

**DETERMINATION OF INDICATORS OF FEMALE ATHLETES' SPEED
MOVEMENT ENGAGING IN ROWING**

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Purpose: to determine the assessment criteria of speed abilities as indicators of the basis for the performance of female athletes' motor actions.

Materials and methods: the analysis of speed abilities of 13-18 years female athletes engaging in rowing during the modeled training and competitive activity is carried out according to the developed method, namely: rate, time and speed of single movement, movement frequency, sensor motor response to sound and light stimulus.

Results: the obtained results characterize the individual peculiarities of psychophysiological features of female athletes' organism in terms of modeling of sports activities, which makes it possible to make adjustments during the management of the training process.

Conclusions: based on the analysis of research results the assessment criteria of physical quality of speed and its components were developed: rate, time of single movement speed, movement frequency to determine the prospects of female athletes as one of the components of the selection methodology. The proposed technique is recommended to be used at different stages of improving sports training.

Keywords: female athletes, rowing, rate, time, single speed movement, movement frequency, time of sensor motor response to sound and light stimuli.

Introduction

Speed is a physical quality that is specifically manifested in various human motor actions. The speed of motor reaction is determined by fixing the time from light or auditory stimulation to the beginning of motor actions. Speed is primarily determined by nervous activity, which corrects movements. It largely depends on the perfection of sports equipment, muscle strength and elasticity, joints mobility [1].

The development of speed and speed-power qualities at school age is determined by the indicators of morpho-functional systems, which characterize the capabilities of an organism and close connection of functional systems with physical fitness [4, 5, 6].

Connection of the research with scientific programs, plans, topics. The research is carried out within the framework of the department theme of the research work "Biological bases (anatomical and morphological, physiological and biochemical) of optimization of the female athletes' training process in different sports and during physical education classes".

Purpose of the research: to develop the assessment criteria of speed abilities by rate of movements, time and speed of single movement, movement frequency, that ensures the performance of motor actions in certain conditions during a particular period of time.

Material and Methods of the research

The research carried out among female athletes of different ages specialize in rowing. The first group (21 people) - 13 - 14 years had the second sports category. The second group consisted of 20 people, aged 15-16 years, with the second and first level of sports qualification. The third group included 18 athletes, aged 17-18 years, who had the first category and Candidates for Masters of Sports of Ukraine.

The speed abilities of female athletes according to the developed method were studied [2, 3, 4, 7, 8]. Female athletes performed hand movements on a special stand

from target to target. During the first period of the test it was necessary to gain the maximum speed, duration of which was 15 s. The second period lasts 60 s. required maintaining the achieved speed. The speed endurance was studied in the third period, lasting 15 s., where the motor task was performed at the maximum speed. Sensory responses to light and sound stimuli were also studied.

Results of the research

Table 1 shows the time of sensory-motor response to sound stimulus. The time of female athletes aged 13-14 years is more by 0,012 s., i.e by 6,06% in comparison with 15-16 years and by 0,024 s. (11,43%) in comparison with female athletes aged 17-18 years.

Table 1

Indicators of physical quality of female athletes' movement speed engaged in rowing

Indicators		13 - 14 years			15 - 16 years			17-18 years		
		M ± m	Max.	Min.	M ± m	Max.	Min.	M ± m	Max	Min.
The first period	Rate (number of movements)	22,5±0,8	26	15	26,05±1,2	37	19	27,0±1,2	31	22
	Time of one movement	0,67	0,57	0,83	0,57	0,41	0,72	0,58	0,48	0,68
	Speed of one movement	0,44	0,52	0,36	0,52	0,74	0,42	0,54	0,62	0,44
	Frequency	1,48	1,73	1,20	1,73	2,47	1,27	1,80	2,07	1,47
The second period	Temp (number of movements)	25,5	33,7	29,05	29,0	32	23	30,5	37	25
	Time of one movement	0,53	0,44	0,66	0,51	0,46	0,65	0,50	0,40	0,60
	Speed of one movement	0,51	0,67	0,43	0,58	0,63	0,47	0,60	0,74	0,50
	Frequency	1,71	2,25	1,47	1,53	2,13	1,53	2,0	2,47	1,68

The response to the light signal in the younger group was more by 0,042 s. (19,35%), in comparison with female athletes in the middle group and by 0,056 s. (16,5%) than in the senior.

In determining the trained effect in the first period in the group of female athletes aged 13-14 years, the rate was lower by 3,7 movements (16,59%) than in

athletes aged 15-16 years, and by 4,7 movements (21,08%) of 17-18 years. The last group showed an increase in pace per movement (3,85%).

The results characterize the unequal reaction of female athletes of all ages, especially in 15-16 years age group, as well as different levels of sports training in all female athletes, especially of 13-14 and 17-18 years.

The time of one movement of female athletes aged 13 -14 years increased by 0,09 s. (16,67%) than in female athletes aged 15-16 years old and by 0,117 s. (21,08%) in contrast to 17-18 year old. Thus, the time of one movement [1, 5] from the younger to the older group decreases, that characterizes the improvement of one of the speed indicators.

The movement frequency of female athletes increases with age. The movement frequency of female athletes aged 15 - 16 years was higher by 0,25 Hz (16,89%) and in 17 -18 years girls by 0,35 Hz (21,62%) than in 13 - 14 years, and in female athletes of 17 -18 years this indicator was more than in 15-16 years by 0,07 Hz (4,05%). In the younger group the maximum frequency was higher than the average value - 0,25 Hz (16,89%), and the minimum - less than the average by 0,28 Hz (23,33%). The highest movement frequency increased by 0,74 times (42,77%) in the middle group of female athletes. In the older group the best indicator was higher than the average by 0,27 Hz (15,22%).

In the second period of the research test in female athletes of 13-14 years, the rate improved less than in female athletes of 15-16 years aged group by 3,5 movements (13,73%). The difference in rate indicators between the maximum and the minimum average results were observed in female athletes of 13 - 14 years age group by 48,26%, 15 - 16 years old - by 36,43%, 17 - 18 years old by 43,33%.

The movement frequency in 13 - 14 years age female athletes' group compared with 15 - 16 years age group is lower by 0,22 Hz (12,87%) and compared with 17 - female athletes of 18 years age group by 0,29 Hz (16,96%).

In the third period of the test the lowest rate in female athletes of 13 - 14 years age group was observed, in 15 - 16 years age female athletes' group by 3,1 movements (11,31%) and in 17 - 18 years by 41,2 movements (13,3 %).

The time of one movement in 13 - 14 years age female athletes' group was more than in 15 - 16 years by 0.56 s. (11,4%), and in the female athletes of the senior group this figure decreased by 0.02 s. (4,25%). The speed of one movement in 13 - 14 years female athletes was lower in contrast with the 15 - 16 year age female athletes' group by 0,062 m/s (11,3%) and lower than in the 17 - 18 year age female athletes' group by 0,088 m / s (16,09%).

The movement frequency in female athletes aged 13-14 years was lower than in 15-16 years by 0,21 Hz (11,56%) and by 0,30 Hz (16,48%) in 17-18 years.

According to the total test indicator the efficiency has the following characteristics. The rate was less in female athletes of 13 - 14 years than in 15 - 16 years by 3,3 movements (13,04%) and lower than in 17 - 18 years female athletes by one movement (3,49%). Female athletes of the first group have the best result that was higher than the average by 7,3 movements (28,85%). The female athletes of the second group have the highest rate that was higher than the average by 12 movements (41,96%) and the lowest average by 6 movements (26,55 %). The athletes of the third group have the highest result that was higher than the average by 6,2 movements (20,65%) and the lowest was lower than the average by 4.8 movements (19,35%). The difference in the total result of the rate between the maximum and minimum compared with the average index was more than by 44,91% in 13 - 14 years, in 15 - 16 years - 68,51% and in 17-18 year - by 40,3%. The time of one movement in the first group was more than by 0,009 (13,91%) in the second group, and in comparison with the third one by 0,018 s. (35,6%). At the age of 13 – 14years the indicator decreased by 0,132s. (28,69 %).

The speed of one movement in female athletes of 13 - 14 years is less than in 15 – 16 years by 0,067 m/s (13,24%) and than in 17 - 18 years by 0,088 m/s (17,39%), and in 15 - 16 years less than 17 - 18 years by 0,021 m/s (3,67%).

In the younger group the total maximum speed is higher than the average by 0.12 m/s (28,85%), the minimum - less by 0.069 m/s (15,79%). In the middle group the deviation is accordingly by 0.244 m/s (42,58%). In the older group the best result is higher than the average by 0.129 m/s (21,79%), the worst result is lower by 0.094

m/s (18,8%). Deviations of the speed of one movement according to the best and lowest results were: in female athletes of 13 - 14 years - 44,64%, in 15 - 16 years- 68,37%, and in 17 - 18 years - 41,73%.

The obtained results characterize the individual characteristics of female athletes in terms of modeling sports activities, reflect different reactions and, thus, different levels of sports qualifications [2, 5, 6, 7].

Table 2 shows the criteria for assessing the quality of speed in the group of female athletes aged 13 - 14 years engaged in rowing. In the third period these results characterize the level of physical and functional condition of the studied female athletes. The average time of sensor motor response to sound is rated as "good".

Table 2

Indicators of physical quality of female athletes' movement speed engaged in rowing

Indicators		13 - 14 years			15 - 16 years			17-18 years		
		M ± m	Max.	Min.	M ± m	Max.	Min.	M ± m	Max.	Min.
Third period	Rate (number of movements)	27,4	35	22	30,5	44	24	31,8	36	27
	Time of one movement	0,54	0,42	0,68	0,49	0,34	0,62	0,47	0,41	0,55
	Speed of one movement	0,54	0,69	0,43	0,61	0,37	0,48	0,63	0,71	0,55
	Frequency of movement	1,82	2,33	1,47	2,03	2,03	16	2,12	2,4	1,8

The average movement rate is evaluated as "good", the best indicator is as "excellent", and the worst – as "satisfactory". The time of one movement is evaluated at the level of "good".

The speed of one movement is mainly at the level of "good" and the maximum speed is at the level of "excellent".

In the second period of the test the female athletes maintain the rate of movement as "excellent" (20,59%), and the minimum evaluation is "satisfactory".

The speed of one movement is on average at the level of "good" and the movement frequency is also at the level of "good".

In the third period of the test the rate of movement exceeded the evaluation "good" by 0,4 (1,48%). The time of one movement took place mainly at the level of "good". The best indicator was at the level of "excellent", and the worst result was not equal to the evaluation "satisfactory" (24,68%). The average speed of one movement reaches the evaluation "good". The average frequency of movements is equal to the evaluation "good", and the maximum is equal to the evaluation "excellent".

According to the total indicator of the test in female athletes 13 - 14 years, the rate of movements is at the level of "good". Time of one movement is at the level of "good". The average frequency of movements is at the level of "good".

The obtained research results of female athletes of 15 – 16 years engaged in rowing allowed to develop the assessment criteria of quality of speed of some of its components, which are presented in table 3.

The time of sensor motor response to sound was equal on average the evaluation "good". The best result was higher than the evaluation "excellent" by 0,028s. (18,42%), and the lowest result is at the evaluation of "satisfactory" by 0,014s. (6,22%). The time of motor reaction to light was on average equal to the evaluation of "good", and the lowest result was less than the evaluation of "satisfactory" by 0,012s. (5,11%).

In the second period of the test the average movement rate was at the level of "excellent", and the maximum result of the movement was higher than "excellent" (4,91%) by 1,5%, and the minimum at the level of "satisfactory". In the third period of the test the rate of movement was equal to the evaluation "good".

In the third period of the test the rate of movement was at the level of "good", and the speed of one movement was on average at the level of "excellent" - 0,199 m/s. The total test score for female athlete of 15 - 16 years engaged in rowing had the following indicators: the rate of movement – "good", and the worst evaluated as "satisfactory". The speed of one movement had evaluation "good".

The big difference between the maximum and minimum indicators was established on the basis of the carried out research that is testified by an unequal level of physical and functional preparation of female athlete of the named group.

The assessment criteria of speed of female athlete of 17 - 18 years are given in table 2.

In the first period of the test the rate of movement evaluated as "good". The best indicator was equal to evaluation "excellent", and the lowest - "satisfactory". In the second period of the test the evaluations of movement indicators were as follows: rate - evaluation "good", time of one movement – evaluation "good".

In the third period, the rate of movement was lower by 0,63% than the evaluation "excellent", the time and speed of one movement on average evaluated as "good".

Thus, the results of the research determine quite comparable level of speed quality. The increase in the level of speed of arbitrary movements is due to the training of speed in integral movement, as well as a number of factors that determine the maximum speed when performing holistic exercises. Of great importance for achieving maximum speed is the desire to achieve maximum speed. Simple motor response is determined by two main components: the latent period and motor ability, which is improved during the training.

Conclusions / Discussion.

The analysis of scientific and methodical literature showed, that for the improvement of methods of the development of motor qualities and the formation of movement speed, the definition of age periods has the greatest value. It is proved that the influence of training changes the rate, time, movement frequency, time of sensor motor reactions to sound and light stimuli. Speed indicators characterize the individual psycho-functional features of the female athletes' body, which makes it possible to make adjustments in the improvement and effective management of the training process. On the basis of comparative analysis the assessment criteria of quality indicators, speed in regard to the definition of prospective female athletes are developed at various stages of sports preparation.

Prospects for further research are to study the relationship of the development of special physical qualities characteristics of athletes in different sports. It is recommended, along with the study of traditional indicators, during the prediction of sports abilities, to identify other functional and psycho-physiological indicators that change under the influence of training.

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References

1. Korsun, S. M., Shaposhnikova, I. I., Suvorova, Ya. V. (2012), Biokhimichna kharakterystyka riznykh vydiv sportu [Biochemical characteristics of different sports]: navchalnyi posibnyk, Kharkiv, 130 p. (in Ukr.)
2. Kostiukevych, V. M., Shynkaruk, O. A., Voronova, V. I., Borysova, O. V. (2019), Osnovy naukovo-doslidnoi roboty zdobuvachiv vyshchoi osvity zi spetsialnosti "Fizychna kultura i sport" [Fundamentals of research work of higher education students majoring in "Physical Culture and Sports"], Kyiv: Olimpiiska literatura, 613 p. (in Ukr.)
3. Platonov, V. N. (2010), Plavanie [Swimming], Kiev: Olimpijskaja literatura, 496 p. (in Russ.)
4. Platonov, V. N. (2015), Sistema podgotovki sportsmenov v olimpijskom sporte: obshhaja teoriya i ee prakticheskie prilozhenija [The system of training athletes in Olympic sports: general theory and its practical applications]: uchebnik, Kiev: Olimpijskaja literatura, 680 p. (in Russ.)
5. Serhiienko, L. P. (2001), Kompleksne testuvannia rukhovykh zdibnostei liudyny [Comprehensive testing of human motor abilities], Mykolaiv: UDMTU, 360 p. (in Ukr.)
6. Shynkaruk, O. A., Lysenko, O. M., Hunina, L. M. (2009), Medyko-biolohichne zabezpechennia pidhotovky sportsmeniv zbirnykh komand Ukrainy z olimpiiskykh

vydiv sportu [Medical and biological support for the training of athletes of the national teams of Ukraine in Olympic sports]: navchalnyi posibnyk, Kyiv: Olimpiiska literatura, 144 p. (in Ukr.)

7. Shynkaruk, O. A. (2004), "Substantiation of the use of physiological indicators as criteria for selection of athletes in cyclic sports", Aktualni problemy fizychnoi kultury i sportu : zb. nauk. pr., Kyiv. NUFVSU, pp. 54-57 (in Ukr.)

8. Shkrebtii, Yu. M. (2005), Upravlinnia trenuvalnymy ta zmahalnymy navantazhenniamy sportsmeniv vysokoho klasu [Management of training and competitive loads of high-class athletes], Kyiv: NUFVSU, pp. 349-394. (in Ukr.)

9. Reinhard, P. A., Gerson, E. A.M., Sheel, A. W. et al. (2020), "Quantifying the mechanical work of breathing in men and women during rowing", Eur J Appl Physiol No. 120 (2), pp. 381–390, DOI: 10.1007/s00421-019-04282-8 (in Eng.)

10. Idan Harat, Nicolas W. Clark, Boffey D., Chad H. Herring, Erica R. Goldstein, Michael J. Redd, Adam J. Wells, Jeffrey R. Stout & David H. Fukuda (2020), "Dynamic post-activation potentiation protocol improves rowing performance in experienced female rowers", Journal of Sports Sciences, DOI: 10.1080/02640414.2020.1754110 (in Eng.)

11. Jason R., Suzanne T., Leaf P., Leaf B. (2020), "Understanding the Unique Psychological Demands of Competitive Collegiate Rowing: A Guide for Practitioners", Journal of Sport Psychology in Action, DOI: 10.1080/21520704.2020.1770908 (in Eng.)

12. Yang Liu, Binghong Gao, Jiru Li, Zuchang Ma, Yining Sun (2020), "Increased foot-stretcher height improves rowing performance: evidence from biomechanical perspectives on water", Sports Biomechanics, No. 19 (2), pp. 168-179, DOI: 10.1080/14763141.2018.1453540 (in Eng.)

13. John Warmenhoven, Stephen Copley, Conny Draper, Andrew Harrison, Norma Bargary & Richard Smith (2019), "Considerations for the use of functional principal components analysis in sports biomechanics: examples from on-water rowing", Sports Biomechanics, No. 18(3), pp. 317-341, DOI: 10.1080/14763141.2017.1392594 (in Eng.)

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