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Functional state of the rowers on kayaks at the stage of special basic training

Volodymyr Bogush[1]
Sergiy Getmantsev[2]
Konstantin Bogatyirev[1]
Ganna Tarasova[1]
Yuriy Kulakov[2]
Yevgen Yatsunskiy[1]

[1]Admiral Makarov National University of Shipbuilding. Mykolayiv, Ukraine
[2]V. Sukhomlynskiy Nikolaev National University, Mykolayiv, Ukraine

Purpose: *conduct a comprehensive study of the functional state, the basic properties of the nervous system of athletes specializing in rowing, for the subsequent determination of perceptivity in this sport.*

Material & Methods: *students of the Higher School of Physical Education, specializing in rowing. Individual indicators were determined in the age group 15–16 years: 25 boys, 23 girls, in total – 48 athletes. The study of the functional state included a test measuring the effect of a training action (META), created on the basis of a tapping test, which allows to determine the complex of kinematic characteristics of movements in autonomous mode, as well as visual-motor and auditory-motor reactions, the level of muscular-articular sensitivity and coordination of movements, the power of forced inspiration and expiration were measured.*

Results: *the conducted studies allowed to study the functional state of athletes. In sports activities, various functional systems of the body operate in the mode of maximum possible physical exertion, while the body adapts to the external and internal factors, and an equilibrium is established between them. Dynamic observation of the functional state, taking into account the individual characteristics that determine the prospects of an athlete, allows for optimal physical performance, improve the effectiveness of the training process, which contributes to the achievement of high sports results. The preservation of the result of activity (quick start of work, maintaining speed at a distance, manifestation of endurance, general performance) with the development of fatigue is due to the formation of specific and mobile adaptive reactions, during which large fluctuations of the main parameters of the movement structure are observed, ensuring an effective solution of the motor task.*

Conclusions: *the proposed tests for measuring the effect of the training action, electromyoreflexometry, pneumotachometry and reverse dynamometry are quite informative in sports practice and allow us to determine and evaluate the individual prerequisites for sporting achievements. The data obtained can be applied in the training process in the preparation of athletes, taking into account the age dynamics of the development of physical qualities, somatic, sensory and vegetative systems of the body in the selection, construction and correction of the training process, the study of compensatory reactions and recovery processes in sports activities.*

Keywords: *functional state, measurement of the effect of the training action, electromyoreflexometry, pneumotachometry, reversible dynamometry.*

Introduction

An important factor in the planning of the training process is the control of the functional state of the athlete. Intensive and volumetric exercise in various sports can lead to overtraining, decrease in athletic performance, contribute to the occurrence of pathological changes in the athlete's body [1; 2].

The process of adaptation is accompanied by an increase in physical activity and improvement of the functional systems of the body. In case of violation of certain compensatory processes, its activity is carried out at the prepathological and pathological levels. Such a state of adaptation can lead to the development of overwork, overstrain, reduced efficiency and in the future - the emergence of diseases and injuries. It is necessary to apply optimally balanced control of the functional training of athletes to achieve significant results [3; 4].

Athletes with a high motivation for sporting achievements, especially at the stage of special basic training, often have a subjective assessment of their state of health, they may underestimate the effect of training on the body and, contrary to the coach's requirements, independently increase the duration or intensity of exercise. This contributes to long-term stress functional systems, the accumulation of fatigue and lack of recovery of the body, which causes the development of overtraining [5; 6].

Balanced autonomic regulation of muscle activity allows an athlete to maximize the use of their functionality with the proper level of motivation, provides the necessary economization of functions and determines the speed of recovery processes. Violation of the vegetative regulation is an early sign of deterioration in adaptation to stress and causes a decrease in efficiency, as well as the appearance of headache, dizziness, sleep disorders, increased excitability, irritability, or, conversely, asthenic condition, accompanied by a decrease in performance, lability of vasomotor reactions, which can lead to neurocirculatory dystonia, which occurs in hypertensive (often in boys and men), hypotonic (more often in women) or the normotonic type [7; 8].

Functional changes in the cardiovascular system are observed: hypertension or hypotension, cardiac arrhythmias, blood filling and vascular tone of the brain. The circulatory system can be an indicator of adaptive reactions of the whole organism. Functional reserves and the expenditure of their operational and strategic components, which are mobilized during the stages of urgent and long-term adaptation, characterize the most visual and typical indicators of this process [9; 10].

The functional reserves of the body are determined by comparing two measurable indicators – the level of functioning of the dominant system and the degree of tension of the regulatory systems, as well as on the basis of the results of the research of functional tests. With their high level, less effort is required to adapt to normal conditions of existence. Reserve capacities create a margin of safety in case of inadequate effects on the body, thanks to which the initial level of its functioning does not decrease [11; 12].

Physical activity in sports activities forms a functional and morphological restructuring of the body systems, in which the main mechanism is a more complete use of physiological reserves, largely due to the improvement of the main functional systems of the body, which should be studied in accordance with the age of the trainees and the specifics of various sports [13; 14].

In sports training and determining the prospects of an athlete, it is necessary to take into account the age, morphofunctional and psycho-physiological characteristics of the organism, which are an indicator of adaptation to environmental conditions. In kayaking, ages 13–16 years old are considered the most favorable for starting regular training and special basic training, which determines further sporting achievements [1; 2; 8].

Purpose of the study: to conduct a comprehensive study of the functional state, the basic properties of the nervous system of athletes specializing in rowing, for the subsequent determination of perceptivity in this sport.

Material and Methods of the research

The students of the Higher School of Physical Education, specializing in rowing, were surveyed. Individual indicators were determined in the age group of 15–16 years: 25 boys, 23 girls, in total – 48 athletes.

The study of the functional state included a test measuring the effect of the training action (META), created on the basis of the tapping test, which allows you to determine the complex of kinematics characteristics of movements in the autonomous mode.

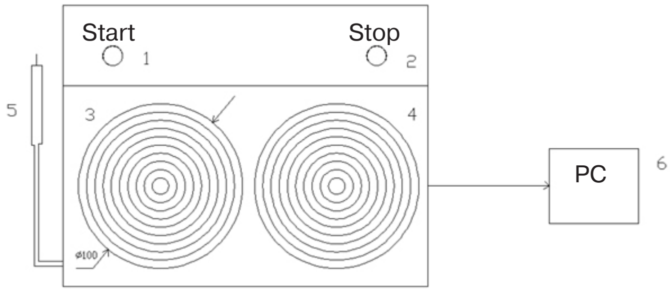

Fig. 1. Scheme of the device for measuring the effect of the training action (META):
1, 2 – alarm device; 3 – left target; 4 – right target; 5 – dipstick; 6 – personal computer.

The device for determining the M (Figure 1) consisted of an electronic unit for automatic registration of movements, a contacting rod and two targets, made in the form of concentric circles, allowing estimating the accuracy of movements from 1 point on the periphery to 10 points in the center of the target. The centers of the targets were located at a distance of 30 cm from each other. Motor actions were performed when fixing the elbow joint of a working hand on a horizontal surface. The motion was considered to be performed upon contact of the rod with the target. This technique allows you to study the pace of movements and their accuracy by the sum of points gained, as well as the accuracy of a single movement. The study of movements performed with maximum speed and accuracy was considered in different conditions, successively in three time periods: for 15 s, 60 s and 15 s, which provided an objective assessment of motor actions in various conditions: with an optimal functional state in the first period of time, in the process of long work in the second and after a long and maximum pace of work in the third period.

The change in the number of movements during the first period of time indicates a high mobility of nervous processes, the second indicates balance, the third indicates strength and, in total, the state of the nervous system as a whole. This physiological justification allows the trainer to objectively evaluate the processes occurring in the body, and purposefully manage the training and competitive activities.

The latent periods of visual-motor and auditory-motor reactions were determined using an electromyoreflexometer (EMR) according to a standard method. The counting device in it started counting the time from the moment when the light or sound stimulus was applied and until the beginning of the response, when the signal was switched off by the subject. We measured 10 sensorimotor reactions to a light stimulus and 10 to a sound one, which were given in a specific sequence with an interval of 3–5 seconds under conditions of relative psychophysiological rest and complete silence. The average reaction time, the maximum and minimum values, the error of the mean and the mean square deviation were calculated.

Visual-motor and auditory-motor reactions are an indicator of complex psycho-physiological processes, reflecting the characteristics of the receptor perception, nervous and muscular systems. This test characterizes the mobility of nervous processes, that is, one of the most important indicators of higher nervous activity. Changes in the mobility of nervous processes in conjunction with various environmental factors determine the level of complex speed abilities.

Musculo-articular sensitivity and coordination of movements, as well as the diagnostic capabilities of the principle of repeated reproduction of a given load were studied by the method of reverse dynamometry (DM_{rev}). The standard method of reverse dynamometry has been modified and adapted for the purposes of our study. The first three attempts to reproduce a given muscular effort of 15–20 kg were carried out by the athlete with visual control, and the remaining 10 attempts were made according to muscle memory. The interval between attempts was 3 min. The possibility of developing a skill to reproduce a given load without visual correction of each of the ten attempts was determined.

Measurement of the power of forced inspiration and expiration was carried out using a pneumotachometer (PT). Estimated air velocity in $l \cdot s^{-1}$ with maximum forced inhalation and exhalation. 10 attempts were used with an interval of at least 10 s. Determining the maximum air flow during inhalation and exhalation allows you to indirectly judge the ability of the respiratory muscles to work intensively. With regular sports activities, the power of forced inhalation and exhalation can increase significantly.

The results of observations were processed by methods of variation statistics.

Results of the research

Athletes aged 15–16 years were examined according to the method of measuring the effect of the training action (Table 1). In the first test period, the average indices were as follows: pace – 32±2,05 hits, total points – 245±14,69, accuracy –7,65±0,44 points; maximum: pace – 39 hits, the number of points for all movements – 280, accuracy – 7,18 hits; minimum: pace – 23 hits, total points – 162, accuracy – 7,04 points.

The maximum indicator was more than the average pace of 7 hits (21,88%), the sum of points – by 35 (14,29%), the accuracy decreased by 0,5 points (6,55%); the minimum is less than the average pace by 9 hits (39,13%), the sum of points is

Table 1

Results of surveys on the method of measuring the effect of the training action (rowing on kayaks, boys 15–16 years old)

		Indicators	M±m	M_{max}	M_{min}	σ	C
Effect of a training action	First period	Pace (number of hits)	32±2,05	39	23	6,49	20,29
		Total points	245±14,69	280	162	46,43	18,95
		Accuracy (points)	7,65±0,44	7,18	7,04	1,40	18,01
	Second period	Pace (number of hits)	142±6,22 (35,5±1,555)	164 (41)	105 (26,25)	30,84	21,72
		Total points	1050±52,50 (262,5±13,125)	1182 (295,5)	824 (206)	165,91	15,80
		Accuracy (points)	7,39±0,32	7,21	7,84	1,01	13,43
	Third period	Pace (number of hits)	37±3,08	42	27	9,74	26,33
		Total points	262±6,16	314	212	19,48	7,44
		Accuracy (points)	7,30±0,39	7,48	5,35	1,23	16,86
	Total	Pace (number of hits)	211±13,25 (35,17±2,208)	245 (40,83)	156 (25,83)	41,88	19,85
		Total points	1556±54,35 (259,5±9,058)	1776 (296)	1199 (199,67)	266,56	17,13
		Accuracy (points)	7,42±0,34	7,25	7,69	1,09	14,48
Test	EMR (s)	Sound	0,170±0,01	0,250	0,150	0,032	19,10
		Light	0,194±0,006	0,225	0,170	0,019	0,595
	PT ($l \cdot s^{-1}$)	Inhale	6,4±0,266	7,6	5,0	0,84	13,19
		Exhale	5,9±0,29	7,3	4,5	0,91	15,41
	DM rev. (kg)			2,0	0,5	1,29	73,4

Remark. *In parentheses are the data reduced to a single time indicator of 15 s.*

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83 points (51,23%), the accuracy is 0,61 points (8,66%).

In the second test period, the average values: pace – 35,5±1,56 hits, total points – 262,5±13,12, accuracy – 7,39±0,32 points; maximum: pace – 41 hits, the sum of points – 295,5, more than the average – respectively by 5,5 hits (15,49%) and 33 points (12,57%), the accuracy is less than the average by 0,18 points (2,49%); minimum: the pace is 26,25 hits, the sum of points is 206, less than the average, respectively, by 9,25 hits (35,24%) and 56,5 points (27,43%), the accuracy is higher than the average by 0,45 points (6,09%).

In the third test period on average: the pace – 37±3,08 hits, the sum of points –262±6,16, the accuracy – 7,30±0,39 points; maximum: tempo – 42 hits, total points – 314, accuracy – 7,48 points; minimum: pace – 27 hits, total points – 212, accuracy – 5,35 points. The best result was observed more than the average pace by 5 hits (13,51%), the sum of points – by 52 (19,85%), accuracy – by 0,18 points (2,.47%), the worst – less than the average pace by 10 hits (37,04%), total points – by 50 (23,58%), accuracy – by 1,95 points (36,45%).

The sum of three periods was observed on average: the pace – 35,17±2,21, the sum of points – 259,5±9,07, the accuracy – 7,42±0,34 points; maximum: pace – 40,83 hits, total points – 296, accuracy – 7,25 points; minimum: pace – 25,83 hits, total points – 199,67, accuracy – 7,69 points. The best indicator was more than the average pace by 5,66 hits (16,09%), the total points – by 36,5 (14,07%) and less in accuracy of movements by 0,17 points (2,34%), the worst – less than average in pace by 9,34 points (36,16%), total points – by 59,83 (29,94%) and more in accuracy of movements by 0,27 points (3,64%).

In the first period of the test, a fairly high level was noted, when compared with our other observations, the pace of movements, the number of points gained for all motor actions, the accuracy of one movement.

In the second period of the test, the effect of the training action was compared with the first period in terms of average values: the pace rose by 3,5 hit (10,94%), the sum by 17,5 points (7,14%), the accuracy decreased by 0,25 points (3,52%); at maximum – increased: the pace – by 2 hits (5,13%), the amount – by 15,5 points (5,54%), the accuracy – by 0,03 points (0,42%); at the minimum – increased: the pace at 3,25 hits (14,13%), the amount – by 44 points (27,16%), the accuracy – by 0,8 points (11,36%).

In the third test period, compared with the first and second periods, respectively, the average values increased – the pace – by 5 hits (15,63%) and 1,5 hits (4,23%), the amount – by 17 points (6,94 %) and did not change, accuracy decreased by 0,35 points (4,79%) and 0,09 points (1,23%); maximum – increased: the rate of 3 hits (7,69%) and 1 hit (2,44%), the amount – by 34 points (12,14%) and by 18,5 points (6,96%), accuracy – by 0,3 points (4,18%) and 0,27 points (3,74%); minimum – the rate of 4 hits (17,39%) and 0,75 hits (2,86%), the amount – by 50 points (30,86%) and 6 points (2,91%).

Athletes aged 15–16 years old practicing rowing kayaking, on average, maintained a good level of pace during testing, which gradually increased from the first to the third period by more than 15%, the amount of points by 7%, but the accuracy decreased by 5%; according to the best indicators, the rate increased slightly less – 8%, the amount of points – by 12%, accuracy – by 4%; at worst – the pace increased by 17%, the amount of points – by 30%, accuracy – by 3%.

Sensoriomotor reactions to the sound signal ranged from 0,170±0,01 s with a minimum time of 0,150 s, a difference of 0,02 s (13,33%), a maximum of 0,250 s, a difference of 0,08 s (47,06%); the light signal is 0,194±0,006 s with a minimum time of 0,170 s, the difference is 0,024 s (14,12%), the maximum is 0,225 s, the difference – 0,031 s (15,98%).

The result of pneumatic tachometer inhalation was on average 6,4±0,266 $l \cdot s^{-1}$, maximum – 7,6 $l \cdot s^{-1}$, more than 1,2 $l \cdot s^{-1}$ (18,75%), minimum – 5,0 $l \cdot s^{-1}$, less than 1,4 $l \cdot s^{-1}$ (28,00%); on expiration, the average result is 5,9±0,29 $l \cdot s^{-1}$, maximum – 7,3 $l \cdot s^{-1}$, more by 1,4 $l \cdot s^{-1}$ (23,73%), minimum – 4,5 $l \cdot s^{-1}$, less on 1,4 $l \cdot s^{-1}$ (31,11%).

The reverse dynamometry test showed an average error when performing an exercise of 1,77±0,560 kg (8,85%), the maximum error was 2,0 kg (5%), the minimum error was 0,5 kg (2,5%).

The test results of measuring the effect of a training effect on girls aged 15–16 years specializing in rowing are presented in Table 2.

In the first test period, which determines the starting speed, the average values were at the level of: the pace of movements – 3,0±0,89 hits, the sum –234±8.32 points, the accuracy – 7,87±0,22 points; maximum: pace – 36 hits, sum – 290 points, accuracy – 8,06 points, more than average, respectively, for 6 hits (20,00%); 56 points (23,93%), 0,19 points (2,41%); minimum: pace – 24 hits, the sum – 196 points, less than the average – by 6 hits (25,00%), 38 points (19,39%), but the accuracy of 8.16 points – more than the average by 0,29 points (3,68%).

In the second test period, showing the ability to maintain speed at a distance, the average indicators were: pace – 31,25±0,89 hits, sum – 235,75±8,78 points, accuracy – 7,57±0,23 points; maximum: pace – 36,25 hits, total – 280,5 points, accuracy – 7,74 points, which is more than the average indicator, respectively, by 5 hits (16,00%), 44,75 points (18,98%), 0,17 points (2,25%); minimum: the pace is 24,25 hits, the sum is 187,25 points, less than the average by 7 hits (28,87%), 48,5 points (25,89%), but the accuracy is 7,72 points more than the average 0,15 point (1,98%).

In the third test period, indicating speed endurance, on average: the pace – 3,1±0,97 hits, the sum – 230±8,25 points, the accuracy – 6,68 points; maximum: pace – 37 hits, sum – 291 points, accuracy – 7,86 points, which is more than the average figure, respectively, by 6 hits (19,35%), 61 points (26,52%),

Table 2

Results of surveys on the method of measuring the effect of the training action (rowing on kayaks, girls 15–16 years old)

		Indicators	M±m	M_{max}	M_{min}	σ	C
Effect of a training action	First period	Pace (number of hits)	30±0,892	36	24	3,46	11,53
		Total points	234±8,32	290	196	32,28	13,79
		Accuracy (points)	7,87±0,22	8,06	8,16	0,865	10,99
	Second period	Pace (number of hits)	125±3,56 (31,25±0,89)	145 (36,25)	97 (24,25)	13,83	11,07
		Total points	943±35,13 (235,75±8,783)	1122 (280,5)	749 (187,25)	136,3	14,46
		Accuracy (points)	7,57±0,238	7,74	7,72	0,922	12,16
	Third period	Pace (number of hits)	31±0,966	37	24	3,75	12,09
		Total points	230±8,245	291	182	31,99	13,91
		Accuracy (points)	6,68±0,245	7,86	7,58	0,951	14,24
	Total	Pace (number of hits)	186±2,80 (31±0,467)	218 (36,33)	145 (24,17)	19,88	10,63
		Total points	1407±45,67 (234,5±7,612)	1703 (283,33)	1127 (187,83)	177,2	12,62
		Accuracy (points)	7,56±0,201	7,79	7,77	0,778	10,37
Test	EMR (s)	Sound	0,178±0,039	0,205	0,152	0,015	8,43
		Light	0,216±0,072	0,279	0,181	1,028	13,08
	PT ($l \cdot s^{-1}$)	Inhale	4,6±0,089	5,2	4,0	0,346	7,5
		Exhale	4,4±0,156	5,4	3,3	0,603	13,75
		DM rev. (kg)	1,16±0,24	2,67	0,23	0,76	65,49

Remark. *In parentheses are the data reduced to a single time indicator of 15 s.*

1,18 points (17,66%); minimal: pace – 24 hits, the sum – 182, which is less than the average by 7 hits (29,17%), by 48 points (26,37%), but the accuracy of 7,58 points is more than the average by 0,9 points (13,47%).

In terms of the total test score of the training effect, reflecting speed abilities, average results: tempo –31±0,46 blows, total – 234,5±7,61 points, accuracy – 7,56±0,20 points, maximum: tempo – 36,33 hits, the sum - 283,33 points, accuracy – 7,79 points, which is 5,33 hits (17,19%) more than the average, respectively, 48,73 points (20,82%), 0,23 points (3,04%); minimum: pace – 24,17 hits, total – 187,83 points, less than the average by 6,83 hits (28,26%), 46,67 points (24,85%), accuracy – 7,77 points, more than the average by 0,21 point (2,78%).

When comparing the indicators in the second period with the first, the average pace and sum of points slightly increased – by 1,25 hits (4,17%) and 1,75 points (0,75%), but the accuracy of one movement decreased by 0,3 points (3,96%); maximum – the pace actually remained at the same level, an increase of 0,25 hits (0,69%), the amount of points decreased by 9,5 points (3,39%) and the accuracy decreased by 0,32 points (4,13%); at the minimum – the pace has not actually changed, an increase of 0,25 hits (1,04%), the amount decreased by 8,75 points (4,67%), the accuracy decreased by 0,44 points (5,69%).

In the third period, compared with the first and second, the changes were insignificant in terms of average values – the pace increased by 1 hit (3,33%) and decreased by 0,25 hits (0,81%), the amount decreased by 4 points (1,74%) and 5,75 points (2,50%), accuracy decreased by 1,19 points (7,81%) and by 0,89 points (13,32%); maximally – the pace increased by 1 hit (2,78%) and 0,75 hits (2,07%), the amount did not change compared to the first period and was less in the second by 10,5 points (3,74%) , accuracy decreased by 0,2 points (2,54%) and increased relative to the second period by 0,12 points (1,55%); at the minimum – the pace is the same in all periods, the amount is less by 14 points (7,69%) and 5,25 points (2,88%), the accuracy decreased by 0,58 points (7,65%) and by 0,14 points (1,85%).

The overall result showed that, on average, the pace did not actually change, the sum with the first and second periods was the same, the difference from the third was 4,5 points (1,96%), the accuracy was lower than in the first one, by 0,31 points (4,10%), the same with the second, more than in the third by 0,88 points (13,17%); in terms of maximum indicators – the pace is the same in all test periods, the amount is

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more than in the second period, by 2,83 points (1,01%) and less than in the first and third periods, by 6,67 points (2,35%) and by 7,67 points (2,71%), accuracy is higher than in the second, by 0,05 points (0,65%), less than in the first and third periods, by 0,27 points (3,47%) and by 0,07 points (0,89%); at the minimum – the pace is the same in all periods of the test, the amount is less than the first, by 8,17 points (4,63%), the same as the second, more than the third, by 5,83 points (3,20%), accuracy is higher than in the second and third periods, by 0,05 points (0,65%) and by 0,19 points (2,51%), less than in the first, by 0,39 points (5,02%).

The difference from the average figures in the sum of the maximum and minimum values was: in the first period, according to the pace, 45,00%, total points 43,32%, accuracy 6,09%; in the second – on the pace of 44,87%, the sum of points 47,85%, accuracy 4,23%; in the third period – at the rate of 48,52%, the amount of points was 52,89%, the accuracy was 5,81%, in total – at the rate of 45,45%, the amount of points was 45,67%, the accuracy was 5,82%. At the maximum pace and sum of points, the accuracy of movements was greater than the average in all periods of the test.

It is possible to assume the likelihood of an error due to an incorrectly understood task, that is, instead of the task – to work as quickly as possible, the subjects tried to perform the task exactly, which is eliminated almost completely, since the testing was carried out under constant control. Therefore, it is a psycho-physiological age feature and is probably determined by the level of qualification.

The speed of sensorimotor reactions in female athletes aged 15–16 years per sound stimulus was determined by the following values: the average – 0,178±0,039 s, the best – 0,152 s, which is less than the average by 0,026 s (17,11%), the worst – 0,205 s, more than the average by 0,027 s (15,17%); on light stimulus: the average indicator is 0,216±0,072 s, the best one is 0,180 s, which is less than the average by 0,035 s (19,34%), the worst is 0,279 s, more than the average by 0,063 s (29,17%), deviations from the average the values in total for the sound signal were 32,28%, for the light signal – 48,51%, the difference between the maximum and minimum parameters was determined by the value – for the sound 1,94%, for the light 9,83%.

With pneumatic tachometer, the air flow rate on the inspiration was 4,6±0,09 $l \cdot s^{-1}$, maximum – 5,2 $l \cdot s^{-1}$, which is 0,6 $l \cdot s^{-1}$more than the average value (13,04%), minimum – 4,0 $l \cdot s^{-1}$, less than the average – by 0,6 $l \cdot s^{-1}$ (15,00%); on an exhalation – 4,4±0,16 $l \cdot s^{-1}$, maximum – 5,4 $l \cdot s^{-1}$, which is more than the average – by 1 $l \cdot s^{-1}$ (22,73%), minimum – 3,3 $l \cdot s^{-1}$, less than average – by 1,1 $l \cdot s^{-1}$ (33,33%).

The average error of muscular effort in the test of reversible dynamometry was determined to be 1,16±0,24 kg (7,73%), the minimum – 0,23 kg (1,53%), less than the average by 0,93 kg (1,53%), maximum – 2,67 kg, more than the average by 1,51 kg (10,07%), deviations from the average value were 11,60%, the difference between the maximum and minimum errors – 8,54%.

Conclusions / Discussion

The effectiveness of the process of training and competitive activity is improved with the intensification of the use of functional reserves of the body and stimulation of adaptation processes. Improved performance contributes to a balanced system of physical activity, rest, nutrition, rehabilitation facilities; and also it is necessary to take into account the holding of competitions in different climatic zones, time zones, oxygen level tension (plain, middle mountains), improvement of motor skills through the use of various instruments and methods.

Adaptation or adaptation to new conditions occurs due to the mobilization of functional reserves and requires a certain amount of regulatory systems, which should not exceed the limits of individual capabilities, lead to overstrain and depletion of regulation mechanisms.

The basis for improving objective knowledge of the general patterns of training and competitive loads in a particular sport and individual capabilities of an athlete emphasizes the need to focus on group and individual model characteristics of functional preparedness. This is one of the main reserves for the rational management of the athlete's condition, his adaptive abilities, and the level of sports preparedness. In sports activities, various functional systems of the body operate in the mode of maximum possible reactions, while the organism adapts to the factors of the external and internal environment, a balance is established between the organism and the environment.

The effectiveness of the use of positive dynamics of adaptation to improve performance, prevent physical overvoltage largely depends on an objective assessment of the functional state of the athlete's body. The lack of a clear idea of the limits of the reserve abilities of a person is, on the one hand, an obstacle to achieving high sports results, and on the other hand, can lead to various disorders in the body due to the incompatibility of the amount of training physical loads with its adaptation capabilities.

Preservation of the result of activity (quick start of work, maintaining speed at a distance, manifestation of endurance, general performance) with the development of fatigue is due to the formation of specific and mobile adaptive reactions, in which there are large fluctuations of the main parameters of the structure of the movement, ensuring an effective solution of the motor task.

The proposed tests for measuring the effect of the training action, electromyoreflexometry, pneumotachometry and reverse dynamometry are quite informative in sports practice and allow you to determine and evaluate the individual prerequisites for sporting achievements.

The data obtained can be applied in the training process in the preparation of athletes with regard to the age dynamics of the development of physical qualities, somatic, sensory and autonomic systems of the body in the selection, construction and correction of the training process, the study of compensatory reactions and recovery processes in sports.

Dynamic monitoring of the functional state, taking into account the individual characteristics that determine the prospects of an athlete, allows for optimal physical performance, improve the efficiency of the training process, which contributes to the achievement of high sports results.

Prospects for further research. Ontogenetic features of the functional adaptation of various body systems can be the basis for further research in sports activities.

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Information about the Authors

Volodymyr Bogush: *PhD (Medicine); Admiral Makarov National University of Shipbuilding: Geroev Stalingrada str. 9, Mykolayiv, 54025, Ukraine.*
ORCID.ORG/0000-0002-7178-6165
E-mail: toops@ukr.net

Sergiy Getmantsev: *PhD (Biology); V. Sukhomlynskiy Nikolaev National University: Nikolskaya str. 24, Mykolayiv, 54030, Ukraine.*
ORCID.ORG/0000-0003-1829-9832
E-mail: s.v.getmantsev@rambler.ru

Konstantin Bogatyirev: *Doctor of Science, Professor; Admiral Makarov National University of Shipbuilding: Geroev Stalingrada str. 9, Mykolayiv, 54025, Ukraine.*
ORCID.ORG/0000-0003-0963-8417
E-mail: toops@ukr.net

Ganna Tarasova: *PhD (Sport); Admiral Makarov National University of Shipbuilding: Geroev Stalingrada str. 9, Mykolayiv, 54025, Ukraine.*
ORCID.ORG/0000-0001-8753-9612
E-mail: annat3047@gmail.com

Yuriy Kulakov: *V. Sukhomlynskiy Nikolaev National University: Nikolskaya str. 24, Mykolayiv, 54030, Ukraine.*
ORCID.ORG/0000-0002-3651-0438
E-mail: KulakoV_MNU@ukr.net

Yevgen Yatsunskiy: *Admiral Makarov National University of Shipbuilding: Geroev Stalingrada str. 9, Mykolayiv, 54025, Ukraine.*
ORCID.ORG/0000-0001-7450-252X

E-mail: lily0210837@gmail.com