

Criteria for assessing the speed of movement in young men in rowing on kayaks

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Purpose: to develop quantitative criteria for assessing the physical quality of the speed and its constituent elements for modeling the training process in rowing on kayaks.

Material & Methods: young men, specializing in rowing on kayaks, differing in age and sports qualification were examined. We have studied the tempo, time and speed of one motion, the frequency of movements, as well as sensorimotor responses to sound and light stimuli, according to the method of measuring the effect of the training action developed by us. The testing process simulates the typical conditions of training and competitive activity and evaluates performance of the task.

Results: on the basis of complex studies of physical quality indicators of rapidity and constituent elements, criteria have been developed for their evaluation for young men of different ages in sports qualification who are engaged in rowing on kayaks. The proposed method of research and comparative analysis of mean values, as well as relative deviations of physical fitness indicators of surveyed athletes from model characteristics may indicate the functional preparedness of oarsmen.

Conclusion: the conducted research made it possible to ascertain the sufficient effectiveness of the method developed by us for measuring the effect of a training action for determining the physical quality of the speed of athletes specializing in rowing on kayaks, which makes it possible to recommend it for practical use in training sessions.

Keywords: criteria for assessing the speed of movement, the pace, time and speed of one movement, the frequency of movements, the time of sensorimotor reactions to sound and light stimuli.

Introduction

Preparation of athletes for competitions provides for achieving a high level of their general, special, functional, technical and tactical and psychological preparedness. The growth of athletic performance of athletes, specializing, in particular, in rowing on kayaks, provides for a serious improvement of training methods taking into account the latest achievements of sports science. The effectiveness of competitive activities primarily depends on the consistency of the interaction of all structural entities of the athlete's training system. Increasing its effectiveness (development of training, the formation of a sports form) contributes to the entire process of training as a system object [1; 2].

The problem of increasing the functional readiness in rowing sports at various stages of long-term sports training is realized by the possibility of practical solution by increasing the physical loads of various orientations, including competitive practices, optimizing the system of rehabilitation measures, increasing the volume of special and auxiliary training [3; 4].

The main objective of the motor action is to achieve the maximum speed of movement, which depends on the metabolic capabilities of the body, the executive systems and biokinematic characteristics of the musculoskeletal system, and the improvement of the result – from the development of high-speed endurance, which is achieved by special physical preparation of cardiovascular and respiratory interdependent mechanisms. The implementation of different approaches to

the construction of the structure of the training process allows for a wide variation of these, but in all cases it is necessary to take into account the anthropometric analysis of the physique, the nature of the metabolic processes, as well as optimize the volume, content and proportion of total and special physical training [5; 6].

The reactions of the organism, and primarily the motor, are adaptive in nature and are aimed at balancing the interaction of the organism with the environment, related to labor and sports activities, which set different requirements for the functional state of the afferent systems and the creation of new coordination relations corresponding to certain conditions. The specificity of physical activity has a certain effect on the sensitivity of sensory systems. Interaction of analyzers indicates that sensory systems experience uniform influences – with a change in the functional activity of one analyzer, similar changes occur in the other. However, one of the main mechanisms of attunement of sensory systems is the presence of diffuse influences of the reticular formation, which cause the interaction background of analyzers [7; 8].

The problem of searching for new means and methods for the development of speed and speed-strength preparedness has always been relevant, and the correctly chosen methodology allows taking into account the age characteristics of athletes, which preserves their health, does not require additional time and simultaneously provides an increase in the level of physical [9; 10] preparedness and, as a result, the enhancement of sportsmanship. The perception of the load by the athletes

will allow the coach to more objectively evaluate the reaction of the athlete's body to the completed training task and promptly adjust the training process. The modern system of training an athlete consists of competitions and competitive activities, sports training and in-training and out-of-competition factors. The success of the functioning of this system is ensured by a complex of knowledge, principles, laws and patterns of interaction between organizational and managerial forms, conditions and rules of competitive activity, means and methods of training, various types of training and external factors [11; 12].

Purpose of the study: to develop quantitative criteria for assessing the physical quality of the speed and its constituent elements (tempo, time and speed of one movement, the frequency of movements) for modeling the training process in rowing on kayaks.

Material and Methods of the research

Young men, students of a boarding school of a sports profile, physical education colleges and students of higher educational institutions specializing in rowing in kayaks aged 11–12 years (21 people, without sports category), 13–14 years (20 people (2 sports category)) were examined, 15–16 years (20 people, 2 and 1 sports categories) and 17–18 years (25 people, first-timers and candidates for master of sports). The pace, the time and the speed of one movement, the frequency of movements studied in the three periods of the test and recorded in an automatic mode, as well as sensorimotor responses to sound and light stimuli, were studied according to the method of measuring the effect of the training action developed by us. The athletes were given the task of making the movements with the leading hand as quickly as possible and accurately between the targets located 30 cm apart from each other and trying to get into their centers by a special rod. The first period of the test – 15 s – characterizes the starting

speed, i.e., the beginning of work with the optimal functional state of the organism, the second – 60 s – in the process of long-term operation the remote speed, the third – 15 s – the ability of the organism at the end of testing to maintain high tempo and speed movements, i.e., speed endurance, the total result for the three periods of the study – speed capabilities. The testing process simulates the typical conditions of training and competitive activity and assesses the fulfillment of the task. The method of research is published in detail in the *Slobozans'kij naukovno-sportivnij visnik*, 2015, No, 4 (48), pp. 19-25 [13].

Results of the research

The results of studies of the physical quality of the rapidity and its constituent elements: the rate, time and speed of one movement, the frequency of movement by measuring the effect of the training action (META) in different age groups are presented in Table 1. A detailed account of the data obtained, their analysis, conclusions and recommendations are published in *Slobozans'kij naukovno-sportivnij visnik*, 2018, No. 1 (63), pp. 7-14 [14], on the basis of which the criteria for assessing the studied indicators.

In young athletes aged 11–12 years, specializing in rowing in kayaks, in the first period of the test of measuring the effect of the training action, the starting speed was studied – the ability to gain the maximum speed for a minimum period of time. In the second period, which determines the ability to maintain remote speed, in comparison with the first period the rate increased by 21,05%, the time of one movement decreased by 20,92%, the speed of one movement increased by 20,88%, the frequency of movements increased by 21,05%. In the third period, characterizing the speed endurance, the studied indicators were at the same level as in the second period of the test. The total values of the investigated parameters of the movements that determine the speed capabilities showed the

Table 1
Indicators of physical quality of speed (boys, kayaking)

Indicators	11–12 years			13–14 years			15–16 years			17–18 years				
	M±m	M _{max}	M _{min}	M±m	M _{max}	M _{min}	M±m	M _{max}	M _{min}	M±m	M _{max}	M _{min}		
Effect of training action	first period	pace (number of movements)	28,5±0,99	31	23	31±1,24	36	23	32±2,05	37	23	31,7±0,68	39	24
		time of one motion (s)	0,526	0,483	0,652	0,484	0,417	0,652	0,468	0,405	0,652	0,473	0,385	0,625
		speed of one motion (m s ⁻¹)	0,570	0,621	0,461	0,619	0,719	0,461	0,641	0,741	0,461	0,634	0,779	0,480
		frequency of movements (Hz)	1,90	2,06	1,53	2,06	2,40	1,53	2,13	2,47	1,53	2,11	2,60	1,60
	second period	*rate (number of movements)	138±12,37 (34,5±4,09)	159 (39,75)	107 (26,75)	133±5,53 (33,25±1,38)	156 (39)	98 (24,5)	142±6,22 (35,5±1,56)	156 (39)	105 (26,25)	136±5,79 (34±1,45)	164 (41)	96 (24)
		time of one motion (s)	0,435	0,377	0,560	0,451	0,385	0,612	0,423	0,385	0,571	0,441	0,366	0,625
		speed of one motion (m s ⁻¹)	0,689	0,795	0,536	0,665	0,779	0,491	0,709	0,779	0,525	0,681	0,819	0,480
		frequency of movements (Hz)	2,30	2,65	1,78	2,22	2,60	1,63	2,37	2,60	1,75	2,26	2,73	1,60
	third period	rate (number of movements)	34±1,359	39	28	34±1,53	41	25	37±3,08	41	27	36,5±1,34	42	26
		time of one motion (s)	0,441	0,385	0,536	0,441	0,366	0,601	0,405	0,366	0,556	0,411	0,357	0,576
		speed of one motion (m s ⁻¹)	0,681	0,779	0,559	0,681	0,819	0,499	0,741	0,819	0,539	0,729	0,841	0,521
		frequency of movements (Hz)	2,27	2,60	1,87	2,27	2,73	1,67	2,47	2,73	1,80	2,43	2,80	1,73
in total	rate (number of movements)	200,5±4,91 (33,42±3,02)	229 (38,16)	158 (26,33)	198±2,57 (33±0,43)	233 (38,83)	146 (24,33)	211±3,78 (35,17±1,26)	234 (39)	155 (28,83)	204,0±2,61 (34±0,87)	245 (40,83)	147 (24,5)	
	time of one motion (s)	0,449	0,393	0,569	0,455	0,386	0,616	0,427	0,385	0,581	0,441	0,367	0,612	
	speed of one motion (m s ⁻¹)	0,668	0,763	0,527	0,659	0,777	0,487	0,703	0,779	0,516	0,681	0,817	0,491	
	frequency of movements (Hz)	2,23	2,54	1,75	2,2	2,58	1,62	2,34	2,6	1,72	2,27	2,72	1,63	
Time of sensorimotor reaction														
	sound (s)	0,207±0,006	0,236	0,185	0,182±0,007	0,249	0,167	0,170±0,01	0,250	0,150	0,166±0,009	0,211	0,132	
	light (s)	0,232±0,01	0,272	0,189	0,216±0,015	0,269	0,158	0,194±0,006	0,225	0,170	0,201±0,006	0,223	0,178	

Remark. * – in brackets are data reduced to a single temporary indicator of 15 s, in particular 138 ± 12.37 (34,5±4,09) number of movements.

corresponding level of physical development and functional preparedness of the surveyed athletes.

In accordance with our criteria for assessing the physical quality of speed (Table 2) in the first period of the test, the average indicators – the rate, time and speed of one movement, the frequency of movements were determined by the "good" estimate, which exceeded the "satisfactory" on 5,56%, 5,51%, 5,36%, 4,97%. By the maximum result – "good", which were less than "excellent" in terms of tempo – by 3,23%; the time of one movement – by 0,84%; the speed of one movement – by 0,81%; and the frequency of movements – "excellent" – by 1,98% more than "good." The minimum score was less than "satisfactory": the pace was – 4,35%; the time of one movement – by 4,23%; the speed of one movement – by 4,12%, the frequency of movements – by 5,23%.

In the second test period, the average values of the indicators studied were rated "good" and were less than "excellent" in terms of the pace of movement – by 1,45%, the time of one movement – by 1,15%, the speed of one movement – by 0,44% the frequency of movement – by 0,43%. According to the maximum result, the investigated values were evaluated as "excellent", with the rate exceeding this estimate by 1,92%, the time of one movement by 2,12%, the speed of one movement by 1,92%, the speed of movement – by 1,92%. According to the minimum result, the rating is "satisfactory" for all the indicators defined, and less "good" in pace – by 8,41%, time of one movement – by 4,67%, speed of one movement – by 4,48%, frequency of movements – by 5,06%.

In the third period of the test, the results obtained were, on average, rated as "good", with less than "excellent": a rate of 2,94%; the time of one movement – by 0,46%; the speed of one movement – by 1,76%; the frequency of movement – by 3,96%. According to the maximum result – the score is "ex-

cellent": the tempo at the level of the upper limit of the criterion for this evaluation; time and speed of one movement, the frequency of movements is less than the upper limit of the criteria for this assessment, respectively 1,32%, 0,26%, 1,92%. According to the minimal result: the tempo and time of one movement are at the level of the upper bound of the evaluation criteria "satisfactory" and the speed of one movement is 0,18% and the frequency of movements is 2,14% less than the upper bound of the "satisfactory".

According to the total indicator of the measurement of the effect of the training action, indicating the speed capabilities, the average values were determined by the evaluation "good" and were less "excellent" in tempo – by 7,72%; the time of one movement – by 2,51%; the speed of one movement – by 6,29%; the frequency of movements – by 1,35%. According to the maximum value, the indicators studied corresponded to the "excellent" estimate; on the minimum – "satisfactory".

The time of sensorimotor reactions in athletes of 11–12 years of age to the sound stimulus was estimated to be "satisfactory" by average value and was less than the "good" rating by 1,97%, the best result was "excellent", the worst – by 9,25% "satisfactorily"; on the light stimulus the average value is "satisfactory" by 3,57% less than the "good" score, the best result is "excellent", the worst is less than the lower limit "satisfactory" for 13,33%.

Consequently, the average starting speed for athletes 11–12 years of age training in kayak rowing was determined at the level of "good" and was within 5–6% more "satisfactory". According to the maximum result, the score was "good," which was better by 1–2% and was rated "excellent"; on the minimum – less "satisfactory" by 4–6%. Remote speed on the average results - the score is "good", which is less than "excellent" by 0,5–1,5%. The maximum result exceeded the

Table 2
Criteria for assessing the physical quality of speed (boys 11–12 years, rowing on kayaks)

Indicators		Evaluation	Pace (number of movements)	Time (s)	Speed (m s ⁻¹)	Frequency (Hz)
Effect of training action	first period	satisfactory	24–27	0,625–0,555	0,480–0,541	1,61–1,81
		good	28–31	0,554–0,480	0,542–0,625	1,82–2,02
		excellent	32–35	0,479–0,425	0,626–0,709	2,03–2,33
	second period	satisfactory	96–112 (24–28)*	0,625–0,536	0,480–0,559	1,61–1,86
		good	116–136 (29–34)	0,535–0,441	0,560–0,691	1,87–2,30
		excellent	140–156 (35–39)	0,440–0,385	0,692–0,780	2,31–2,60
	third period	satisfactory	24–28	0,625–0,536	0,480–0,560	1,65–1,91
		good	29–34	0,535–0,440	0,561–0,692	1,92–2,35
		excellent	35–39	0,439–0,380	0,693–0,781	2,36–2,65
	in total	satisfactory	144–174 (24–29)	0,625–0,535	0,480–0,561	1,62–1,86
		good	180–210 (30–35)	0,536–0,439	0,562–0,709	1,87–2,25
		excellent	216–246 (36–41)	0,438–0,360	0,710–0,825	2,26–2,55
Time of sensorimotor reaction						
evaluation			sound (s)		light (s)	
satisfactory			0,216–0,204		0,240–0,225	
good			0,203–0,191		0,224–0,209	
excellent			0,190–0,178		0,208–0,193	

Remark. * – in brackets are given the data reduced to a single time indicator of 15 s, in particular 96-112 (24-28) number of movements.

estimate of "excellent" about 2%, the minimum – "satisfactory" and approached the "good" estimate, which is 4,5–8,5% less. Speed abilities on the average indicators were observed at the level of "good", which is less than "excellent" by 1–8%; the maximum result is "excellent", the minimum is "satisfactory". Sensory motor responses to sound and light stimuli were, on average, evaluated as "satisfactory" and did not reach the "good" 2–3,5%.

Athletes aged 13–14, training in kayak rowing, in the first period of the test of measuring the effect of the training action as a whole showed higher results in terms of the tempo of movements, time and speed of one movement, the frequency of movements compared with 11–12 year old rowers. In the second test period, compared to the first period, the rate increased by 7,26%, the time of one movement decreased by 7,31%, the speed of one movement increased by 8,34%, the movement frequency became more by 7,77%. In the third test period, compared with the second, the pace of movement increased slightly – by 2,26%, the time of one movement decreased by 2,27%, the speed of one movement increased by 2,14%, the movement frequency increased by 5,0%. The total indicators of the test on the tempo of movements, time and speed of one movement, the frequency of movements revealed a sufficient level of functional fitness for young athletes.

The results of studies of young men aged 13–14 in the first period of the measurement of the effect of the training action were determined by the following criteria for assessing the physical quality of the speed (Table 3). According to the average values of the indicators studied, the assessment was "good", and there was less than "excellent" in the pace of movements by 6,45%, the time of one movement – by 5,22%, the speed of one movement – by 1,94%, the frequency of movements – by 1,46%. The maximum result: the

tempo and time of one movement are "excellent", the speed of one movement and the frequency of movements exceeded the upper bound of the score "excellent", respectively, by 1,27% and 4,80%; minimum: it was less than the lower level of the assessment "satisfactory" for the rate of movement by 8,69%, the time of one movement – by 6,89%, the speed of one movement – by 6,29%, the frequency of movements – by 9,15%.

In the second period of the test, the average indicators were noted at the level of marks "good" and slightly more "satisfactory": the pace – by 3,91%, the time of one movement – by 2,21%, the speed of one movement – by 2,31%, the frequency of movements – by 7,25%. The maximum result: the pace, time and speed of one movement – "excellent", the frequency of movements – above the upper limit of the criterion "excellent" by 4,42%; minimum: less than the lower bound of the rating "satisfactory": the rate – by 14,29%, the time of one movement – by 14,39%, the speed of one movement – by 14,05%, the frequency of movements – by 14,72%.

In the third period, the average data obtained was assessed as "good", which was slightly less than "excellent": pace – by 2,94%, time for one movement – by 8,62%, speed of one movement – by 3,08%, the frequency of movements – by 2,21%. The maximum indicator is "excellent", with the upper limit of criteria being higher: the pace – by 7,89%, the speed of one movement – by 4,73%, the frequency of movements – by 6,64%; the minimum – below the mark "satisfactory": the pace – by 8,0%, time of one movement – by 8,29%, speed of one movement – by 8,21%, frequency of movements – by 8,38%.

According to the aggregate indicator, the average data obtained were at the level of "good" and were less than "excellent": the rate – by 3,03%, the time of one movement – by

Table 3
Criteria for assessing the physical quality of speed (boys 13–14 years, rowing on kayaks)

Indicators	Evaluation	Pace (number of movements)	Time (s)	Speed (m s ⁻¹)	Frequency (Hz)	
Effect of training action	first period	satisfactory.	25–28	0,610–0,536	0,490–0,560	1,67–1,87
		good	29–32	0,535–0,461	0,561–0,630	1,88–2,08
		excellent	33–36	0,460–0,386	0,631–0,710	2,09–2,29
	second period	satisfactory.	112–124 (28–31)*	0,535–0,461	0,560–0,650	1,87–2,07
		good	128–140 (32–35)	0,460–0,386	0,651–0,741	2,08–2,28
		excellent	144–156 (36–39)	0,385–0,310	0,742–0,832	2,29–2,49
	third period	satisfactory.	27–30	0,555–0,481	0,540–0,620	1,81–2,06
		good	31–34	0,480–0,407	0,621–0,701	2,07–2,31
		excellent	35–38	0,406–0,332	0,702–0,782	2,32–2,56
	in total	satisfactory.	156–174 (26–29)	0,575–0,501	0,520–0,594	1,73–1,98
		good	180–198 (30–33)	0,500–0,426	0,595–0,669	1,99–2,24
		excellent	204–222 (34–37)	0,425–0,351	0,670–0,745	2,25–2,50
Time of sensorimotor reaction						
	evaluation	sound (s)		light (s)		
	satisfactory.	0,205–0,193		0,225–0,205		
	good	0,192–0,180		0,204–0,189		
	excellent	0,179–0,167		0,188–0,173		

Remark. * in brackets are given the data reduced to a single time indicator of 15 s, in particular 112–124 (28–31) number of movements.

7,05%, the speed of one movement – by 1,67%, the frequency of movements – by 2,27%. The maximum score was "excellent", and exceeded the upper limits of the criteria: tempo – by 4,95%, speed of one movement – by 4,29%, movement frequency – by 3,2%; the minimum is less than the lower level of the rating "satisfactory": by the rate of 6,86%, the time of one movement by 7,13%, the speed of one movement by 6,78%, the frequency of movements – by 6,79%.

The time of sensorimotor reactions to the sound stimulus was determined by the average value by the evaluation "good" and was worse than the "excellent" score by 1,68%, the best result – "excellent", the worst – by "satisfactory" by 21,46%; to the light stimulus by the average value – "satisfactory", which was less than the "good" score by 5,88%, for the best indicator – "good", at worst – less than the lower level of the "satisfactory" estimate for 19,56%.

Consequently, the average starting speed for athletes aged 13–14 years trained in kayak rowing was noted at the "good" grade, and was less than "excellent" by 1,5–6,5%; by the maximum result – "excellent", and by some indicators was higher "excellent" by 1–5%; on the minimum – less "satisfactory" by 6–9%. The distance velocity along the average values was observed at the level of "good", which was approaching "satisfactory" and was only 2–7% higher than this level; by the maximum result – "excellent", and some indicators exceeded this estimate by 4%; on the minimum indicator – less than the estimate of "satisfactory" by 14–15%. Speed endurance for the average indicators was determined by the evaluation of "good", but was less "excellent" only by 2–8%; by the maximum result – "excellent" and above the level of this assessment by 5–8%; at the minimum – less than the estimate "satisfactory" by 8%. Speed abilities on average results were rated as "good", and were less than "excellent" only by 2–7%; by the maximum result – "excellent" and exceeded this level

by 3–4%; at the minimum – below "satisfactory" by 6–7%. Sensory motor responses on average to a sound stimulus were rated "good", but did not reach the "excellent" grade by 1,6%; on the light stimulus – "satisfactory", and there were fewer "good" 6%.

In the group of 15–16 year olds specializing in kayak rowing, there were athletes of different levels of physical and functional preparedness, as indicated by the large differences in the minimum values from the average values in all periods of the test in terms of tempo, time and speed, and the frequency of movements. In the first period, such fluctuations were in the range of 39,05–39,32%, in the second – 34,99–35,43%, in the third – 37,04–37,48%, in total – 36,05–36,24%. The fact of heterogeneity of the group is also indicated by differences in the studied indicators from the average values for the best indicators, which in the first period were in the range of 15,56% to 15,96%, in the second – 9,71%–9,87%, in the third – 10,53%–10,81%, in total – 10,89%–11,11%. The maximum values of deviations from the average indicators in the first period corresponding to the starting acceleration are more pronounced, somewhat less in the third period indicating the speed endurance, and even less in the second period in the study of the remote speed.

In the first period of the test of measuring the effect of the training action, the indicators studied (Table 4) were at the level of "good" and less "excellent": tempo – by 12,5%; time of one movement – by 4,69%; the speed of one movement – by 4,68%; the frequency of movement – by 5,16%. The maximum result for all studied indicators is "excellent"; the minimum is lower than the "satisfactory" rating: by the rate of 13,04%, the time of one movement by 5,16%, the speed of one movement by 6,29%, the frequency of movements – by 11,11%.

In the second period of the test, the average indicators corre-

Table 4
Criteria for assessing the physical quality of speed (boys 15–16 years, rowing on kayaks)

Indicators		Evaluation	Pace (number of movements)	Time (s)	Speed (m s ⁻¹)	Frequency (Hz)
Effect of training action	first period	satisfactory	26–30	0,620–0,549	0,490–0,580	1,70–1,96
		good	31–35	0,548–0,448	0,581–0,670	1,97–2,23
		excellent	36–40	0,447–0,380	0,671–0,760	2,24–2,50
	second period	satisfactory	104–124 (26–31)*	0,620–0,548	0,485–0,585	1,73–2,06
		good	128–148 (32–37)	0,547–0,420	0,586–0,715	2,07–2,46
		excellent	149–164 (38–43)	0,419–0,350	0,716–0,790	2,47–2,86
	third period	satisfactory	27–31	0,615–0,555	0,490–0,590	1,80–2,06
		good	32–36	0,554–0,415	0,591–0,725	2,07–2,45
		excellent	37–41	0,414–0,360	0,726–0,830	2,46–2,75
	in total	satisfactory	156–186 (26–31)	0,620–0,548	0,490–0,590	1,75–2,06
		good	192–216 (32–36)	0,547–0,415	0,591–0,725	2,07–2,45
		excellent	222–246 (37–41)	0,414–0,360	0,726–0,830	2,46–2,75
Time of sensorimotor reaction						
	evaluation		sound (s)		light (s)	
	satisfactory		0,184–0,172		0,210–0,195	
	good		0,171–0,159		0,194–0,179	
	excellent		0,158–0,146		0,178–0,163	

Remark. * in brackets are given the data reduced to a single time indicator of 15 s, in particular 104–124 (26–31) number of movements.

sponded to the "good" estimate and did not reach the "excellent" level: by the tempo – by 7,04%; the time of one movement – by 0,95%; the speed of one movement – by 0,85%; the frequency of movements – by 4,22%. The maximum result for all studied indicators is "excellent", the minimum is "satisfactory".

In the third period of the test, the following estimates were determined. The average values of the studied indicators were "excellent", and they were better than the "good" ones: by a rate of 2,78%, the time of one movement by 2,47%, the speed of one movement by 2,21%, the frequency of movements – by 0,82%; the maximum is "excellent"; minimum – the lower level of the assessment is "satisfactory".

The overall test results for the average values of all the indicators studied corresponded to the "good" estimate, while they were less than the level of the criteria "excellent": at a rate of – 5,21%, time of one movement – 3,14%, speed of one movement – 3,27%, the frequency of movements – by 5,13%. The maximum indicators are "excellent" and lower than the upper level of the physical quality criteria for fastness by the tempo – by 5,13%, the time of one movement by 6,94%, the speed of one movement by 6,55%, the speed of movement by 5,77%. The minimum indicators are "satisfactory", the rate actually corresponds to the lower level of this estimate, the others are slightly larger than this criterion boundary: the time of one movement – by 6,71%, the speed of one movement – by 5,31%, the frequency of movements – by 1,74%.

The time of sensorimotor reactions in this group of athletes was determined on the average by the sound stimulus as "good", the best result was "good" and less "excellent" by 5,33%, the worst – less than the lower level of "satisfactory" by 35,87%; on the light stimulus – by the evaluation of "good" (the lower bound of this estimate), the best result is "good" and at 4,71% does not reach the "excellent" level, the worst

indicator is less than the lower bound of the "satisfactory" estimate for 7,14%.

Consequently, the average starting speed for athletes aged 15–16 years was at the level of "good" and was less than "excellent" by 5–12%; on the maximum result – "excellent"; at the minimum – below the estimate of "satisfactory" by 5–13%. The distance speed was marked by average values at the "good" and "excellent" ratings by 1–7%; by the maximum value – "excellent"; on the minimum – "satisfactory". Speed endurance for the average was rated "excellent", better than "good" for 1–3%, maximum – "excellent," minimal – "satisfactory." Speed abilities on average were at the level of "good" and were less than "excellent" by 3–5%; the maximum indicator approached the upper boundary of the evaluation criterion "excellent"; minimum – at the level of the lower values "satisfactory". The sensorimotor responses to sound and light stimuli were at the level of "good", with the best results being "excellent" by 5%, and the worst – less than the lower boundary "satisfactory" by sound – by 36% and by light – by 7%.

In the group of 17–18 year olds specializing in rowing on kayaks, there were significant differences in the studied indicators. The maximum results in the first period of the META test were better than the average: by the rate of movement – by 23,09%, the time of one movement – by 22,86%, the speed of one movement – by 22,87%, the frequency of movements – by 23,22%. The minimum values were less than the average for 31,88–32,14%. Among the surveyed athletes there were rowers with a good starting acceleration, while others showed poor results in their abilities to quickly gain speed. In the second period of the test, which characterizes the distance speed, the maximum indicators were larger than the average values by the tempo – by 20,59%, the time of one movement – by 20,49%, the speed of one movement – by 20,26%, the frequency of movements – by 20,80% and minimal – less than average values by tempo – by 41,67%, time and speed

Table 5
Criteria for assessing the physical quality of speed (boys 17–18 years, rowing on kayaks)

Indicators	Evaluation	Pace (number of movements)	Time (s)	Speed (m s ⁻¹)	Frequency (Hz)	
Effect of training action	first period	satisfactory	27–31	0,555–0,480	0,540–0,610	1,80–2,05
		good	32–36	0,479–0,404	0,611–0,681	2,06–2,31
		excellent	37–41	0,403–0,329	0,682–0,752	2,32–2,57
	second period	satisfactory	112–128 (28–32)*	0,535–0,460	0,560–0,630	1,86–2,11
		good	132–148 (33–37)	0,459–0,384	0,631–0,701	2,12–2,37
		excellent	152–168 (38–42)	0,383–0,308	0,702–0,772	2,38–2,63
	third period	satisfactory	29–33	0,520–0,446	0,590–0,670	2,00–2,25
		good	34–38	0,445–0,370	0,671–0,761	2,26–2,51
		excellent	39–43	0,369–0,302	0,762–0,842	2,52–2,77
	in total	satisfactory	168–192 (28–32)	0,538–0,463	0,562–0,632	1,88–2,13
		good	198–222 (33–37)	0,462–0,387	0,633–0,703	2,14–2,39
		excellent	228–252 (38–42)	0,386–0,311	0,704–0,774	2,40–2,65
Time of sensorimotor reaction						
evaluation		sound (s)		light (s)		
satisfactory		0,173–0,161		0,205–0,190		
good		0,160–0,148		0,189–0,174		
excellent		0,147–0,135		0,173–0,158		

Remark. * in brackets are given the data reduced to a single time indicator of 15 s, in particular 112–128 (28–32) number of movements.

of one movement, respectively – by 41,72% and 41,88%, the frequency of movements – by 41,25%. Thus, many athletes can maintain high remote speed, and some – do not have this quality. In the third test period, indicating speed endurance, the best results were greater than the average for the pace – by 15,07%, the time of one movement – by 15,13%, the speed of one movement – by 15,36%, the frequency of movements – by 15,23% and the worst indicators were less than average in terms of pace – by 40,38%, time of one movement – by 40,15%, speed of one movement – by 39,92%, frequency of movements – by 40,46%. In this group of subjects were athletes with high speed endurance, others noted a low value of this quality, while the rest 44,47% – the average level of this indicator. According to the combined results of the test of measuring the effect of the training action, characterizing the speed capabilities, the maximum indicators were more than average: by the rate of movement – by 20,09%, the time of one movement – by 20,16%, the speed of one movement – by 19,97%, the frequency movements – by 19,82% and the minimum was less than the average: by the pace of movement – by 38,78%, the time of one movement – by 38,78%, the speed of one movement – by 38,69%, the frequency of movements – by 39,26%. Consequently, some athletes had high rates of speed abilities, some oarsmen were defined as low, and the rest 40,92% had the results at the level of average values.

In the first period of the META test, the indicators studied were determined by estimates (Table 5): the rate was "satisfactory", which is only 0.95% less than "good", the other indicators were "good" and were more "satisfactory": the time of one movement – on 1,48%, speed of one movement – on 3,93%, frequency of movements – on 2,93%; the maximum performance was "excellent", and the speed of one movement and the frequency of movements were higher than the recommended upper limit of the criteria, respectively, by 3,59% and 1,17%; minimum – less than the lower level of the evaluation criteria "satisfactory": by the pace – by 22,73%, the time of one movement – by 22,88%, the speed of one movement – by 23,01%, the frequency of movements – by 22,45%.

In the second period, the studied indicators were at the level of "good" and more "satisfactory": according to pace – by 6,25%, time of one movement – by 4,31%, speed of one movement – by 8,09%, frequency of movements – by 7,11%. The maximum indicators were determined by "excellent" marks near the top level of the criteria, while the speed of one movement and the frequency of movements were higher, respectively, by 6,09% and 3,81%; minimum – below "satisfactory": by pace – by 21,74%, time of one movement – by 21,87%, speed of one movement – by 21,48%, frequency of movements – by 21,57%.

In the third period of the test, the average indicators were rated as "good", and were less excellent "excellent": by pace – by 6,84%, time of one movement – by 11,38%, speed of one movement – by 4,53%, frequency movements – by 3,70%. The maximum results were determined by the rating "excellent" at the upper limit of the criteria for assessing the physical quality of speed, the minimum – less than the rating "satisfactory": by pace – by 11,54%, time of one movement – by 10,77%, speed of one movement – by 13,24%, frequency of movements – by 15,61%.

According to the total result of the test, the average assess-

ment of the studied parameters is "good" and a little more "satisfactory": by pace – by 6,25%, time for one movement – by 4,99%, speed of one movement – by 7,75%, frequency of movements – by 6,57%. The maximum results corresponded to the "excellent" assessment for the pace and time of one movement and were higher than the upper limit of the criteria for this assessment by the speed of movement by 5,56%, the frequency of movement – by 2,64%, the minimum - below the "satisfactory" rating by 14,29%, the time of one movement – by 13,75%, the speed of one movement – by 14,46%, the frequency of movement – by 15,34%.

Sensorimotor responses to a sound stimulus in average were observed at the "satisfactory" assessment level, the best indicator exceeded the excellent assessment limit by 2,27%, the worst was lower than the lower level "satisfactory" by 21,97%; on the light stimulus, the average indicator was rated as "satisfactory", the best – "good" and less "excellent" by 2,89%, the worst – less "satisfactory" by 17,56%.

Consequently, the starting speed of athletes aged 17–18 corresponded to an average "good" assessment, but was only 1–4% more "satisfactory"; according to the maximum indicator "excellent"; minimum – less than "satisfactory" by 23%. The remote speed was determined by a rating of "good" and was more "satisfactory" by 4–8%; on the maximum result – "excellent"; minimum – below "satisfactory" rating 22%. On average, speed endurance was rated as "good" and was less than "excellent" by 4–11%; the maximum value is "excellent"; minimum – less "satisfactory" by 10–15%. On average, speed abilities were observed at the level of "good" and were more "satisfactory" by 5–8%, according to the maximum indicator – "excellent"; minimum – below "satisfactory" by 13–15%. Sensomotor reactions to sound and light stimuli were on average within the limits of assessment "satisfactory": the best indicators for sound were "excellent", to the light – "good"; the worst – less than the lower level – "satisfactory", respectively, by 22% and 18%.

Thus, the starting speed in all age groups was at the level of "good", but at 11–12 years old and 17–18 years old it differed from "satisfactory" by 5–6% and 1–4%, respectively, and at 13–14 years and 15–16 years – from "excellent" by 1,5–6,5% and 5–12%. The average remote speed was determined by the "good" rating, but at 13–14 years and at 17–18 years it was better "satisfactory", respectively, by 2–7% and 4–8%, and at 11–12 years and 15–16 years – less than "excellent" by 0,5–1,5% and 1–7%. On average, speed endurance was observed at the level of "good" and was less – "excellent" at 11–12 years old by 0,5–4%, at 13–14 years old – by 2–8%, at 17–18 years old – by 4–11%, but at 15–16 years of age it was determined by an "excellent" grade and more than "good" by 1–3%. On average, speed abilities were noted in all age groups with a "good" rating, which was less than "excellent" at 11–12 years old by 1–8%, at 13–14 years old – by 2–7%, and at 15–16 years old – by 3–5%, but at the age of 17–18 years it was more – "satisfactory" by 5–8%.

The research and evaluation of the physical quality of speed in terms of pace, time and speed of one movement, frequency of movements characterize the data obtained as an important qualitative and quantitative component of the method of selecting promising athletes in rowing.

The arising contradictions between physical activity and the

functional capabilities of the athlete's body, as well as the model characteristics and its individual characteristics, can be compensated for in the training process and as sports grows by means and techniques that are in unity with the structural formations of the athlete's training system.

Conclusions / Discussion

The results of a comparative analysis of average values, as well as relative deviations of the indicators of functional fitness of the examined athletes from model characteristics may indicate the undoubted practical significance of the developed criteria for assessing the physical quality of speed and its components (pace, time and speed of a single movement, frequency of movements).

The study allowed us to establish the sufficient effectiveness of the method developed by us for measuring the effect of a training action to determine the physical quality of speed of athletes of different ages and skills who specialize in rowing, which gives grounds for recommending it for practical use in training sessions.

The most promising direction in improving the functional readiness of rowers is the development and application of new methods of training sessions that take into account the characteristics of the dynamics of the indicators of functional readiness of athletes, as well as model characteristics for representatives of this sport.

Prospects for further research. To develop an effective selection methodology, it is planned to study the various physical qualities of athletes specializing in rowing sports.

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