

Research of functional status of handball player is in a training process

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Purpose: to learn functional changes in the organism of sportsman in the conditions of training process for optimization of sporting preparation of handball player.

Material & Methods: the handball player of different age groups and sporting qualification inspected: 13–15 years without a sporting digit, 16–18 years is the second digit, 19–23 years is the first digit and candidates in masters of sport, in all 45 persons. Sensomotorni reactions, exactness of dosage of muscular efforts, limit of the line of sight, frequency of cardiac reductions, maximal consumption of oxygen, general and special capacity, were studied.

Results: showed that an increase in the level of training significantly improved response sensorimotor systems (visual, auditory, motor), increased limits the field of vision that promotes a special game quality – the ability to see the field increased general and special performance, the optimum duration of intensive work is the heart rate and oxygen consumption, when a specific task training is a definite change in physiological systems.

Conclusions: objective assessment and analysis of changes in the studied parameters of the functional state of an athlete revealed their relationship, which can be used in the training process.

Keywords: handball, sensorimotor reactions, frequency of cardiac reductions, maximal consumption of oxygen, general and special capacity.

Introduction

Sports games belong to a group of situational sports for which non-standard movements, lack of stereotype and repetitions of invariable, standard provisions, and also inconstancy of conditions of their performance are peculiar. Kind of work of a sportsman is decided, first of all, by interaction on the rival or members of the team, isn't regulated in advance and changes according to their actions, which can be at some point to a certain extent stereotypic (run, walking, etc.), acyclic, high-speed and power (throws, jumps, blows, falling). It predetermines considerable probability of use of repetitions of certain situations, game moments and techniques. At the same time the variety of forms of manifestations of actions of a sportsman is constantly connected with the solution of numerous game combinations which depend to a large extent on sports experience of players [3; 10].

The maximum repetition of special and auxiliary exercises leads to a change of certain physiological functions of an organism of a sportsman, promotes the best development of physical qualities, the increase of functionality and, therefore, sports preparedness [6].

The most important feature of sports games is their emotional saturation, high degree of unpredictability of actions of the rival that causes the physiological changes in an organism proceeding as stressful reactions. A sportsman has to assess

quickly arisen situation, make the effective decision, choose the expedient game technique, execute it in the rational way taking into account the time, a space, a dosage of muscular efforts, to be ready to performance of the following motive task [5].

The efficiency of the training process considerably depends on correctness of selection and distribution of means and methods in which every period certain problems are solved. The productivity of their performance depends on a combination of various loadings and their alternation to rest that is a prophylactic of exhaustion, overfatigue and overtraining. At the same time it is necessary to set a task of development and fixing of the certain motive qualities on each training classes, providing a performance of difficult coordination movements in sports games [11].

Handball is characterized by high intensity of movement, a constant differentiation of three-dimensional motions, locations of a partner, the rival, throws, and passes, techniques of a ball with a different speed and force that makes active the level of perception of various analyzers [2].

In the conditions of trainings afferent influences form a certain level of activity of touch systems and promotes emergence of mood between them that probably is specific and characteristic of certain sports. High degree of interrelation of analyzers when performing exercises with a ball is noted in sports

games, when moving partners and the opponent on the platform. The change of functional activity of one analyzer (visual, kinaesthetic) leads to similar changes in another. The level of sensitivity of touch systems in a concrete sport is formed by the specifics of muscular activity causing a background of interaction of analyzers [13].

Sportsmen have to have the high level of physical and technical-tactical preparedness with manifestation of standard and coordination abilities in the existential accuracy of physical actions and their biomechanical rationality [9].

The impact on physical and functional preparedness is applied in improvement of the system of training of handball players, that will provide co-ordination, speed, variability of technical-tactical opportunities promoting effectively and rationally to perform physical actions in a game at influence of various forcing-down factors [7; 12].

Components in the structure of sports preparedness are interconnected and are based on activity of functional complex of motive coordination: technique and processing of information, accumulation and realization of a play experience, mechanisms of correction, executive components. However the interrelation of separate elements in physical and technical-tactical preparedness in general isn't essential, that it is explained by a large amount of individual distinctions. The correlation interrelations during the different age periods are ambiguous on the level between indicators of physical and functional preparedness [1; 8; 14].

Construction, planning, management of training of handball players of the system has to be evidence-based, consider tasks, working conditions, continuity, new achievements and innovative prospects [4].

The purpose of the research

Studying of functional changes in the sportsman's organism for the optimization of his physiological state in the conditions of the training process which is brought closer on intensity and loading to extreme conditions of competitions.

Material and Methods of the research

The examination of handball players of various age groups and sports qualification was conducted: 13–15 years old – beginners (without sports category), 21 persons; 16–18 years old – the second category, 15 people; 19–23 years old – the first category and candidates for the master of sports, 9 people. Indicators were studied: general and special working capacity, borders of fields of vision, sensomotor reactions (visual, acoustical, motive), accuracy of a dosage of muscular efforts, heart rate, maximum consumption of oxygen.

Results of the research and their discussion

Indicators of sensomotor reactions of handball players on the general and specific irritants are presented in table 1. Reaction to light in the age group of 13–15 years old equaled 0,237 s, on a sound – 0,218 s, in 16–18 years old respectively 0,225 s and 0,195 s, in 19–23 years old – 0,211 s and 0,188 s. Therefore, with the increase of sports preparation the time of reaction to a light irritant decreased in the group of sportsmen of the second category in comparison with the beginners

by 5,1% and for a sound irritant for 10,5%, at more qualified sportsmen respectively for 10,9% and 20,6%. The improvement of the time of reaction when carrying out game techniques in the studied groups respectively for 6,3% and 23,3%, on an assessment of a game situation was noted at a throw for 12,2% and 24,4%, by passes for 2,6% and 5,1%, at an inking for 6,3% and 12,6%. The time of reaction of the choice of techniques in the set game situations was various in the observed age groups. In training exercises: 1x1 at the age of 13–15 years old equaled 0,649 s, 15–16 years old – 0,586 s, 19–23 years old – 0,524 s; i.e. it decreased respectively by 9,7% and 19,2%; 2x1 according to the age groups equaled 0,651 s, 0,599 s, 0,547 s and decreased by 8% and 15,9%; 2x2 on the studied age was – 0,603 s, 0,548 s, 0,494 s, it was noted the reduction of indicators by 9,1% and 18%. At the increase of professional skill the time of reaction decreased, that is the reaction of the choice of techniques in game situations improved. Sports games are an effective remedy of improvement of a functional condition of touch systems, namely visual, acoustical and motive analyzers.

Hard or long work changes the functions of physiological systems of an organism, showing by exhaustion, which signs are deterioration in accuracy of physical actions, increase in quantity of technical mistakes, temporary decrease in working capacity, etc. The noticeable discoordination of vegetative functions and subjective feeling of fatigue appear later. The indicators of special and general efficiency of sportsmen are distinguished, first of all, in game sports from the limiting factors of working capacity, which are presented in table 2.

Methods were applied at the research of special working capacity: run with the maximum speed at 30 m, dribbling at the same distance, jumps – threefold from the place and according to Abalakov. Results of testing were the lowest at sportsmen at the age of 13–15 years old, in groups of 16–18 years old and 19–23 years old increased respectively in run with acceleration by 2,12% and 7,36%, dribbling – 1% and 4,25%, a triple jump – 2,45% and 1,5%, a jump according to Abalakov – 2% and 5,4%. The general working capacity was determined by results of intensive run on 30 m, 5 times with an interval of rest of 20 s. The best result was in the first attempt at the age of 19–23 years old – 3,96 s, i.e. for 5% speed was more, than in the younger age group. The average value on five attempts had the same tendency, i.e. the time of execution of the test decreased respectively by 0,5% and 3,8% at sportsmen of higher qualification in comparison with the beginners.

The development of coordination abilities is closely connected with the improvement of specialized perceptions – space sense, time, accuracy of a dosage of muscular efforts as ability of handball players effectively depends on these properties to operate the movements. The data of the accuracy of differentiations of the set effort (mistake) by handball players of various level of preparation are given in tab. 3.

The researches were conducted before and after training at the maximum effort of 20 kg, then a half and the fourth part. The smallest mistake was noted in the senior age group, and the accuracy of differentiation of the maximum effort worsened almost twice at all sportsmen after training, and smaller dosages of muscular loading under the same conditions are characterized by the increase of accuracy of physical actions.

Table 1
Indicators of sensomotor reactions of handball players to the general and specific irritants (s)

Age	Light	Sound	Game techniques (throws, passes, outplay)	Game situations			Reaction of the choice of techniques in game situations		
				throw	pass	outplay	1x1	2x1	2x2
13–15	0,237	0,218	0,304	0,720	0,648	0,663	0,649	0,586	0,524
16–18	0,225	0,195	0,285	0,632	0,631	0,621	0,651	0,599	0,547
19–23	0,211	0,188	0,233	0,544	0,615	0,579	0,603	0,548	0,494

Table 2
Indicators of special and general efficiency of handball players

Age	Special working capacity					General working capacity					
	Acceleration 30 m, s	Dribbling 30 m, s	Triple jump from the place, m	Jump according to Abalakov, sm	Accuracy of throws, quantity	Acceleration 5x30 m with an interval of rest 20 s					
						1-st	2-nd	3-rd	4-th	5-th	M _{av.}
13–15	4,23	4,24	7,94	76,0	7	4,15	4,23	4,20	4,28	4,25	4,22
16–18	4,14	4,20	8,14	77,5	6	4,16	4,19	4,23	4,23	4,23	4,20
19–23	3,94	4,06	8,06	80,1	7	3,96	4,09	4,09	4,10	4,08	4,06

Table 3
Indicators of differentiation of the set effort (mistake) at handball players, kg

Age, years	Dosage of muscular efforts (20 kg)					
	Before training			After training		
	Max	S from max	j from max	Max	S from max	j from max
13–15	3,7	3,8	3,6	7,1	2,9	2,6
16–18	0,9	4,1	3,9	1,7	3,6	2,8
19–23	0,3	2,98	2,5	0,6	1,6	2,4

The increase of coordination complexity of training impacts influences the size of response of an organism more than their duration, and in some cases and intensity. This regularity is result of features of a functional condition of nervous system of a sportsman in game sports which allows him in specific conditions more effectively to conduct processing of the obtained information in comparison with sportsmen of other specializations. Unexpectedly arising and quickly changing game episodes demand from players of high degree of perception of separate situations and ability correctly them to solve.

One of the factors limiting effective use by sportsmen of information on game actions of the partners and team of the rival about movements of a ball, is functional restriction of fields of vision as result of insufficient special preparedness and lack of a necessary play experience. Special quality – ability to see the field is distinguished in sports game.

The comparative assessment of border of fields of vision in various directions testifies to higher rates at handball players, namely it is more than to outside on 2°, inside on 15°, up on 7°, on 13° from the top till the bottom, than at the persons who aren't playing sports.

Borders of fields of vision of both eyes (tab. 4) with the in-

crease of sports qualification increase: external border on 6°, lower – on 6°, internal – 3–4°, top – 4°, i.e. the lowest indicator at the age of 13–15 years old and the highest in the group of 19–23 years old sportsmen.

Table 4
Borders of fields of vision of handball players (degrees)

Indicator	Age (years)		
	13–15	16–18	19–23
External border			
Left eye	71	73	77
Right eye	69	72	75
Low border			
Left eye	47	51	53
Right eye	45	48	51
Internal border			
Left eye	48	50	52
Right eye	50	51	53
Top border			
Left eye	32	33	36
Right eye	33	31	37

The acceleration of rate of a game, the increasing mental and physical tension raise approximate activity at handball players which is a compound component of tactical preparation and to a great extent causes the general scheme of behavior of a sportsman in difficult game situations, is inseparably linked with tactics of a game in attack, in defense and in transition just seeing the game activity to another. The structure of sports activity of handball players is made: speed of perception and an assessment of game situations, decision-making on implementation of a concrete game technique; speed and accuracy of carrying out the corresponding combinations, control over the implementation of a motive task.

Character, structure, content of a game demands from a handball player of manifestation not of separate components of motive activity, and all its complex which is provided with interaction of the main functional systems of an organism: central nervous system, neuromuscular, cardiovascular and respiratory. Optimum ratios between the physiological systems providing the most rational solutions of motive tasks by transition from one functional state to another are established in an organism.

The criterion for the determination of optimum duration of a hard work and intervals of rest between series of exercises in trainings of athletes is the heart rate that is the cardiovascular system which is most reacting and functionally significant in the development of volume of a training load. It is confirmed by the indicators of heart rate at handball players of various age groups and sports qualification at training and competitive loads are presented in table 5.

Movements of a sportsman have a various character in the direction of movement, intensity, performance of numerous accelerations therefore in power ensuring his activity aerobic and anaerobic processes are of great importance in sports games.

Impact of systematic trainings on an organism of handball players places great demands on systems of power supply that is caused by the volume of the performed work and its intensity.

During the game activity which is taking place in conditions of a high emotional pressure, intensity of power processes reaches very considerable sizes. One of factors of high perfor-

mance of sportsmen in sports games is the aerobic productivity which is defined by the size of the maximum consumption of oxygen – the leading factor of efficiency of a sportsman. Therefore, intensity of physical activities is characterized by indicators of the cardiovascular system on HR and consumption of oxygen.

Handball players hold rather high position among sportsmen of various specializations in the aerobic opportunities. The maximum consumption of oxygen made: at the age of 13–15 years old an absolute value of $3,1 \pm 0,127 \text{ l} \cdot \text{min}^{-1}$, relative – $49,2 \text{ ml} \cdot \text{min}^{-1}$ on 1 kg of body weight; in 15–16 years old respectively $4,6 \pm 0,66 \text{ l} \cdot \text{min}^{-1}$ and $52,7 \text{ ml} \cdot \text{min}^{-1}$, increase for 48,3% and 7,1%; in 19–23 years old an absolute value – $5,5 \text{ l} \cdot \text{min}^{-1}$, relative – $59,4 \text{ ml} \cdot \text{min}^{-1}$, increase respectively by 77,4% and 20,7%. Changes of an absolute value it is caused first of all by anthropometrical and constitutive features, and relative – it is generally connected with the professional standard. The working capacity in sports games depends on the efficiency of information processing and its use for implementation of special motive activity, and also on power opportunities of an organism of a sportsman. More qualified sportsmen more likely foresee nature of action of the rival and find necessary tactical and technical techniques for counteraction.

Various factors work at the same time in the numerous combinations, which are determined at present by a concrete game situation in sports practice. The reaction of an organism in a training task is always the total answer on physical, emotional and other influences (household, climatic, educational, and stressful). The optimization of sports preparation is connected with the increase of efficiency of planning and the accounting of training and competitive loads.

Conclusions

The obtained data give the chance to estimate objectively changes in components of motive activity, feature of indicators of physiological and functional condition of organism of sportsmen of the various age groups and the level of sports preparation and qualification which can be used in the training process, that is manifestation of the principle of expediency realized in the changing conditions of trainings or competitions.

The results of the research confirms essential reserves of a

Table 5
Heart rate at handball players in the conditions of training and competitions

Type of activity	HR on 30 s								
	Walking in warming-up	Runs in warming-up	Runs in the main part of trainings (competitions)	Run without a ball (spurt)	Run with a pass of a ball to a partner	Dribbling in the main part of trainings (competitions)	Pass of a ball in pairs at place (with various quantity of touches)	Pass a ball moving	Pass a ball moving with throws at the gate
Training	40–70	60–75	75–80	60–75	75–85	75–85	60–70	70–80	60–70
Unofficial games	50–90	60–65	80–85	75–85	75–85	75–90	70–75	75–80	65–75
Calendar games	60–75	65–80	80–90	80–95	80–90	80–95	70–80	70–80	70–85

functional state that provides the improvement of motive abilities and technical preparedness of handball players and need of introduction of means of joint impact on the development of coordination abilities and the formation of methods of a game for the increase of level of physical and technical-tactical preparedness of handball players.

One of the main methods of improvement of the training process in sports games is the directed physical activity, which

is connected with manifestation of force, speed, endurance (aerobic and anaerobic) which exert specific impact on working capacity and exchange processes.

Prospects of further researches. Complex researches of functional changes of organism of sportsmen of various age groups and levels of preparedness at physical activity will be conducted for the creation of a technique of determination of prospects of a sportsman in the chosen sport.

Conflict of interests. *The authors declare that there is no conflict of interests.*

Financing sources. *This article didn't get the financial support from the state, public or commercial organization.*

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Received: 26.04.2016.

Published: 30.06.2016.

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