 | 9,63 | 0,21 | | | | | | | |
| 20. | Turnovers on the "bridge stand" 15 times (s) | 34,83 | 2,06 | 5,91 | 0,38 | | | | | | | |
| | General endurance | | | | | | | | | | | |
| 21. | Running on 800 m (s) | 155,83 | 5,65 | 3,63 | 1,03 | | | | | | | |
| 22. | Running 2x800 m (1 min rest) (s) | 320,33 | 10,27 | 3,21 | 1,88 | | | | | | | |
| Special endurance | | | | | | | | | | | | |
| 23. | 1 series of 15 back arch throw (s) | 32,13 | 3,34 | 10,40 | 0,61 | | | | | | | |
| 24. | 2 series of 15 back arch throw (s) | 32,83 | 4,06 | 12,37 | 0,74 | | | | | | | |
| 25. | 3 series of 15 back arch throw (s) | 35,97 | 5,46 | 15,18 | 1,00 | | | | | | | |
| 26. | Sum of three series of back arch throw (s) | 100,93 | 12,09 | 11,98 | 2,21 | | | | | | | |

The perception of the change in the size of the object has an interrelation with the overall endurance, manifested in running at 800 m (r=0,42) and running 2x800 m (r=0,38).

The parameters of a simple visual-motor reaction, a simple auditory motor reaction, a selection reaction from dynamic objects, an appreciation of the sense of tempo, and an estimation of the reproduction of the accuracy of a given line do not have statistically reliable connections with physical readiness.

The analysis revealed a number of shortcomings in the physical preparedness of the athletes under study and made it possible to establish that when planning training loads it is necessary to increase the requirements for the level of development of the special working capacity of wrestlers taking into account the measure of manifestation of psychophysiological indicators in conditions of competitive activity.

Conclusions

The results of the study indicate the homogeneity of the indices of simple and complex reactions, since the coefficient of variation lies in the range from 6.04% to 10.94%. The indica-

tors of specific perceptions have a high coefficient of variation (from 15,56% to 48,82%). This is due to the fact that specific perceptions reflect, to a greater extent, an individual, genetically conditioned, characteristic for a particular athlete's psychophysiological state.

The materials of the research showed that the most important indicators of physical readiness are the tests of the fighter's speed-strength abilities, which have connections with 11 psychophysiological indicators, followed by tests showing force endurance, with 5 statistically significant interrelations.

It is revealed that the indices of physical readiness of qualified wrestlers are characterized by predominantly low variability in testing the speed-strength qualities, coordination abilities, general and strength endurance, and the average in the results of special endurance. This gives grounds to argue that in the training process of qualified Greco-Roman wrestlers it is necessary to devote more time to the development of special endurance.

Further research will be aimed at determining the relationship between physical development and psychophysiological indicators of wrestlers.

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Table 3 Interrelation of psychophysiological indicators and physical readiness of qualified wrestlers (n=30)

| Indicators | Simple reactions | | | | | Complicated reactions | | | | Spec | | | |
|----------------------------------|------------------|-------|-------|-------|-------|-----------------------|-------|-------|-------|-------|-------|-------|-------|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| | 13 | 0,16 | 0,17 | 0,29 | 0,08 | -0,14 | -0,03 | 0,01 | -0,02 | 0,02 | -0,06 | 0,43 | -0,28 |
| တ္ | 14 | 0,16 | -0,37 | -0,04 | 0,07 | -0,12 | -0,28 | -0,15 | 0,12 | -0,10 | 0,02 | -0,29 | 0,20 |
| Speed-strength abilities | 15 | 0,24 | -0,33 | -0,11 | -0,07 | -0,02 | -0,20 | -0,11 | 0,04 | -0,13 | -0,01 | -0,34 | 0,05 |
| abi | 16 | -0,22 | 0,45 | 0,03 | -0,31 | -0,11 | 0,01 | 0,28 | -0,03 | 0,16 | -0,04 | 0,40 | -0,12 |
| Jt. | 17 | -0,25 | 0,52 | 0,04 | -0,25 | -0,06 | 0,11 | 0,29 | -0,03 | 0,20 | -0,02 | 0,46 | -0,14 |
| euć | 18 | 0,26 | -0,26 | -0,07 | 0,03 | -0,21 | -0,11 | -0,20 | 0,03 | -0,23 | 0,06 | -0,29 | -0,03 |
| -str | 19 | 0,40 | -0,20 | -0,11 | -0,02 | -0,37 | -0,24 | -0,25 | -0,10 | -0,29 | -0,02 | -0,22 | -0,10 |
| pe | 20 | 0,07 | 0,06 | 0,09 | -0,02 | -0,13 | 0,03 | -0,04 | -0,06 | 0,23 | -0,06 | 0,49 | -0,14 |
| Spe | 21 | 0,30 | -0,34 | -0,21 | 0,15 | -0,11 | -0,21 | -0,44 | -0,01 | -0,21 | 0,00 | -0,25 | 0,22 |
| o, | 22 | 0,31 | -0,36 | -0,12 | 0,14 | -0,09 | -0,19 | -0,31 | -0,02 | -0,11 | -0,07 | -0,22 | 0,20 |
| | 23 | 0,20 | -0,18 | -0,22 | 0,08 | -0,04 | -0,14 | -0,30 | 0,04 | -0,24 | -0,04 | -0,33 | 0,30 |
| | 24 | -0,20 | -0,12 | 0,14 | -0,04 | 0,17 | 0,24 | 0,06 | -0,02 | 0,07 | 0,06 | -0,27 | -0,27 |
| Strength Endurance | 25 | 0,08 | -0,38 | -0,17 | 0,04 | -0,10 | -0,03 | -0,29 | -0,06 | -0,20 | -0,13 | -0,40 | -0,13 |
| Strength | 26 | 0,10 | -0,43 | 0,11 | 0,30 | 0,27 | 0,33 | -0,17 | 0,24 | 0,02 | 0,29 | -0,40 | 0,17 |
| Stre | 27 | -0,06 | -0,11 | 0,04 | -0,01 | 0,09 | 0,39 | -0,04 | -0,18 | -0,04 | 0,01 | -0,36 | -0,11 |
| э ш | 28 | -0,01 | -0,17 | -0,04 | -0,01 | 0,03 | 0,33 | -0,15 | -0,26 | -0,03 | -0,04 | -0,26 | -0,01 |
| | 29 | -0,11 | -0,11 | 0,23 | 0,00 | 0,12 | 0,04 | 0,05 | -0,08 | 0,04 | 0,12 | -0,06 | -0,36 |
| ation | 30 | -0,26 | 0,18 | 0,02 | -0,26 | 0,14 | -0,07 | 0,23 | -0,13 | -0,16 | -0,16 | 0,02 | -0,13 |
| Coordination | 31 | -0,32 | 0,25 | 0,08 | -0,27 | 0,08 | 0,02 | 0,26 | -0,18 | 0,00 | -0,10 | 0,22 | -0,23 |
| | 32 | -0,30 | 0,18 | 0,15 | -0,09 | 0,19 | 0,01 | 0,37 | 0,03 | -0,08 | 0,00 | 0,04 | 0,05 |
| General and special endurance | 33 | 0,05 | 0,07 | -0,31 | -0,11 | -0,17 | -0,27 | -0,13 | 0,03 | -0,23 | -0,17 | 0,16 | 0,42 |
| e co | 34 | 0,18 | 0,13 | -0,25 | -0,06 | -0,21 | -0,20 | -0,08 | 0,05 | -0,19 | -0,08 | -0,02 | 0,38 |
| eral and spo | 35 | 0,02 | 0,19 | -0,08 | -0,01 | -0,12 | -0,14 | -0,05 | 0,05 | 0,02 | 0,07 | 0,01 | 0,09 |
| al ar dur | 36 | -0,10 | 0,31 | -0,01 | -0,07 | -0,06 | -0,02 | 0,09 | 0,02 | -0,01 | 0,14 | -0,15 | 0,06 |
| en | 37 | -0,16 | 0,32 | -0,08 | -0,12 | -0,03 | -0,08 | 0,18 | 0,12 | -0,11 | 0,11 | -0,30 | 0,14 |
| Ger | 38 | -0,10 | 0,30 | -0,06 | -0,08 | -0,06 | -0,08 | 0,10 | 0,07 | -0,05 | 0,11 | -0,18 | 0,11 |

Remark. 1–12 psychophysiological indicators: 1 – simple motor skills (number of clicks per 10 s), 2 – resistance to knock-down factors (%), 3 – simple visual-motor reaction (ms), 4 – simple auditory motor reaction (ms); 5 – selection reaction from static objects (ms), 6 – reaction to a moving object (ms), 7 – reaction discrimination (ms), 8 – selection response from dynamic objects (ms); 9 – Assessment of the sense of tempo (80 beats min⁻¹) (ms), 10 – evaluation of line accuracy reproduction (mm), 11 – playback speed of the preset line (mm s⁻¹), 12 – assessment of the perception of the change in the size of the object (s). 13–38 indicators of physical readiness: 13 – running on 30 m (s), 14 – leap in height (cm) (Abalakov's method) (cm), 15 – leap in length (cm), 16 – throwing jerks 10 times (s), 17 – throws roll 10 times (s), 18 – throw the ball (3 kg) back with both hands (cm), 19 – throw a printed ball (3 kg) forward from behind the head (cm), 20 – climbing a rope without the feet (s), 21 – pulling on the crossbar for 20 seconds (number of times), 22 – push-ups for 20 s (number of times), 23 – flexion of the trunk lying on the back for 20 s (number of times); 24 – lifting the legs on the gymnastic wall (number of times), 25 – squatting with a partner of equal weight (number of times), 26 – pulling on the crossbar (number of times), 27 – push-ups number of times), 28 – flexion-extension of hands in the rest on the uneven bars (number of times), 29 – partner's uplift of the trunk from behind (number of times); 30 – running on the "bridge stand" (5 – to the left, 5 – to the right) (s), 31 – 10 somersaults forward (s), 32 – turnovers on the "bridge stand" 15 times (s); 33 – running on 800 m (s), 34 – running 2x800 m (1 min rest) (s); 35 – 1 series of 15 back arch throw (s), 36 – 2 series of 15 back arch throw (s), 37 – 3 series of 15 back arch throw (s), 38 – sum of three series of back arch throw (s).

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