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PSYCHOPHYSIOLOGICAL STATES AND SPECIAL PERFORMANCE OF BOXERS WITH DIFFERENT STYLES OF FIGHT

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Annotation. *Purpose:* The style of the fight is one of the important factors that affect the quality of the arts in boxing. Particularly important factor in the modern boxing are the mental processes that are involved in forecasting and analyzing the situation that arises in the ring and are associated with cognitive functions. *Purpose* - to examine the psychophysiological state and a special performance for skilled boxers with different styles of input match. *Material:* 22 highly qualification boxer aged 18-23 years were studied. The absolute and the relative strength of serial and single strikes were studied. Definition of special performance and power strokes performed on a special simulator. Recorded the absolute and relative strength of serial and single strikes. *Results:* The results show that the attacking style of the fight in boxing is accompanied by the presence of a high level of efficiency, reduction of fatigue, anxiety, and depending on the condition of vegetative functions. Showed a reduction in the growth of autonomy and heteronomy in the structure of psycho-physiological state of boxers with the attacking style of the fight, which indicates the presence of compromise and avoidance of external failures. *Conclusions:* Boxers with attacking style of fight characterized by high values of the left side impact forces and reduce the values of the right direct strike force, compared with boxers protective style of fight.

Keywords: boxing, psychological, special, performance, forecast.

Introduction

Progress of boxing as Olympic kind of sports is connected with demand in demonstration of different qualities, which ensure effectiveness of competition functioning [1,2]. One of the most important factors, which influence on quality of duel in boxing, is boxing style. Prevailing majority of specialists think that boxing style is individual for every boxer [3,4].

In modern boxing especially important factor is sportsman's ability to take optimal and adequate decisions in conditions of duel. Psychic processes, which participate in prognostication and analysis of ring situation, are connected with cognitive functions [5,6].

Analysis of scientific literature witnesses that problem of boxers' psycho-physiological status and cognitive functions' manifestation has been studied insufficiently. Psycho-physiological status is a reflection of psychological, individual-typological and functional properties, which influence on boxing style [7,8].

They think that the most lucky variant for a boxer is ability to combine different boxing styles [9,10,11]. Determination of boxer's bent to certain boxing style is an urgent problem as far as style of functioning, as a rule, is manifested at stage of maximal realization of sportsman's potentials; though for increasing of effectiveness of boxers' training, boxers' bent to certain style is determined at all stages of trainings [12,13]. For this purpose it is necessary to use indicators, which would be sufficiently informative and would not require long time for their mastering and would not change in their ontogeny. In connection with above mentioned it is urgent to conduct research of psycho-physiological characteristics, which have individual-typological origin, as well as special workability of boxers with different boxing styles.

Purpose, tasks of the work, material and methods

The purpose of the work is to analyze psycho-physiological status and special workability of qualified boxers with different boxing styles.

Materials and methods of the research

22 highly qualified boxers of 18-23 years old age took part in our researches. Testing was fulfilled with the help of programmed psycho-diagnostic complex "Multi-psycho-meter-05".

Psycho-physiological status was tested with 8-color variant of Lucher's test in modification of L. Sobchik (method of coupled comparisons). We determined indicators of workability, tiredness, anxiety, eccentricity, concentricity, vegetative coefficient, autonomy, heteronomy.

Cognitive functions, as components of psycho-physiological status, in particular attention, perception and thinking, were registered with test "registration of regularities". We evaluated quickness and accuracy of recognition of word, coded by signos' sequence, among 25 variants with 5 attempts of choice.

Special workability was determined by power of blows on special simulator. We registered absolute and relative strength, serial, single and double blows.

Results of testing and their discussion

For estimation of psycho-physiological status and cognitive functions all boxers were divided into two groups by their boxing styles. With questioning we determined two main boxing styles: attacking and defensive. "Attacking" group consisted of 10 persons and "defensive" group – 12 boxers. In table. 1 we present results of Lucher's test of different styles' boxers.

Table 1

Mean values of digital Lucher test's indicators of different styles' boxers (n=22)

Indicators	Boxing styles	
	Attacking (n=10)	Defensive (n=12)
Workability	10.90±0.76	9.16±0.60*
Tiredness	2.00±0.81	2.66±0.74
Anxiety	1.00±0.51	2.25±0.52
Eccentricity	8.50±0.96	7.91±0.86
Concentricity	9.00±0.84	8.41±0.71
Vegetative coefficient	14.30±1.68	16.50±1.09
Geteronomy	7.90±0.60	6.00±0.42*
Autonomy	9.60±0.45	10.33±0.43

Notes: * - $p < 0.05$, comparing with "attacking" style's sportsmen.

Analysis of table 1 data witnesses about presence of difference by certain indicators of digital Lucher's test. Workability indicator shows trend to increasing for "attacking" style's boxers. Besides, we detected confidently higher values of "attacking" style's boxers' geteronomy.

The obtained result reflects fact of presence, on the one hand, of "attacking" style's boxers' higher workability, comparing with "defensive" style's boxers and, on the other hand, dependence on external influences. It is proved by unconfidently lower indicator of autonomy of "attacking" style's boxers (see table 1). Though it is compensated by lower indicators of tiredness, anxiety and vegetative coefficient (see table 1).

Thus, boxers, who prefer attacking style in combat conditions, have higher level of workability, lower tiredness, anxiety and dependence on vegetative functions' state.

However, reduced autonomy and increasing of geteronomy in psychology structure of boxers with attacking boxing style, show their willingness to compromise and avoiding of failures. We can say about presence of compensatory characteristics for formation of psychological status in competition's conditions.

In table 2 we provide indicators of test "registration of regularities" (cognitive functions) of different boxing styles' boxers.

Table 2

Mean values of test "registration of regularities" of different boxing styles' boxers. (n=22)

Indicators	Boxing styles	
	Attacking	Defensive
Efficiency	16.70±0.66	20.41±0.84*
Quickness, sec.	3.93±0.07	4.75±0.04*
Accuracy	0.77±0.04	0.83±0.03*
Effectiveness	48.60±5.23	66.75±5.32*

Notes: * - $p < 0.05$, comparing with "attacking" style's sportsmen.

Analysis of table 2 data witnessed that attacking and defensive styles' boxers differ by indicators of efficiency and effectiveness of determination of holistic object. With it, attacking style's boxers have lower efficiency and effectiveness than boxers of defensive style (see table 2). However, by quickness and accuracy indicators attacking style's boxers have better quickness (less response time) and better accuracy (less quantity of erroneous responses). In table 3 we give values of relative power of blows (in respect to body mass) of different boxing styles' boxers.

Results of table 3 witness about absence of confident difference between different boxing styles' boxers.

Table 3

Mean values of relative power of blows of different boxing styles' boxers. (n=22)

Blows, indicators	Boxing styles, conv.un	
	Attacking	Defensive
Left side	2.85±0.04	2.12±0.03*
Right straight	2.34±0.03	2.84±0.05*

Notes: * - $p < 0.05$, comparing with "attacking" style's sportsmen.

As per table 3, we detected that attacking style's boxers have confidently higher indicators of relative strength of left side blow, comparing with defensive style's boxers.

At the same time attacking style's boxers have strength of right straight blow confidently lower than defensive style's boxers (see table 3).

It should be noted that for attacking style boxers left side blow is the most optimal, while boxers of defensive style have better characteristics of right straight blow. This fact reflects bigger percentage of actions of attacking style's boxers.

Thus, attacking style's boxers are characterized by high quickness and processing of information. However, increasing of their quickness characteristics is connected with worsening of cognitive functions: effectiveness and

efficiency of processing of information. It was registered that for attacking style's boxers left side blow prevails, while for defensive style's boxers – right straight.

Conclusions:

1. Attacking style of boxing is accompanied by high workability, low tiredness, anxiety and dependence on vegetative functions.
2. Reduction of autonomy and increasing of heteronomy in psycho-physiological status of attacking boxing style's boxers point at presence of willingness to compromise and avoiding of failures.
3. Attacking style's boxers are characterized by stronger left side blow and reduced power of right straight blow, comparing with boxers of defensive boxing style.
4. Increasing of boxers' quickness is connected with worsening of cognitive functions: effectiveness and efficiency of processing of information.

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THE INFLUENCE OF SPORTS ACTIVITIES FOR PERSONALITY OF JUDOIST

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Annotation. *Purpose:* the testing of personality quality, physical and psychical health of judoists within preparatory and contest periods of their activities. *Material:* 52 sportsmen, the age from 17 to 22 years old, have been took part in investigation. *Results:* found that the features of the influence of sports activities on the quality of individual athletes are caused by their stress tolerance and the conditions under which it is carried out (training or competitive). Significant and strongly influence the results of performances of athletes in competitions are such qualities as self-confidence, composure, calmness. Athletes are aware that they need to mobilize their strength and skills to be as active and ready for action in unfamiliar situations. *Conclusions:* the complication of activities conditions for sportsmen in contests period has been demonstrations presence of negative changes of personality virtue, absence of professional and qualitative psychological training.

Key words: qualitative of personality, judoists, health, activities, psychological training.

Introduction

Conditions of modern sport training in elite sports and extremely high level of contest require form sportsmen maximal tension and mobilization of all physiological potentials of organism, including psychic ones. In this connection dependence of competition functioning's effectiveness on individual psychic qualities of sportsman's personality increases [4, 6]. It conditions demand in perfection of sportsmen's training system not only in direction of technical tactic skills' development, but also in direction of searching of new psychological resources, which would ensure increased efficiency of sportsmen's performances [1, 2, 15].

As a result usage of knowledge about psychic features of sportsman's personality becomes still more important. Analysis of numerous works [8, 9, 10, 14] shows that conditions of human functioning substantially influences on manifestation of personality's features, person's character and temper. From practice of sports functioning it is known that such personality's qualities as emotional and nervous-psychic stability, anxiety, aggressiveness, depressiveness and other to large extent influence on results of sportsmen's performances [10, 11, 15].

At the same time scientists note insufficient development and low level of recommendations for sportsmen, practicing different kinds of sports, which would consider not only age, sport qualification and individual potentials, but also influence of specificity of certain kind of sports on personality's qualities and health of sportsmen. Concerning judo wrestlers there is very little such researches.

The urgency of solution of a.m. questions is evident that exactly forced us to fulfill such research.

The research has been fulfilled in compliance with plan of scientific-research works of Ministry of family, youth and sports of Ukraine by topic "Psychological-pedagogic foundation of increasing of sport functioning's effectiveness and recreational processors after physical loads".

Purpose, tasks of the work, material and methods

The purpose of the work is to test qualities of personality, judo wrestlers' physical and psychic health in preparatory and competition periods.

Organization and methods of the research: in the present research 52 sportsmen (male) of age from 17 to 22 years), who had the following sport qualifications: first sport degree, candidate master of sports, master of sports of Ukraine. All sample of sportsmen consisted of two groups: successful – control group (CG) and unsuccessful – experimental group (EG). Application of method of experts' evaluations with analysis of exercises' mastering, practicing of sparring at trainings and, the main thing, quantitative evaluation of wins at competitions, permitted to call CG a successful group and EG – unsuccessful.

Diagnostic of many-factors' research of personality by R.B. Cattle [5] is one of the best methods of analyzing of environmental factors' influence on personality's qualities. Quantitative data were processed with methods of mathematical statistics [12].

Results of the research

Like in many other kinds of sports, sport functioning of judo wrestlers is realized in extreme conditions and has its own peculiarities [1, 3]. In literature there exists an opinion that specificity of sport functioning appropriately reflects in qualities of sportsman's personality [7, 13]. Sport functioning of judo wrestlers is composed of training and competition processes, which substantially differ from each other, mainly by psychological criteria.

Data about influence of training functioning on personality's qualities of judo wrestlers are given in table 1.

Table 1

Level of personality's manifestation of the tested sportsmen on preparatory period of their sport functioning ($\bar{X} \pm m$)

Factors 16 PF	Control group (n=26)	Experimental group (n=26)	Level of probability	
			t	p
A	7.06±0.38	6.18±0.34	1.8	>0.05
B	7.13±0.27	6.30±0.21	2.5	<0,05
C	6.37±0.29	5.46±0.24	2.5	<0.05
E	8.08±0.27	7.63±0.21	2.3	<0.05
F	6.30±0.79	7.51±0.85	2.8	<0.01
G	8.07±1.20	5.36±1.17	2.3	<0.05
H	9.06±0.37	7.72±0.30	2.9	<0.01
I	5.13±0.41	6.87±0.54	2.6	<0.05
L	5.33±0.52	7.04±0.56	2.2	<0.05
M	8.45±0.81	6.27±0.75	2.0	<0.05
N	7.38±0.72	5.67±0.67	1.8	>0.05
O	7.05±0.077	8.11±0.082	2.6	<0.05
Q ₁	6.11±0.44	7.84±0.50	2.6	<0.05
Q ₂	9.26±0.82	6.55±0.74	2.5	<0.05
Q ₃	8.17±0.43	6.88±0.37	2.3	<0.05
Q ₄	6.02±0.65	8.58±0.74	2.6	<0.05

Notes: A – closeness-friendliness; B – intellect; C – emotional instability-stability; E – obedience—domination; F – continence-expressiveness; G – low behavioral standards; H – timidity – brevity; I – severity- kindness; L – credulity-suspiciousness; M – practicality – daydreaming; N – straightness - diplomacy; O – calmness – anxiety; Q₁ – conservatism – radicalism; Q₂ – conformism – non-conformism; Q₃ – low self-control – high self-control; Q₄ – relaxation – tension.

Results of competition functioning's influence on personality's qualities of judo wrestlers are given in table 2.

Table 2

Manifestation of personality's qualities of the tested sportsmen in competition period ($\bar{X} \pm m$)

Factors 16 PF	Control group (n=26)	Experimental group (n=26)	Level of probability	
			t	p
A	6.04±0.44	7.86±0.50	2.3	<0.05
B	8.65±0.36	7.45±0.31	2.6	<0.05
C	8.43±0.36	7.13±0.31	2.8	<0.01

Factors 16 PF	Control group (n=26)	Experimental group (n=26)	Level of probability	
			t	p
E	11.50±1.21	7.51±1.16	2.4	<0.05
F	5.34±0.78	7.96±0.86	2.3	<0.05
G	10.66±0.51	8.81±0.43	2.8	<0.01
H	10.95±.72	8.14±0.67	2.9	<0.01
I	6.71±0.77	8.33±0.88	2.8	<0.01
L	8.56±0.18	7.89±0.21	2.6	<0.05
M	7.96±0.51	6.14±0.43	2.7	<0.01
N	8.59±0.57	6.57±0.51	2.6	<0.05
O	7.93±0.83	10.37±0.80	2.1	<0.05
Q ₁	6.38±0.38	7.41±0.42	1.8	>0.05
Q ₂	10.26±1.76	5.30±1.48	2.2	<0.05
Q ₃	8.36±0.57	6.95±0.51	2.3	<0.05
Q ₄	7.46±1.16	11.55±1.21	2.4	<0.05

Marks by first factor A witness about differently oriented changes of personality's qualities in compared groups of sportsmen. Videlicet: in CG, in comparing with preparatory period, there is observed reduction of marks from 7.06 to 6.04 stens ($p<0.05$), and in experimental group (EG) this indicator increases from 6.18 to 7,86 ($p<0.05$). It means that in competition period EG sportsmen also activate their friendliness, discuss possible variants of their performances; they are ready to listen to the thoughts of other.

Concerning CG sportsmen, their increasing of emotional tension is accompanied by increasing of closeness, reducing of friendliness, personal speculations about own tactic in future duels.

As per scale of intellect in both groups of the tested higher than in training period marks were received. In EG increment of this indicator changed by 1.11 points and in CG – by 2.45 ($p<0.05$). That means that sportsmen of both groups in this period manifested intellectual efforts for achievement of their performances' success. Though, CG sportsmen made it more efficiently. It is quite obvious that it was conditioned by their "switching off" from environment, "by diving in their sub-consciousness". In any way, increasing of intellectual activity can be regarded as a tool of choice of behavior, taking more reasonable and correct decision, especially in extreme conditions of sport functioning, which achieved with sportsman's experience.

Emotional balance is also an important lever in formation of resistance of personality's psychological sphere to stressful factors. The data, received by this scale, also demonstrate increment of marks in both groups of the tested. Though, again it should be noted that there is substantial difference between indicators of both groups. EG sportsmen had increment by 1.67, and CG – by 2.06 ($p<0.05$). In other words, emotional balance of judo sportsmen is manifested in this period much higher. In the author's opinion, methodic by R.B. Cattle, increasing of emotional balance is always accompanied by reducing of nervous tiredness, increasing of emotional rigidity and lowering of threshold or sense perception organs' irritability, that is especially important in martial arts.

Lowering of marks by scale E means increasing of dependence, obedience to general psychological atmosphere, to group actions, demand in listening to other's opinions. Just this is realized in EG with increasing of nervous-psyche tension. That is why, in competition period, their obedience increases that is manifested in low marks and it is quite logic and corresponds to received by us results (we registered reduction of this indicator by 0.12, $p<0.05$).

At the same time, in CG we observed increasing of this indicator by 3.42 points ($p<0.05$). This fact should be understood as proof of demand in extreme conditions to have dominance of own actions and not to depend on adversary, to have own tactic of duel and be concentrated on this tactic.

Marks by factor F also permitted to convince in directly opposite direction of their changes in both groups. For example, for EG judo wrestlers, this indicator increased, though insignificantly, by 0.45. It can be explained by which and understanding of importance of interpersonal contacts, mutual analysis of competition situations and results of intermediate performances.

In Cg, on the contrary, marks by this factor reduced by 0.96 points ($p < 0.05$). It is also important for receiving of positive results, because, it means that these subjects, being influenced by stressful factors, become more reasonable, cautious, —measure” every step, comparing all actions with actions of adversaries. So, it is quite logic that CG judo wrestlers to lagers extent than EG sportsmen are able to self mobilization at competitions.

Especial jump of data was after analysis of G-scale marks. It was determined that in EG this indicator increased to 10.66 points, that, in comparison with preparatory period is by 3.45 higher, and in CG – to 8.81 that is higher by 2.59 points ($p < 0.05$). In other words in both groups competition’s conditions mobilize responsibility, commitment, wish to win. However, quantitative value of changes in this direction is higher, is sportsman is able to control himself, is stress-resistant in extreme conditions, i.e. it is higher in CG group.

Increasing of indicators by factor H also illustrate presence of adequate responses to situations and plasticity of psychic processes of CG sportsmen. They understand that they shall mobilize all their strength and skills, be maximally active and be ready for sudden situations. For example EG judo wrestlers’ indicator increased only by 0.42 points because competition conditions do not cause their emotional uplift. At the same time, CG wrestlers have increment of this indicators by 1,60 points ($p < 0.01$). It is undoubtedly substantial difference in change of indicators by this scale.

The next factor, I, permits to calculate —security – kindness”. In both groups there is observed reduction of kindness and romanticism in competition period. Like in previous scale changes in indicators take place in one direction – they increase. But in EG – by 1.46points and in CG – by 1.58p<0.01).

The same changes were detected after analysis of data by scale L. In both groups indicators in competition period increase. In EG – by 0.85 and in CG – by 3.23 points ($p < 0.05$). Cautiousness, egocentricity, suspicious attitude to adversary are sharpened.

By scale M we obtained data, which show decreasing of marks in EG by 0.13 points and reduction of their quantitative value in CG by 0.49 ($p < 0.01$) that means increasing of responsibility and attention even to insignificant changes in environment.

Marks by scale N increase in both groups of the tested. With it, in CG we registered increment by 0.90 points and in CG – by 1.31 ($p < 0,05$). In other words for CG it is very important to sharpen such qualities as calculation of own actions and behavior, which are reflection of positive influence of better psychological training on their mentality.

Such qualities as self assurance, calmness are also rather substantial and influencing on competition results. But, unfortunately, as received data witness, in both group marks by scale o increase that means weakening of the above listed qualities: in CG – by 0.88 points and in EG – by 2.15 стена ($p < 0.05$). Such change of psychological status, is surely undesirable for sportsmen and such results can be explained only by poor psychological training, inability to control oneself in extreme conditions of competitions.

Scale Q₁ permits to measure —onservatism-radicalism”. In our research we received by this scale unconfident data, but we should not insignificant rising of this indicator in CG and reducing in EG.

The marks, obtained as a results of Q₂, scale’s analysis shows their reduction in EG and increasing in CG. In CG quantitative reduction equaled to 1.25points and in EG – increasing by 1.0 ($p < 0.05$). Increasing of this indicator in CG is explained y strengthening of such qualities as independence, domination of own decisions, obedience to own tactic that, undoubtedly, is very important for victory in judo.

As per factor Q₃ we received also increment of indicators, but in EG increasing of one of the main quality – self-control was only by 0.07 points and in CG – by 0.19 ($p < 0.05$). In this case we have to mark that increasing of so important for judo qualities should be higher than actual. In our opinion such insignificant shift was a result of poor psychological training of sportsmen.

Especially clearly this opinion is proved by analysis of Q₄ scale’s results. With sufficiently reliable control of emotions, skills of self-regulation, control psychic state in extreme conditions sportsmen would not have such undesirable qualities as hyper excitability, frustration, anxiety and depression in competition conditions. But, unfortunately, CG sportsmen had increment of this indicator by 1.44points and EG – by 2.97 ($p < 0.05$). It can mean only one thing: with such increment of negative qualities’ manifestation against the background of constant (in competition conditions) influence of this qualities on sportsmen’s behavior it would be difficult to expect some significant success..

Conclusions:

1. Peculiarities of sport functioning’s influence on sportsmen’s personalities are conditioned by their stress-resistance and training or competition conditions. In both groups in competition period level of personality’s qualities was higher than in training one. However, EG members had higher the following indicators: friendliness, intellect, emotional stability, brevity, trustfulness, straightness, calmness, radicalism, discipline, tension, irritability.

Judo wrestlers of CG in competition period had the following increased qualities: quick-witness, emotional maturity, independence, persistence, bent to risk, self assurance, self-control, suspiciousness, hyper-excitability, frustration, aggressiveness.

2. Increasing of manifestation of qualities, which are required for successful sport functioning in extreme conditions, was insignificant in both groups (within 1.2-1.7 points). It is conditioned by absence of good qualified general and special psychological training.

The further prospects of the researches can be determination of factors, which influence not only on psychological but also on physiological processes in sportsman's organism.

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FEATURES OF DEVELOPMENT OF COORDINATION ABILITIES FEATURES OF ATHLETES IN SPORTS AEROBICS IN INITIAL TRAINING

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Annotation. *Purpose:* to develop theoretically and experimentally justify the methodology of development of coordination abilities of athletes aged 7-9 years involved in sports aerobics. *Material:* the study involved 20 participants (7-9 years). 8 athletes performed the test tasks. The choice of tests carried out on the basis of the analysis of the dominant motor mode competition exercises. *Results:* It was found that the coordination abilities are necessary in the development of speed, density, and the number of running technical elements. With more than a significant increase in performance test tasks that characterize: musicality, coordination, dynamic balance. The basic tools, methods, techniques, and requirements for the exercises. The level of development of coordination abilities. *Conclusions:* the author's method of development of coordination abilities include: rational choice of means and methods of training impact on their similarities and differences with the target competitive activity.

Keywords: coordination, ability, aerobics, training, young.

Introduction

Growth of sport aerobics' popularity, which is a new, non-traditional kind of sports, among different strata of Ukrainian population, increasing of international competition in this sphere require theoretical analysis and scientific-practical foundation of methodic of many years' training of different age sportsmen [1; 3; 11; 16 et al].

Sport aerobics is a kind of sports with complex coordination. Exercises of sport aerobics are fulfilled at rather high temp, under clear musical rhythm. By its character all movements are quick, accurate and require comprehensive coordination in time and space. Sportsmen fulfill many different complex elements, including steps in rotation, turns, jumps and so on.

Changes of trends in competitions' rules cause changes in structure of sportsmen's competition programs. This process is progressing partially by means of sportsmen's mastering of complexly coordinated elements and combinations. That is why one of specificities of exercises' fulfillment is dependence of sport results in this kind of sports on sportsmen's coordination. [4; 12; 19; 20 et al.].

In the opinion of authors [2; 5; 6; 14 et al.], it is necessary to start training human coordination abilities in junior school age. The older children are the longer is the process of their coordination abilities' training. In sport aerobics age of first significant success is earlier than in most other kinds of sports, but high results can be achieved only after intensive trainings. That is why, in connection with complicating of sport techniques, shortening of trainings terms even junior sportsmen face with high requirements to their coordination abilities. It is known that exactly stage of initial training is, to large extent, a determining one for further sport perfection [6; 9; 10; 17 et al.].

At present, practice of sport dancing supplies examples of mastering of rather complex elements in junior age. That is why, from first steps of training it is necessary for training process to ensure quick and qualified mastering of movements and was oriented on training of complex elements. However, in training process it is necessary to consider morphological and physiological characteristics of children's organism [2; 6], to avoid over-training, attempts to replace qualified construction of training process by excessive scope of trainings, repetitions and so on.

However, in spite of great number of scientific-research works [5; 7; 13; 15 et al.], devoted to development and improvement of junior sportsmen's coordination, the problem of the most purposeful training of the mentioned abilities of junior sportsmen at the stage of initial training has been insufficiently solved. All these make evident demand in studying of junior sportsmen's coordination abilities and in working out of purposeful trainings' methodic at stage of initial preparation for increasing of junior sportsmen's sportsmanship.

The research has been fulfilled in compliance with topic of combined plan of scientific and research works in sphere of physical culture and sports of Ministry of education and science of Ukraine for 2011-2015 by topic 2.2.4. "Improvement of mechanisms of sportsmen's motion functioning's control".

Purpose, tasks of the work, material and methods

The purpose of the work: to work out theoretically and prove experimentally methodic of improvement of 7-9 years old sport aerobic sportsmen's coordination abilities.

The tasks of the research:

1. Determination of coordination abilities' level of sport aerobics' junior sportsmen.
2. Fulfillment of comparative analysis of the received results.

Material and methods of the research: the researches were conducted on base CJSS No.3, Kharkov. In experimental part 20 sportsmen of 7-9 years old age participated. Pedagogic experiment, in which two groups (control – 10 children and experimental group – 10 children) took part was conducted during year. We used the following complex of scientific *methods of research:* pedagogic methods (analysis and generalization of scientific-methodic literature data, pedagogic observation, pedagogic testing); methods of mathematical statistic.

Results of the research and their discussion

In training process of junior sportsmen, who specialize in sport aerobics, we tested author’s methodic. We applied systemic approach to using of training means, determined level of coordination abilities and conducted comparative analysis of results of control and experimental groups’ sportsmen [8]. In combined training process we kept gradually increasing dynamic of training loads, used general training means, special physical training (special exercises, structurally close to main motion skills, required for fulfillment of competition compositions; complexes of preparatory exercises for technical elements; means of acrobatic and choreography).

At the beginning and at the end of experiment in main and control groups we conducted testing. We determined level of coordination abilities of sportsmen, specialized in sport aerobics. На початку і по завершенню експерименту в основній і контрольній групах було проведено тестування.

Selection of tests for evaluation of sportsmen’s coordination abilities we carried out on the base of analysis of dominating motion regime of competition exercise and specificity of sport aerobics; on the base of age characteristics of junior sportsmen, requirements of competitions’ rules; on the base of earlier conducted researches in kinds of sports with complex coordination (gymnastic and calisthenics, acrobatic and etc.), considering commonly accepted tests [18]. We offered the following tests:

1. Shuttle run 3x10 meters with moving around filled balls (sec.);
2. Running to filled balls with numbers (sec.);
3. Jump with turn (points);
4. Static balance by methodic of Bondarevskiy (sec.);
5. Dynamic balance with fulfillment of turns on gymnastic bench (sec);
6. Walk with clapping the certain rhythm (points);
7. Two forward tumbles, jump with 360° turn (points);
8. Exercises for determination of motion memory (sec).

Results of testing of junior sportsmen’s coordination abilities are give in table 1.

Table 1

Indicators of coordination abilities of control and experimental groups ($\bar{X} \pm m$) (n=10; p<0.05)

№	Indicators of coordination abilities	Control group				Experimental group			
		ID*	FD	abs.	%	ID	FD	abs.	%
<i>Space-time and dynamic parameters of movements</i>									
1	Shuttle run 3x10 meters with moving around filled balls (sec.)	10.66±0.09	10.54±0.3	0.12	1.2	10.75±0.08	10.66±0.06	0.09	0.84
<i>Orientation in space</i>									
2	Running to filled balls with numbers (sec.)	23.31±1.02	22.91±0.2	0.4	1.7	23.41±1.06	23.22±1.3	0.19	0.81
3	Jump with turn (points)	1.68±1.72	1.73±1.02	0.05	2.8	1.87±1.2	1.89±0.02	0.02	1.05
<i>Static and dynamic balance</i>									
4	Static balance by methodic of Bondarevskiy (sec.)	1.78±0.38	1.82±0.8	0.04	2.2	1.83±0.82	1.85±0.02	0.02	1.08
5	Dynamic balance with fulfillment of turns on gymnastic bench (sec)	6.57±0.24	6.32±0.4	0.25	3.9	6.7±0.43	6.63±0.03	0.07	1.05
<i>Music abilities</i>									

№	Indicators of coordination abilities	Control group				Experimental group			
		ID*	FD	abs.	%	ID	FD	abs.	%
6	Walk with clapping the certain rhythm (points)	3.67±1.12	3.87±1.02	0.2	5.2	3.77±1.21	3.82±1.01	0.05	1.3
<i>Coordination of movements</i>									
7	Two forward tumbles, jump with 360° turn (points)	2.75±1.02	2,86±1,04	0.11	3.9	2.76±1.01	2.84±1.01	0.08	2.8
8	Exercises for determination of motion memory (sec)	18.84±0.6	18.97±0.7	0.13	0.7	18.43±0.75	18.55±0.05	0.12	0.6

*ID – initial data (at the beginning of experiment);

FD – final data (at the end of experiment).

The obtained results witness that in both groups there is increasing of coordination abilities' indicators. However, the most substantial changes took place in main group. Analysis of received data permits to say that implementation of author's experimental methodic in practice of training process shows that junior sportsmen, who were trained by author's methodic, reached higher level of coordination abilities, which effectively influence on training and perfection of technical elements of sport aerobics.

In fig. 1 we present changes of coordination abilities' level in groups.

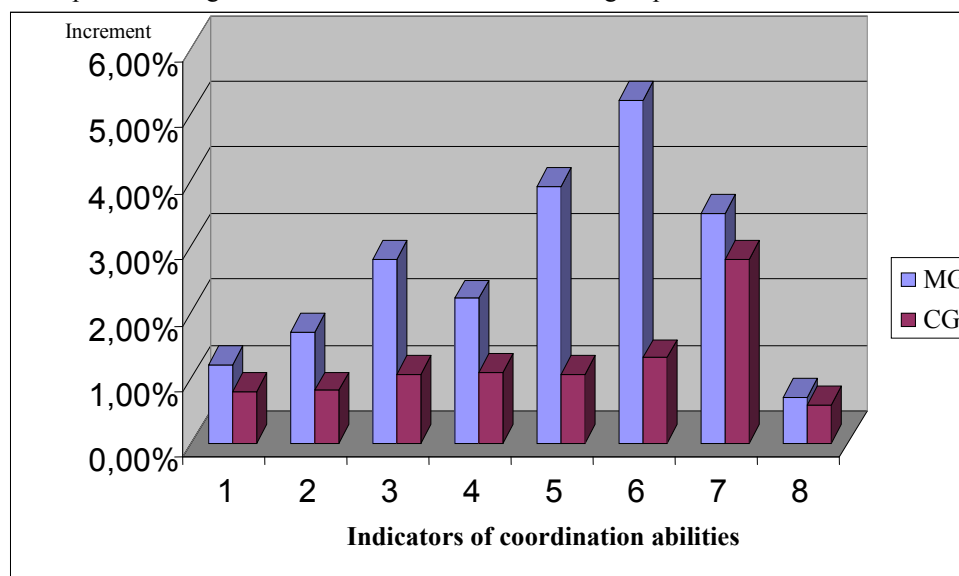


Fig. 1. Dynamic of increment of junior sportsmen's coordination abilities

The fulfilled comparative analysis of coordination abilities' indicators of main and control groups' junior sportsmen shows variability of indicators that evidently witnesses about complex motion functioning of sport aerobics and about importance of coordination abilities' development. Actual proof of it is increasing of indicators in both groups. But the most significant increment of indicators was registered in main groups in the following tests: №6 – music bents of junior sportsmen (5.2%), №7 – coordination (3.5%), №5 – dynamic balance (3.9%) and №3 – orientation in space (2.8%). Such dynamic is explained by the fact that sense of rhythm and coordination as abilities accurately reproduce and purposefully change speed-power and space-time parameters condition, to large extent, level of sport success in sport aerobics.

We also detected significant rates of increment in experimental group's sportsmen in indicators of tests №4 and №2 (static balance and ability to orient in space) – 2.2% and 1.7% accordingly. It is explained by the fact that in

sport aerobics ability to keep balance is manifested with quite different positions of body, in static and dynamic conditions, with and without support.

In the process of the research we noticed reducing of time for overcoming distance 3x10 meters (shuttle run with moving around filled balls) from 10.66 sec. to 10.54 sec. that was 1.2% of increment. Substantial changes took place with indicator №8 (control of movements' coordination) – 0.7%. All these indicators can be conditioned by specificity of sport aerobics, because all abilities are manifested with fulfillment of technical elements of this kind of sports.

The received results witness about rational application of training methods and means, naturally and reasonably introduced in general training process of junior sportsmen, who specialize in sport aerobics. It has been proved that the author's methodic facilitates effective development of coordination abilities at this stage of training.

Conclusions

We have determined level of coordination abilities. We also determined that coordination abilities are necessary for development of quickness, density and quantity of fulfilled techniques that set still higher requirements to physical condition of junior sportsmen – representatives of sport aerobics. Sportsmen of main and control groups showed improvement of indicators of coordination, music abilities, orientation in space, balance and ability to control space-time characteristics.

Comparative analysis of coordination abilities of both groups' sportsmen showed that as per indicators of all tested parameters sportsmen of main group had advantage over sportsmen of control group

The worked out author's methodic of coordination abilities' development includes rational choice of means and methods of training influence in the aspect of their similarity and difference form targeted competition functioning, in respect to which training of junior sport aerobics' sportsmen is built.

The prospects of further researches imply to study peculiarities of coordination abilities' training of qualified sportsmen at stage of sport perfection.

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PHYSICAL TRAINING OF YOUNG BIATHLETES IN STEP PRELIMINARY PREPARATION

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Annotation. *Purpose:* To examine the effectiveness of different allocation of general and special physical training of young biathletes in the preparatory and competitive periods of the annual cycle at the stage of preparation. *Material:* The study included 24 young athletes (age 13-15 years, have been employed 1 year or more). *Results:* shows dynamics of the various components of fitness of young biathlon (running at 30 meters from the place of 1000 and 3000 meters, pulling up on crossbeam flexion and extension hand in the emphasis lying down, raising and lowering legs Wies, long jump with space shuttle run 4 x 9 meters). Recommended for general physical training in the preparatory period allocate 65% of the time, a special and comprehensive training - 35%. Time on general fitness is distributed as follows: Power - 50% of the time, speed and speed-power - 25%, the development of general and special endurance - 20%, improving flexibility and coordination skills - 5%. *Conclusions:* lessons for biathlon in the early years of training should not be aimed at increasing the level of general and special endurance. In more classes should be directed at improving the physical fitness of versatile, high-speed, speed-strength and power qualities of athletes.

Key words: young biathletes, physical training, complex control, speed, wstrength, training.

Introduction

In connection with progress and popularity of biathlon in CIS and other countries, recent time sportsmanship of biathletes has significantly increased. They become winners of any kinds of competitions, such as World Championships, Olympic Games, National championships.

In young age, as a rule, junior skiers, having certain experience in skiing, come to biathlon clubs. Speed of skiing is one of the most important factors of biathlete's sportsmanship. Plastic skis, new means of ski routs' preparation influenced on arsenal of skiing technique. Using of skating techniques is main reason of sport achievements' progress. But the problems of individualization of sportsman's training, of rational eating and distribution of training means in annual training cycle have not been studied sufficiently yet; solution of this problem opens new reserves for improvement of biathlon's sport results.

In biathlon, one of such reserves is determination of optimal correlation of means, oriented on development of speed and speed-power qualities and perfection of speed and power endurance in annual cycle's stages.

Further improvement of sport results in biathlon is closely connected with searching of reserves of mean distance speed's increasing in skiing, which consists of speed at different by complexity segments of speed, accurate and quick shooting on firing lines.

Some authors (V.P. Andreyev, 1998; V./U. Afanasyev, 2004; A.I. Kudrenko; A.A. Burla, 2006, 2010; V.V. Mulik, 2002) say that improvement of sportsmen's special physical fitness can be realize both at the account of improvement of separate physical qualities and by means of their combination (for example: power and speed endurance, which form level of special endurance).

Determination of variety of skating techniques permits their more variable application as a mean of effective development of biathletes' physical condition. Choice of rational correlation of physical training's means and methods to large extent conditions successfulness of junior sportsmen's training, though there is deficit of researches, devoted to training of junior biathletes. Among available works we can note the works by V.F. Mamatov (1980), I.G. Gibadullin (1991, 2006), G.Ya. Shydlovskiy (1987), Yu.S. Piadukhov (1989), V.V. Mulik (1999, 2002), V.I. Chebotkevich (1997), A.I. Kudrenko, A.O. Burla (2004, 2005).

In modern theory and practice of biathlon the problem of general and special physical endurance at early stages of many-years' training has been remained insufficiently solved that is proved by absence of scientifically grounded recommendations, devoted to construction of physical training process and control over it at different stages of annual cycle. Training of sportsmen in children junior sport schools is realized basing on unified programs, without objective evaluation of sportsmen's bents to improvement of different components of special physical fitness. The subject of our research is exactly solution of this problem.

As on to day the most important task for coaches is searching of new, most effective means and methods of biathletes' special physical training as well as distribution of these methods in annual cycle of training. Just speed-power and power exercises can increase training load without overloading organism's vegetative system, owing to their local influence.

Optimal distribution of special and general physical training's means in annual cycle at basic preliminary stage requires experimental decision.

The work has been fulfilled in compliance with combined plan of scientific-research works in sphere of physical culture and sports of Ukraine for 2011–2015 by topic 1.2.12 "Improvement of sportsman's training system in cyclic sports in different structures of many-years' sport training" (state registration number 0106V011987).

Purpose, tasks of the work, material and methods

The purpose of the work is determination of the most optimal correlation of junior biathletes' physical training means at stage of preliminary basic training.

The tasks of the work:

1. To analyze theoretical-methodic principles of junior biathletes' physical training in preparatory and competition periods of annual cycle.
2. To determine significance of factors, which influence on dynamic of special physical fitness of junior biathletes at stage of preliminary basic training.
3. *The object of the research* is training process of junior biathletes.

The subject of the research is general and special physical training of junior, 13-15 years old age, biathletes. For solution of the listed tasks we used the following *methods of the research*: analysis of scientific and special literature; pedagogic observation; questioning of caches-teachers; dynamometry; pedagogic experiment; methods of mathematical statistics.

Our main task was experimental determination of rational correlation of means of junior biathletes' general and special physical training at stage of preliminary basic training.

For solution of this problem we conducted pedagogic experiment. Experimental groups consisted of teenagers of 13-14 years old age, who attended biathlon training not less than one year. In process of groups' completing we paid attention to indicators of height and weight. Tall, thin teenagers with skiing experience were preferable.

Junior biathletes were divided into two groups (12 teenagers in every groups) – control and experimental by anthropometric indicators and by results of testing of special physical fitness. All of them had no statistically confident differences between mean indicators of weight, height, VCL. Backbone strength and age – t was within 0.87–1.86 $P > 0.05$.

Results of the research

For analyzing of dynamic of indicators, characterizing junior biathletes' physical fitness, at the beginning and at the end of pedagogic experiment we conducted testing of speed, speed-power qualities, as well as general and special endurance.

Junior biathletes of control and experimental groups were trained in equal conditions on sport training base "Dynamo" (tract "Tokary", Sumy) by one and the same program for second year of CJSS. The difference was only in different distribution of physical training means in preparatory period.

For junior biathletes of experimental group 100% of total time was devoted to general physical training at general preparatory stage (ay, June); 90% - in July. At special-preparatory period (August, September, October - accordingly 80%, 70%, 60%; at pre-competition period (November-December) – accordingly 50% and 40%. The rest time was paid to improvement of skiing technique on roller-skies, to fire and complex training.

Junior biathletes were trained as per approved for Ukrainian CJSS program of biathlon: for general and special physical training were devoted, accordingly, 26.6% and 15.4% of total time. For firing and skiing technique was spared accordingly 10.2% and 20.8%. For complex training 20% of total time was paid.

For general physical training in preparatory period in experimental group about 65% of total time was spared; for special and complex training – 35%. For general physical training of control group's teenagers about 30% was spared.

Time for general physical training in experimental group was distributed in the following way: 50% of total time – for power training, 25% - for speed and speed-power training, 20% - for training of general and special endurance, 5% - for training of flexibility and coordination (see fig. 1).

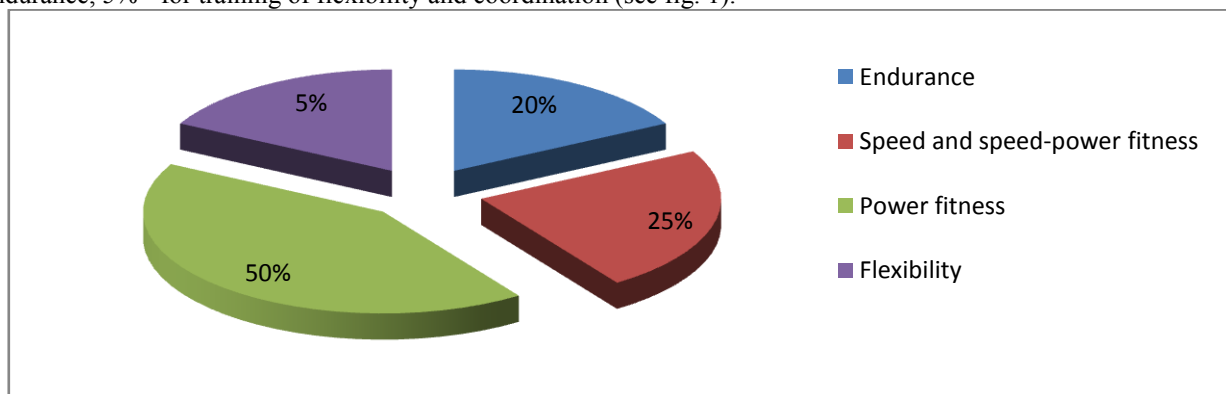


Fig.1. Distribution of general physical training means in experimental group in preparatory period

Time, assigned for general physical training in control group was distribute in the following way: 20% of total time – for general physical training, 25% - for speed and speed-power training, 50% - for training of general and special endurance, 5% - for development of flexibility and coordination (see fig.2).

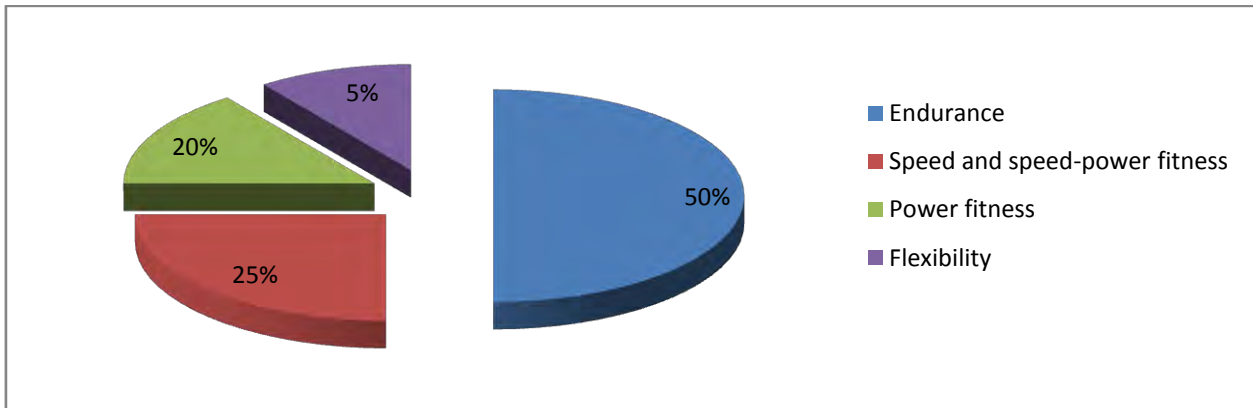


Fig. 2. Distribution of general physical training means in control group in preparatory period

Training of junior biathletes of experimental group was, mainly, oriented on perfection of power and speed-power qualities. Physical training of control group’s biathletes was oriented on increasing of general and special endurance.

For controlling of dynamic of junior biathletes’ general fitness indicators in process of pedagogic experiment we used testing of different components of physical fitness: speed, speed-power, power and endurance: 30 meters’ run, 1000 and 3000 meters’ run, chin ups, pressing ups, rising and dropping legs, hanging on horizontal bar, long jump from the spot, shuttle run 4x9 meters.

In table 1 we provide indicators of general fitness of trainees at the beginning of pedagogic experiment. Analyzing testing data of different components of junior sportsmen’s general physical fitness, it was noted that between mean indicators of all test exercises, except “chin ups” there were no statistically confident differences: t was within 0.02–1.99 with $P > 0.05$. It witnesses that level of general physical fitness in both groups was approximately the same at the beginning of experiment.

Table 1

Comparative characteristics of general fitness’s indicators of teenagers at the beginning of pedagogic experiment

Indicators	Group	n	X	S	m	V%	t	P
30 meters’ run, sec.	E	12	4.80	0.18	0.05	3.8	-1,56	>0.05
	C	12	4.90	0.16	0.04	3.3		
1000 meters’ run, sec.	E	12	212.00	5.54	1.60	2.6	-1.69	>0.05
	C	12	216.00	6.04	1.74	4.0		
Chin ups, quantity of times	E	12	6.00	1.00	0.29	16.7	-2.06	>0.05
	C	12	7.00	1.35	0.39	19.3		
Pressing ups, quantity of times	E	12	28.00	2.04	59.00	7.3	0.02	>0.05
	C	12	27.00	2.35	0.68	8.7		
Rising of legs in hanging on horizontal bar position, quantity of times	E	12	7.00	1.00	0.29	14.3	-1.99	>0.05
	C	12	8.00	1.41	0.41	17.6		
Long jump from the spot, cm	E	12	175.00	3.81	1.10	2.2	-1.59	>0.05
	C	12	177.00	2.10	0.61	1.2		
Shuttle run 4x9 meters	E	12	12.30	0.35	0.10	2.8	-0.58	>0.05
	C	12	12.40	0.47	0.14	3.8		
3000 meters run (min/sec)	E	12	12.28	0.24	0.07	2.0	-1.92	>0.05
	C	12	12.47	0.26	0.07	2.1		

Notes: C – control, E – experimental.

Repeated testing of different components of teenagers' physical fitness, fulfilled at the end of pedagogic experiment showed significant changes of all indicators, characterizing fitness of trainees (see table 2). Analysis of changes of physical fitness at the end of pedagogic experiment showed that the most significant changes took place in two tests from eight: 1000 meters' and 3000 meters' run. But confident changes were registered only in 3000 meters' run test: $t = 3.40$ with $P > 0.05$.

Table 2

Comparative characteristics of general fitness's indicators of teenagers at the beginning of pedagogic experiment

Indicators	Group	n	X	S	m	V%	t	P
30 meters' run, sec.	E	12	4.30	0.09	0.03	2.1	-	<0.05
	C	12	4.60	0.18	0.05	3.9	5.14	
1000 meters' run, sec.	E	12	202.00	3.65	1.05	1.8	1.30	>0.05
	C	12	200.00	3.92	1.13	2.0		
Chin ups, quantity of times	E	12	12.00	1.68	0.49	14.0	2.95	<0.05
	C	12	10.00	1.63	0.47	16.3		
Pressing ups, quantity of times	E	12	38.00	3.08	0.89	8.1	3.23	>0.05
	C	12	34.00	2.97	0.86	8.7		
Rising of legs in hanging on horizontal bar position, quantity of times	E	12	12.00	2.38	0.69	19.8	1.26	>0.05
	C	12	11.00	1.35	0.39	12.3		
Long jump from the spot, cm	E	12	215.00	5.40	1.56	2.5	5.38	<0.05
	C	12	200.00	8.00	2.31	4.0		
Shuttle run 4x9 meters	E	12	10.50	0.77	0.22	7.3	2.23	<0.05
	C	12	11.12	0.60	0.17	5.4		
3000 meters run (min/sec)	E	12	10.52	0.28	0.08	2.7	3.40	<0.05
	C	12	10.24	0.07	0.02	0.7		

Notes: C – control, E – experimental.

More significant improvement of testing results of experimental group's sportsmen is seen in such tests as 30 meters run from the spot, chin ups, pressing ups, rising legs in hanging on horizontal bar position, long jump from the spot and shuttle run 4x9 m: t between final indicators of control and experimental groups was from 2.23 to 5.38 with $P > 0.05$.

For determination of training's influence, oriented on development of speed-power and power qualities of 13-15 years old biathletes, on their special physical fitness, at the beginning of preparatory period (June) and at the end of it (December) we tested indicators of special endurance of the trainees. For determination of speed components of special endurance we applied such control exercises as 100 meters run on ski-rollers on even land with one-step technique, 500 meters' run on ski-rollers on even land; for determination of power components of special endurance we used run on ski-roller with ascending by 7-8 degrees with the help of arm and without arms; for determination of general

endurance's level we applied test "3000 meters' run on ski-rollers".

If at the beginning of pedagogic experiment there was statistically significant difference between mean indicators of control and experimental groups only in one exercise ("3000 meters' run on ski-rollers") ($t = 6.39$ with $P > 0.05$) (see table 3) that points at equal character of sportsmen's distribution in groups, then at the end of preparatory period, with repeated testing of the same components we found significant changes of physical fitness's indicators of both groups' teenagers.

Table 3

Indicators of most important components of special physical fitness at the beginning of preparatory period

Indicators	Group	n	X	S	m	V%	t	P
100 meters' run on ski-rollers (one-step technique) on even land, sec.	E	12	22.60	1.52	0.44	6.7	-1.04	>0.05
	C	12	23.30	1.77	0.51	7.6		
100 meters' run on ski-rollers (no-step technique) on even land, sec.	E	12	22.90	2.08	0.60	9.1	-0.38	>0.05
	C	12	23.20	1.72	0.50	7.4		
500 meters' run on ski-rollers on even land, sec.	E	12	99.80	1.75	0.50	1.8	1.35	>0.05
	C	12	98.90	1.53	0.44	1.5		
100 meters' run on ski rollers with ascending by 7- 8 ⁰ , sec.	E	12	35.60	1.39	0.40	3.9	-1.28	>0.05
	C	12	36.40	1.67	0.48	4.6		
Run on ski rollers with ascending by 7- 8 ⁰ , without help of arms, sec.	E	12	38.90	1.07	0.31	2.8	0.48	>0.05
	C	12	38.60	1.87	0.54	4.8		
100 meters' run on ski rollers with ascending by 7- 8 ⁰ , with the help of arms, sec.	E	12	42.40	1.87	0.54	4.4	-1.97	>0.05
	C	12	43.80	1.59	0.46	3.6		
3000 meters run on ski-rollers, sec.	E	12	774.00	3.57	1.03	0,5	6.39	<0.05
	C	12	762.00	5.46	1.57	0.7		

Notes: C – control, E – experimental.

Analyzing improvement of indicators of different physical fitness's components at the end of preparatory period (see table 4) we can say that the most significant changes of control group's indicators were in such control exercises as 100 meters' run on ski rollers with ascending by 7- 8⁰ without help of arms, 500 meters' run on ski-rollers on even land and 3000 meters run on ski-rollers.

Table 4

Comparative characteristics of most important components' indicators (special endurance) at the end of preparatory period- first stage of pedagogic experiment

Indicators	Group	n	X	S	m	V%	t	P
100 meters' run on ski-rollers (one-step technique) on even land, sec.	E	12	19.60	0.80	0.20	4.1	5.55	<0.05
	C	12	21,60	1.03	0.30	4.8		
100 meters' run on ski-rollers (no-step technique) on even	E	12	20.20	1.10	0.30	5.4	-	<0.05

Indicators	Group	n	X	S	m	V%	t	P
land, sec.							2.83	
	C	12	21.80	1.67	0.48	7.7		
500 meters' run on ski-rollers on even land, sec.	E	12	96.10	1.40	0.40	1.5	5.31	<0.05
	C	12	92.40	1.97	0.57	2.1		
100 meters' run on ski rollers with ascending by 7- 8 ⁰ , sec.	E	12	33.30	1.60	0.50	4.8	-	<0.05
	C	12	34.80	1.56	0.45	4.5	2.23	
Run on ski rollers with ascending by 7- 8 ⁰ ,without help of arms, sec.	E	12	36.10	1.50	0.40	4.2	-	>0.05
	C	12	36.70	1.51	0.43	4.1	1.02	
100 meters' run on ski rollers with ascending by 7- 8 ⁰ ,with the help of arms, sec.	E	12	40.30	1.50	0.40	3.7	-	<0.05
	C	12	42.60	2.48	0.72	5.8	2.79	
3000 meters run on ski-rollers, sec.	E	12	667.00	4.10	1.20	0.6	2.20	<0.05
	C	12	663.00	4.75	1.37	0.7		

Notes: C – control, E – experimental.

More significant changes of indicators of physical fitness's components in preparatory period of experimental group's junior sportsmen took place in such tests as run on ski-rollers with ascending by 7- 8⁰,with the help of arms, 100 meters' run on ski-rollers (no-step technique) on even land, 100 meters' run on ski-rollers (no-step technique).

Comparing increment of some components of junior biathletes' special fitness in spring-autumn, summer-spring and autumn-winter stages of preparatory period we can conclude that teenagers of experimental group had increment in four exercises from seven more significant than teenagers of control group and statistically confident in 100 meters' run on ski-rollers (one-step technique); improvement of results in experimental group was 3.0 sec., while in control 1.7 sec. (t between final results of groups was 5.55 with $P>0.05$); in 100 meters' run on ski-rollers (no-step technique) improvement of experimental group's results was 2.4 sec., while in control it was 1.4 (t between final results of groups was 2.8 with $P>0.05$); in run with ascending improvement in experimental group was 2.3 sec. and in control – 1.6 sec. (t between final results of groups was 2.23 with $P>0.05$); in 100 meters' run on ski rollers with ascending by 7- 8⁰,with the help of arms increment of results in experimental group was 2.1 sec. and in control – 1.2 sec. (t between final results of groups was 2.79 with $P>0.05$). In run on ski rollers with ascending by 7- 8⁰,without help of arms changes of indicators were statistically unconfident (t – 1.02 with $P>0.05$).

Conclusions:

Analysis of received data permits to make conclusion that application of power and speed-power exercises at stage of preliminary basic training facilitates junior sportsmen's significantly develop strength of those muscles, which endure the most of loads during skiing and running on ski-rollers. Alongside with it, training, oriented, mainly on development of endurance, to less extent facilitates increment of indicators of general and special fitness of junior biathletes.

The prospects of further researches imply fulfillment of pedagogic control of special physical fitness of 15-16 years' junior biathletes after two years comprehensive training.

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**SPECIFIC CHARACTERISTICS OF PHYSICAL FITNESS AT WORK ANAEROBIC ENDURANCE TYPE
OF ROWERS IN CANOE**

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Annotation. *Purpose:* to determine the effect of the reactive properties cardiorespiratory system to a special performance by canoe paddlers who specialize in the 200 m. *Material:* The study involved 22 paddler aged 18 - 29 years. *Results:* there were significant indicators of the reaction due to pulmonary performance and efficiency of anaerobic metabolism. The range of correlation coefficients (r) was $-0.54 - 0.77$ ($T_{50} V_E$) and $0,55-0,71$ (V_E). *Conclusions:* It was found that the optimization of the reactive properties of the cardiorespiratory system to realize the potential impact endurance rowers when using anaerobic nature. The greatest number of significant connections were indicators of efficiency and response of pulmonary ventilation. This allowed the evaluation of the functional improve information security work and increase specialized training sessions focus in the development of anaerobic endurance while working character in canoeing.

Keywords: canoe, sprint, endurance, anaerobic capacity, cardiorespiratory system.

Introduction

Introduction of new competition program – 200 meter canoe rowing- in pre-Olympic training puts forward new requirements to level of functional provisioning of rowers' special endurance. It is well known that dominating abilities for this distance are sprinter skills and strength of rowers [1,2]. Time of competition distance's passing by highly qualified rowers is about 40 seconds. High rate of rowing, which it is necessary to maintain during all period of distance causes significant tension of organism's functions and puts increased requirements to realization of anaerobic mechanism [8]. In this connection orientation of training process is connected with application of training loads, ensuring the fullest mobilization of anaerobic alactate and lactate responses of energy supply [15]. To realization of this direction recent works have been devoted [6,13,14].

Alongside with it, it was shown that identical programs of trainings caused different energy supply responses and, as a result, differences in effectiveness of training process [9]. There appeared an idea that in process of training, oriented on development of rowers' functional potentials, specific features of organism acquire special importance, features, which influence on realization of accumulated potential [3,7].

In special literature on cyclic kinds of sports, devoted to rowing in particular, it was elucidated that problems of realization of potential in process of training and competition functioning depend to large extent on organism's individual responsiveness of sportsman [4,9]. At the same time it was shown that optimization of physiological responsiveness, considering specific requirements of special endurance, depends on system of training influences, which include modes of work, stimulating responsive of organism [5,11]. Especially important is the fact that optimization of responsive features of sportsmen's organisms influences on increasing of degree of mobilization and, as a result, realization of anaerobic glycolytic energy supply in process of competition functioning [6].

Researches in this direction (canoe rowing) are paid insignificant attention to. Most of works are devoted to stating of the problem [1,2]. Clear methods of its solution are insufficient in special literature. It determines urgency of researches in this direction, including in the context of the present work.

Thus, it has become evident that it is necessary to conduct special analysis of workability's quantitative and qualitative indicators in their interconnection with indicators of cardio-respiratory system (CRS). It will permit to determine those sides of organism's responsive features, which influence on realization of rowers' endurance, when they fulfill anaerobic work. On this base it is possible to improve evaluation of special endurance of rowers-sprinters, to determine directions of rising of sport training's effectiveness.

Purpose,, tasks of the work, material and methods

The purpose is to determine responsive properties of cardio-respiratory system and their influence on canoe rowers' special workability, specializing in 200 meters distance.

The methodic of the research: the researches have been conducted on the base of laboratory of functional diagnostics of Ukhan institute of physical; culture. 22 rowers - winners and prize winners of China championship and Asian province Khubay participated in the research. The age of sportsmen was from 18 to 29 years old.

Indicators of rowers' workability were evaluated for 60 second of maximal test. We evaluated response of lung ventilation, O_2 consumption, speed of progressing of O_2 consumption, HBR and lung ventilation (by time of achieving of 50% of response – T_{50}) [12]. We also measured maximally accumulated O_2 deficit (MAOD) We measured in special conditions MAOD (combination of step-by-step increasing load and 60 seconds of work at level of $115\% VO_2 \max$) [10].

The following research apparatus were used: research complex for metabolism's researches Oxycon Pro; sport-tester "Polar"; laboratory complex for determination of blood lactate LP 400, "Dr Lange"; rowing ergo-meter

«Paddlelite». Processing of experimental material was carried out with the help of integrated statistical and graphic packages MS Excel-7, Statistica.

Results of the research

In table 1 we have presented correlation connections of indicators of CRS response and rowers' workability. We used indicators, which, with evaluation of levels, had high model values, in compliance with requirement of functional fitness of highly qualified rowers and low level ($CV < 15\%$) of individual differences in rendered characteristics.

Table 1

Correlation connections of workability's indicators, anaerobic metabolism and cardio-respiratory system of qualified canoe rowers, specializing in 200 meters distance μ

Indicators	V_E , l.p.min ⁻¹	VO_2 , ml.p.min ⁻¹ .kg ⁻¹	$T_{50} VO_2$, sec.	$T_{50} HR$, sec.	$T_{50} V_E$, sec.
W av., BТ	0.67	0.33	-0.11	-0.49	-0.61
W av. 25-30 sec., BТ	0.71	0.21	-0.21	-0.59	-0.77
La, m.mol ⁻¹	0.55	0.22	-0.39	-0.57	-0.54
MAOD, ml.p.kg ⁻¹	0.59	0.61	-0.51	-0.51	-0.58

In the table it can be seen that the highest correlation connections of special workability's indicators and anaerobic metabolism with indicators of CRS response were registered by indicators of lung ventilation (V_E , $T_{50} VO_2$). At the same time we noted that indicators of power and kinetic of anaerobic energy supply (VO_2 , $T_{50} VO_2$) had confident connections only with indicators of maximal accumulated O_2 deficit of MAOD, which is connected with response of CRS and ensures effectiveness of anaerobic energy supply at longer segments of distance. In this connection role of energy supply from the point of view of realization of special workability at distance is rather vague. Alongside with it we should not deny role of power, kinetic and other anaerobic energy supply components in the process of training work, considering importance of aerobic metabolism for optimization of sportsmen's functional state. It is especially important in period of fulfillment of great training loads, including with training of special endurance with anaerobic work [9]. The trend to connection of speed of HBR progressing indicators is connected with high tension of organism's functions and only indirectly determines responsive potentials of rowers (aerobic metabolism or response of lung ventilation).

Significance of ventilation response was proved during analysis of response's dynamic of rowers, who had high and reduced indicators of workability in the process of testing. In fig.1 we can see dynamic of lung ventilation response (by mean indicators 10 seconds of work's segments) of three rowers, who had the highest ($W_{av.} = 247.3 \pm 1.1$) and the lowest ($W_{av.} = 236.2 \pm 1.1$) indicators of workability in one minute maximal test.

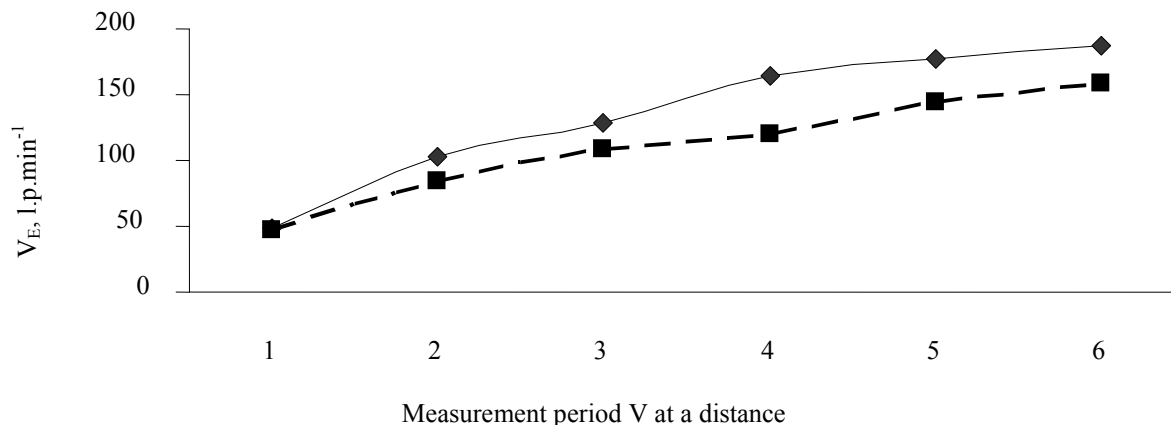


Fig.1. Dynamic of lung ventilation's response in process of 1 min. Test with work of maximal intensity (average indicators of three rowers, who had the highest (continuous line) and the lowest (dotted line) indicators of workability:

1,2... 6 – average indicators V_E : in measurement period: 1–10, 11–20, 21–30, 31–40, 41–50, 50–60 seconds of work

In the figure one can clearly see difference between responses of lung ventilation in period of test work's fulfillment. Rowers with highest level of workability showed increased level of lung ventilation response at all distance. Also attracts attention the fact that start point of non-linear deviation of response is characteristic for forth 10 seconds segment in 30-40 seconds work. It is connected with organism's response to maximization of anaerobic glycolytic energy supply, increasing of speed of accumulation of excessive CO_2 in period from 25 to 30 seconds of work [8]; in special literature this property is related to one of effective criteria of compensation, increasing of academic shifts and manifestation of organism's responsive properties in conditions of tensed physical loads, including loads during work for endurance of anaerobic character [1,6]. It is necessary to note that rowers, who had increased level of responsiveness of CRS we registered higher rate of restoration responses (by HR up to 120 b.p.m^{-1}). HBR indicators of both groups' rowers were accordingly within 70–90 seconds and 80–140 seconds.

The supplied data witness about significance of organism's responsive potentials for realization of sportsman's potential in conditions of anaerobic training loads, including with progressing of specific endurance's manifestations in sprinter disciplines in cyclic kinds of sports. It implies not only formation of appropriate evaluation system of rowers' special fitness, but also development and foundation of means of practical realization of specialized training means, oriented on increasing CRS's responsive properties, considering targeted influence on increasing of lung ventilation response.

Realization of such direction of researches seems to be a perspective one in system of special fitness improvement of canoe rowers, specialized in 200 meters distance.

Conclusions:

1. It has been established that there is influence of CRS's responsive properties on canoe rowers' workability in the process of improvement of anaerobic endurance.
2. We determined confident connections of indicators of lung ventilation with indicators of workability and anaerobic metabolism. The range of correlation coefficients (r) was $-0.54 - -0.77$ ($T_{50} \text{ V}_E$) and $0.55-0.71$ (V_E). Rowers, who had increased level of response during 60 seconds fulfillment of maximal test task at ergo-meter «Paddlelite» had higher level of workability.
3. We determined pre-conditions for foundation of training means, oriented on stimulation of CRS's responsive properties and their implementation in training process of sprinter canoe rowers.

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HEALTHSAVING ACTIVITY OF COMPREHENSIVE EDUCATIONAL ESTABLISHMENTS' LEADERS AS PSYCHOLOGICAL AND PEDAGOGICAL PROBLEM

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Annotation. *Purpose:* to show the essence and structural components of healthsaving activity of comprehensive educational establishments' leader. *Material:* conducted an analysis of psychological and pedagogical sources. *Results:* healthsaving activity of comprehensive educational establishments' leader was conducted. An integral part of leader's management-pedagogical activity directed on creation of healthy environment (physical-subjective, psychological-communicative, educational) of educational establishment. Also floating, saving and strengthening of health of all participants (pupils, pedagogues, parents) of pedagogical process. It was analysed contents of main components (planning, organization, stimulation, control) of healthsaving activity of leader. *Conclusions:* constant pedagogical monitoring allows to estimate an effectiveness of educational work of establishment according to the degree of achievement of assigned tasks and to make corresponding corrections in a decision of healthsaving questions of pedagogical process participants.

Key words: comprehensive educational establishment, leader, healthsaving activity, management.

Introduction

In modern social-cultural conditions there exist rather high requirements to professional competence of administrators of education, in particular to headmasters of comprehensive educational establishment (CEE) that was resulted from realization of governmental educational policy, oriented on reforming and upgrading of educational branch, substantial renewal of content and structure of educational establishments' functioning.

One of the most important aspects of CEE headmaster's functioning is his (her) ability to effectively and independently solve different tasks in field of health preservation of schoolchildren that was conditioned by a number of factors.

For example, it is quite undoubted that in solution of problem of schoolchildren's health preservation, as the highest value and state of human welfare in all aspects – physical, psychic, social and spiritual – school is of the first priority.

At the same time we have to state that, in spite of great attention of government to development of personality's health through education, actual school practice have not been ensuring yet preservation and improvement of pupils' health. It is witnessed by such statistic data: up to 80-90% of school age children have health problems; for the period of studying at school from 1st to 9th forms quantity of healthy pupils reduces 4 times.

Such situation is a result of many social-pedagogic factors, among which there are: unfavorable ecology, insufficient stimulation for healthy life style, spreading of harmful habits (smoking, alcohol, drugs, toxic substances taking and etc.).

Alongside with it as per data of World health protection organization significant portion of children's and youth's diseases is of the so-called "didactic" nature (insufficient organization of school physical education, didactic neurosis, stresses, over-tiredness), i.e. is directly caused by school.

In such conditions the problem of increasing of CEE headmaster's health related functioning becomes very important, because organization of pedagogic process, which would create safe and comfortable conditions for schoolchildren at school, prevention from stresses, overloading and over-tiredness, directly depends on him (her); headmaster shall ensure individual trajectory of teaching and personality's education and, thus, facilitates preservation and strengthening of schoolchildren's health.

Analysis of psychological-pedagogic resources permits to make conclusion that problem of health related functioning of CEE headmaster is studied in the following directions:

- main principles of theory of management of comprehensive educational establishments, work with pedagogues, organization of educational process subjects' interaction (Ye. Berezniak, V. Bondar, Yu. Vasylyev, G. Dmytrenko, G. Yelnikova, L. Kalinina, L. Karamushka, N. Kolominskiy, Yu. Krychevskiy, A. Markova, V. Maslov, V. Oliynyk, V. Pikelna, M. Potashnik, T. Rogova, P. Tretyakov, Ye. Khrykov, Castanheira P., Costa J.A., Gökyer N., Roberts S.M.) [10-12, 18].

- problem of valueology in educational process as factor of educational process effectiveness's effectiveness (T. Volchenska, T. Savustyanenko, L. Tatarnikova, G. Tushina, S. Shmaley), progressing of health and personality through education, formation of health culture and healthy life style (N. Bibik, T. Boychenko, O. Vakulenko, V. Goraschuk, T. Yermkova, G. Zaytsev, S. Zakopaylo, O. Ionova, S. Kyrlyenko, S. Kondratiuk, V. Kuzmenko, S. Lapayenko, O. Lukashenko, S. Omelchenko, V. Orxhekhovska, N. Pobirchenko, O. Savchenko, G. Serikov) [13-17].

At the same time in psychological-pedagogic science the problem of health related functioning of CEE headmaster has not become a subject of special research.

The present work has been fulfilled in compliance with plans of SRW of Kharkiv national pedagogic university, named after G.S. Skovoroda.

Purpose, tasks of the work, material and methods

The purpose of the article is determination of essence and structural components of health related functioning of comprehensive educational establishment's headmaster.

Results of the research

Analysis of great number of sources, devoted to development of professionalism in management activity of CEE headmaster (V. Alfimov, L. Danylenko, Yu. Konarzhevskiy, V. Kryzhko, N. Kuzmina, Ye. Pavliutenkov, V. Simonov, V. Slastionin, T. Sorochan, T. Shamova) [5-8], literature on trainings of pedagogues for health preservation of pupils, formation of personality in conditions of educational establishments (O. Avdeyeva, M. Bezrukykh, V. Bobrytska, Yu. Boychuk, L. Dykhan, O. Ionova, V. Nsterenko, N. P'yasetska, T. Seschenko, O. Filip'yeva, Ye Chernyshova) [1-4, 9] permitted to conclude that *health related functioning of comprehensive educational establishment's headmaster* as an integral component of his (her) management activity, is functioning, oriented on creation of health strengthening environment in educational establishment, which ensures preservation and strengthening of health of all participants of educational process (schoolchildren, pedagogues, parents).

Health improving environment of educational establishment, as certain system of conditions and means of influence on formation of personality, is determined by the following parameters:

- Physical environment, i.e. architecture, external and internal design of premises, servicing infrastructure, material-financial provision of educational activity, sanitary-technical, medical, sport equipment, organization of eating in compliance with sanitary standards and rules;
- psychological-communicative environment – interpersonal relations of educational process's subjects, individual and age distinctions of pupils, quality level of pedagogues, relations of parents and pedagogues, their ideas about healthy life style;
- educational environment – principles, forms, methods, technologies of teaching and education of pupils, oriented on preservation of personality's health.

As a component of management-pedagogic functioning, health related functioning of CEE headmaster includes the following components: planning, organization, stimulation and control.

Thus, *planning* – is determination of strategic and tactic aims of CEE functioning, main and auxiliary tasks, all actions and measures, required for achieving of targets of health preservation of pedagogic process's subjects. In particular, strategic targets are determined on the base of aim, conception of functioning, program of development of educational establishment, creation of its positive image. Tactic planning is resulted from composing of annual, monthly, weekly plans, which determine health related orientation of CEE functioning for certain period.

Organization stipulates creation of structure, which would permit for pedagogic collective to effectively work for achieving of strategic and tactic targets of health preservation with determined restrictions of resources (time, informational, financial-material, human, emotional-psychological and so on), ensures clear interaction of all departments of the establishment and its workers.

Organization requires from CEE headmaster to solve such main tasks: creation of pedagogic conditions (formation of health preserving environment of educational establishment – physical-objective, psychological-communicative, teaching-educational); development of health related means, forms and methods, technologies of teaching and education; coordination of activity of all educational process's participants (selection and distribution of pedagogic staff in compliance with task of health preservation; creation of temporary creative groups, special services and departments, coordination of their work; material and scientific-methodic provisioning of educational process of health related orientation at educational establishment).

Stimulation implies influence of CEE headmaster on pedagogues and workers, stimulation of pedagogic collective for health related activity.

In general, influence of headmaster is realized through three main forms: fear (feel of anxiety, which forces a person for obedience or appropriate actions); convincing (rendering facts, which cause worker's interest); satisfaction of interests through motivation.

In context of solution of health related problems the most important forms of CEE headmaster's influence are, undoubtedly convincing and motivation of subordinates, which ensure headmaster's knowing of life views, interests, hopes and expectations of his workers that facilitate choice of adequate methods of influence on them; support of pedagogues' initiatives in improvement of health related educational work; encouragement of creative searches, experimental work; ensuring of coordination of establishment's interests and personal demands of pedagogues that is a stimulus for human effective functioning.

Exclusively important role is played by CEE headmaster in stimulation of school pedagogues for development of conscious attitude to own health, for teacher to be an example of healthy life style.

Stimulation and mobilization of both – separate teachers and the whole pedagogic collective for solution of health related tasks shall be accompanied by realization of close connection of school and families, pedagogues and parents that express mutual understanding of educational tasks, oriented on protection and support of health of rising generation.

Control – as an element of feedback permits to determine how health related targets, set at the stage of planning, are realized.

Control can be fulfilled with the help of different organizational form, in particular: control of organization of eating and medical servicing, control over documentation, calendar planning, suitability of the used methods, forms and means of teaching to their age and psychological characteristics and etc.

In organization of control special place shall be taken by complex medical examinations of pupils. Criteria and indicators of efficiency of health related activity can be the following factors: understanding by pupil his progress in studying, steady interest to studying; presence of motivation for health, for methods of healthy life style (rational eating, motion activity, rhythm of work and rest); adequate recreation of physical, psychic and mental resources (absence of tiredness, high workability, activity, persistence, healthy complexion and so on); balance of mental state, communicability, ability for cooperation with people, social mobility; adequate self evaluation and evaluation of other people; belief in own potentials, setting for success in life and etc.

Constant pedagogic monitoring permits to estimate effectiveness of educational-teaching work of educational establishment by level of achieving of planned targets and insert appropriate corrections in solution of health related tasks by pedagogic process's participants.

Conclusions

Health related functioning of CEE headmaster, as an integral component of his (her) management functioning, is an activity, oriented on creation of health improving environment (physical-objective, psychological-communicative, educational-teaching) in educational establishment and ensuring of support, preservation and strengthening of health of all pedagogic process's participants (pupils, pedagogues, parents).

Health related functioning of CEE headmaster includes such components: planning, organization, stimulation, control.

The prospect of further researches imply research of readiness of comprehensive educational establishments' headmasters for health related functioning.

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CORRECTION OF PSYCHO-EMOTIONAL STATE OF ATHLETES PLAYING SPORTS WITH THE CONSEQUENCES OF INJURIES OF THE LOWER EXTREMITIES

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Annotation. *Purpose:* development of techniques for using factors of psychological support for the recovery of athletes playing sports after injuries of the lower extremities. *Material:* The study involved 44 sportsmen. During 2008 - 2013 years was recorded 558 injuries. *Results:* The results psychodiagnosis injured athletes procedure K. Leonhard additions to copyright. Recommended approaches such psychological rehabilitation: gaining an understanding of real prospects athlete restore lost functions; mobilization will athlete to actively participate in the rehabilitation process; help in facing traumatized and need opportunities to participate in training-competitive process. *Conclusions:* The proposed package of measures for psychological support provided athletes decrease recovery times for 1 - 3 weeks and return to training-competitive process.

Keywords: physical, rehabilitation, methodology, psychophysical, tests.

Introduction

Recent years quantity of works, supporting application of psychological means in sports has significantly grown [1, 7], but psychological influence is rarely used in process of physical rehabilitation (PR) after sport traumas. Appropriate researches are published in special medical literature and are not available for coaches. Alongside with anatomical, ecological and other physical factors, psychological pre-conditions are rather significant in trauma-hazard situations and with rehabilitation of traumatized sportsman. Recent researches witness that with treatment of sport traumas it is necessary to pay more attention to individual psychological features of sportsman [2, 4, 11]. Statistical data for several recent years prove constant increasing of traumatism among workable population [9, 10, 12]. From 60% to 72% of traumatized persons are students of sport perfection groups of team kinds of sports. In spite of appropriate training in every of the mentioned sports risk of traumas still remains to be high.

In students' teams there is no individual approach to controlling of loads and fulfillment of techniques. It results in overtiredness and over-tension, especially in competition period that, in its turn, results in traumas.

Injuring of lower limbs is, as a rule, psycho-traumatic factor because of sharp restriction of mobility and freedom of movements, pain, change in family relations, professional functioning, impossibility to participate in trainings and competitions. Problems, which appear as a result of traumas, often cause sportsman's depression and passivity, complicate rehabilitation process. Organism of traumatized person responds to trauma by general and local responses to injure, which are called traumatic disease (TD). Nearly all traumatized sportsmen have TD at the beginning of rehabilitation process. Except the above mentioned factors there exist psychological ones, which also cause traumas and include different features of a personality. Among personality's characteristics, connected with sport traumas, specialists regard negative emotional state, behavioral responses, stresses.

Purpose, tasks of the work, material and methods

The purpose of the work is working out of effective methodic of psychological maintenance factors for sportsmen's rehabilitation – representatives of team kinds of sports, after traumas of lower limbs as well as evaluation of psychological maintenance's efficiency (meaning programs for sportsmen with lower limbs' injures).

The tasks of the research:

- Generalization of experience of psychological maintenance's application in rehabilitation of sportsmen with lower limbs' traumas;
- Working out of psychological maintenance program for the a.m. sportsmen in complex with other PR means.;
- Estimation of efficiency of traumatized sportsmen's psychological maintenance.

Organization and methods of the research:

For testing of efficiency of the offered psychological maintenance program for the a.m. sportsmen we invited basketball players of combined teams of Zhytomir state technological university (ZhSTU) and Zhytomir automobile college (ZhAC), whose lower limbs were traumatized in period 2008-2013. After graduation from ZhAC most of graduates entered ZhSTU and became members of combined teams of this HEE. In experiment sportsmen of all years of study participated, that is why their age was not considered by the authors. At the beginning of the research we systemized all traumatic situations in both groups of sportsmen: in ZhSTU group there were 23 sportsmen, in group of college – 21 sportsmen with traumas, received in training-competition process. As per quantity of the received traumas the groups were rather different: in ZhSTU we registered 196 traumas and in ZhAC – 362. Character and localization of traumas were as follows: in general they were abrasions and bruises (58.6%); second place was taken by open sores –

17.4%, and the third by quantity required specialized medical aid and effective PR measures (injures of joints and fractures).

In our researches, for the described period, there were 2 such traumas in ZhSTU and 4 in ZhAC. The authors connect this fact with better physical fitness's indicators of ZhSTU sportsmen. Besides, we detected that with increasing of training's duration quantity of traumas reduces. The traumatized sportsmen of ZhSTU received psychological maintenance in compliance with worked out program and sportsmen of ZhAC were rehabilitated traditionally. ZhSTU sportsmen returned to trainings by 1 – 3 weeks earlier. After receiving of trauma no sportsman stopped attending basketball trainings at all, while in ZhAC there were 7 cases, when students gave up basketball. After entering ZhSTU basketball players start to receive psychological maintenance as per authors' PR program. From 2008 up to the present time psychological maintenance has been remaining efficient, helps for traumatized basketball player to successfully overcome trauma's after-effects and return to training-competition process.

Psychological maintenance of the traumatized shall be started since early stages of rehabilitation. With it main tasks of rehabilitation are:

- Sportsman's understanding of actual prospects of lost functions' rehabilitation;
- Mobilization of sportsman's will for active participation in rehabilitation process;
- Assistance for the traumatized to understand need and possibility of participation in competition-training process, preservation of good relations in family, even is there are steady restrictions of functions and ability to move.

For solution of the listed tasks we used the following methods of research: theoretical analysis and generalization of literature sources, pedagogic methods, clinical methods of psychological state's examination, psycho-emotional testing [13], methods of mathematical statistics. Results, obtained in these methods of research are delivered more specifically in [6, 14].

Results of the researches and their discussion

Correction of psycho-emotional state includes: explanation, emotional influence, didactic and rhetorical questions. The basis of influence on psycho-emotional sphere of the traumatized is correct sportsmen's understanding of character and reasons of traumas and prognosis of its treatment. Functioning of traumatized person in the process of physical rehabilitation is constantly oriented on positive results. It facilitates formation of adequate attitude to own disease. In talk with sportsman mechanisms of positive influence of physical loads on injured muscles and organism in general are explained.

Communicating with the traumatized, the authors clearly determine measures for further recovering, overcoming of pain [3,15], explanation of ways to full recovery and do not stress heaviness of trauma, difficulties, which sportsman will meet in the future. It is necessary to constantly stress on active participation of the traumatized in the process of treatment.

In rehabilitation process the authors offer to apply methodic by B. Crook, O. Kuts [8] for formation of optimistic hopes concerning own condition and further opportunities. With every positive change of physical condition the authors convince sportsman in his ability to achieve positive result in treatment of his trauma.

Lower limbs' traumas of sportsmen of team kinds of sports significantly influence on their psycho-motor functioning and psycho-emotional sphere. Psycho-motor potentials of most of traumatized sportsmen reduce.

The authors evaluate psychological maintenance by two directions:

- Psycho-motor abilities of the traumatized;
- Psycho-emotional state of the traumatized.

The worked out forms of documents permit to evaluate changes of sportsmen's psycho-emotional state as a result of PR. Characteristics of motion potentials of the traumatized sportsmen are received by the authors in compliance with recommendation [6]. Evaluation of psycho-motor potentials shall be fulfilled as per table 1.

Home tasks of the traumatized include exercises for stretching, power training (including on authors' simulator) [6], and special exercises, developed by the authors for the heaviest traumas [6].

Table 1.

Evaluation of psycho-motor potentials of traumatized sportsmen

Motion potentials	Condition	Points
Impossibility	Not understanding of task or physical impossibility of fulfillment	
Difficulties	Weak understanding, owing to: <ul style="list-style-type: none"> - Unfamiliar character of movements; - Pain; - Defects of memory, rough mistakes in fulfillment of task. 	
Practical norm	Understanding of task, but: <ul style="list-style-type: none"> - Confused fulfillment; - Unsatisfactory fulfillment of certain exercise, which cause pain or discomfort. 	
Independence	Absolute understanding, independent fulfillment with especially responsible attitude (sometimes with improvisations).	

Notesa: for it.1 – 0 points; for it.2 – 1 point; for practical norm – 2 points; for independent fulfillment of exercise – 3 points.

The authors recommend to carry out evaluation of psycho-emotional state with the help of test –“HOSPITAL ANXIETY AND DEPRESSION SCALE” by D.Wade, which consists of 14 questions: in it odd questions (1, 3, 5, 7, 9, 11) compose sub-scale of anxiety and even (2, 4, 6, 8, 10, 12, 14) – subscale of depression. Every question implies 4 variants of answers, which reflect gradation of symptoms, coded with increasing of their heaviness: from 0 (absent) to 3 (maximally expressed). The sum of points is calculated separately for subscale of anxiety and for subscale of depression. They mark out the following limits of points' totals for every subscale: 0-7 points – norm; 8-10 points – sub-clinically expressed anxiety-depression; 11 points and more – clinically expressed anxiety and depression. For correction of psycho-emotional state of the traumatized the authors used special breathing exercises.

Quantitative characteristic of psycho-emotional testing results of sportsmen with lower limbs' traumas is schematically shown in fig.1.

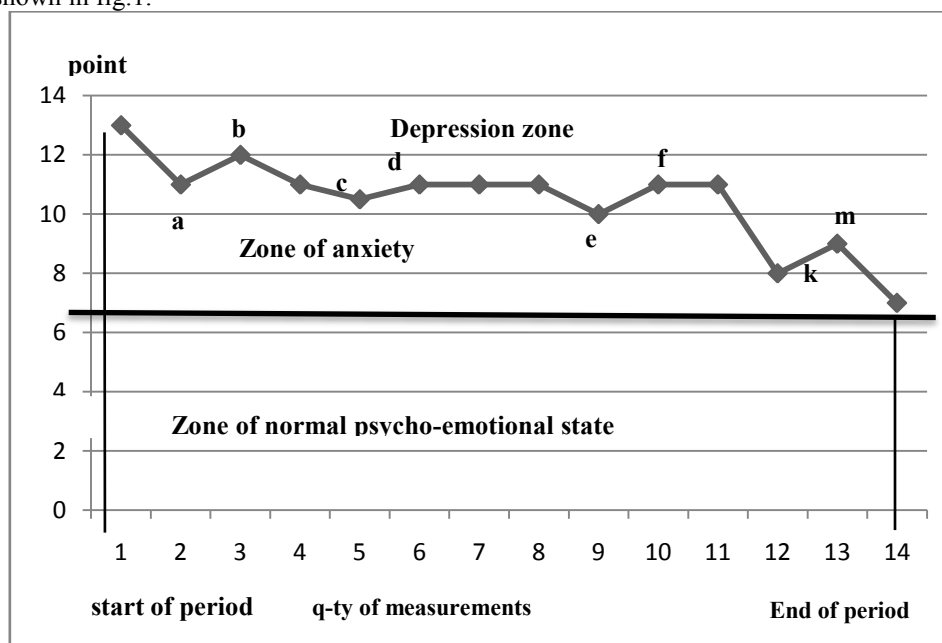


Fig.1. Diagram of testing of traumatized sportsman's psycho-emotional state

With increasing of sportsman's clinically expressed anxiety and depression (>11 points) the traumatized needs combined psychologist's and rehabilitation specialist's, coach's and other members of team aid.

Reduction of abnormalities in psycho-emotional sphere and normalization of sportsman's psychological state witness about success of rehabilitation specialist, coach and collective in psycho-emotional maintenance. Negative results with single increasing of depression state (parts a-b, c-d, e-f, k-m on diagram) witness about mistakes in PR process and shall be immediately analyzed and corrected [5].

For receiving of confident results it is recommended to apply the worked out by the authors methodic of psychological testing. It is necessary to clearly formulate conditions of its conducting. Only accurate fulfillment of the requirements can ensure positive general result of rehabilitation. It is possible under the following conditions:

- calm, adequate attitude of psycho-therapy specialist, PR specialist, coach and members of team to every traumatized sportsman;
- individual approach to every traumatized sportsman;
- creation of friendly atmosphere at individual trainings, talks and meetings;
- serious answering every question and serious fulfillment of every exercise or requirement;
- reasonable estimation of own general condition and state of abnormality after every session.

The received results of traumatized sportsmen's psycho-diagnostic (by K. Leongard's methodic with authors' supplements, given in table 2) can be also rather important.

Estimating own impressions of traumatized sportsman's condition after personal meeting or after questioning of team members, coach can offer the sportsman to answer only some of items of the table.

Table 2.

Characteristics of different sides of traumatized sportsmen's personalities

Code	State	Points			
		0	1	2	3
A	Sad or depressed				
B	Trouble of the future				
C	Hopes for sport future				
D	Actions				
E	Results of work				
F	Self-satisfaction				
G	Attitude to pain				
H	Thoughts about suicide				
I	Crying				
J	Nervousness				
K	Taking decision				
L	Wish to re-start trainings				
M	Self-appraisal of own appearance				
N	Attitude to work				
O	Attitude to people				
P	Sleeping				
Q	Tiredness				
R	Appetite				
S	Weight for recent month				
T	Sexual interest				
U	Care of own health				
Mean value of psychic state					

Comparing resulting points with previous answers to analogous questions it is easy to make conclusion about presence or absence of positive changes in psychological state of the traumatized. Points' result, in this case, is sufficiently informative and calculations are simple and do not require complex formulas and expensive equipment.

For choice and usage of certain questions of the table it is very important to apply correct approach to individual features of everybody, i.e. to training and competition experience, will qualities, features of character.

Conclusions:

Psychological health's condition and its physical components are interconnected and closely interdependent. Under influence of psycho-emotional state's correction indicators of psycho-motor potentials of the tested traumatized sportsmen manifested significant positive changes; motion inabilities, caused by not understanding of task, were eliminated as well as physical impossibility to fulfill movements; sportsmen did not meet difficulties of unfamiliar movements. By 31.3% quantity of sportsmen, who felt pain, decreased and by 30.% - quantity of sportsmen, who felt pain owing to unsatisfactory fulfillment of certain exercise. Analysis of psycho-emotional state witnessed that among traumatized sportsmen the quantity of those with reduced level of anxiety and depression reduced or came to norm ($P < 0.01$). Repeated examination showed that quantity of persons with sub-clinical form of anxiety reduced and quantity of persons with clinical form – came to zero ($P < 0.01$).

The applied by the authors complex of measures on sportsmen's psychological maintenance in PR after lower limbs' traumas ensured reduction of rehabilitation period by 1-3 weeks with returning to training – competition functioning. The prospects of the researches imply searching of other individual methods of psychological maintenance in PR programs for traumatized sportsmen, for improvement of their speed-power qualities and normalization of their psycho-emotional state.

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ALLOCATION ALGORITHM FOR ATHLETES GROUP TO FORM TACTICAL TASKS IN GAME TEAM SPORTS USING THE METHODS OF MULTIVARIATE ANALYSIS (ILLUSTRATED WOMEN UKRAINIAN TEAM BASKETBALL WITH HEARING IMPAIRMENTS)Kozina Zh.L.¹, Sobko I.N.², Kolomic N.A.³, Jagiełło Władysław⁴, Jagiełło Marina⁴Kharkov National Pedagogical University¹Kharkov National Economic University²Academy of Design and Arts³Academy of Physical Education and Sports, Gdansk, Poland⁴

Annotation. *Purpose:* develop and prove experimentally allocation algorithm athletes in groups to form a tactical tasks in team sports game using methods of multivariate analysis. *Material:* The study involved 12 basketball hearing impaired 20-25 years old - female players team of Ukraine on basketball. Analyzed the results of testing and competitive activity 12 basketball players with hearing impairments - Lithuanian team players. *Results:* An algorithm for distribution by groups of athletes for the formation of tactical tasks. The algorithm consists of the following steps: 1 - testing of athletes; 2 - A hierarchical cluster analysis performance testing; 3 - Distribution of sportsmen groups, analysis of the characteristics of athletes, the formation of tactical tasks. Found higher rates of reaction rate at the offensive players. We pivot revealed a higher level of absolute strength. The defenders found a higher frequency of movement and jumping. *Conclusions:* The algorithm is the basis for determining the best options mutual combination players in the development and implementation of tactical combinations, the selection of partners when working in pairs and triples in training.

Keywords: cluster, basketball, tactic, Deflimpiada, preparedness, hearing.

Introduction

In basketball training process there happen situations when coach shall quickly and effectively determine the most rational tactic interactions between players and role of every player [1, 2, 3, 4, 10, 11]. This task is closely connected with determination and specification of players' functions that is especially important for combined teams, which are composed from players of different clubs and, thus, there can be excess of one role games and deficit of other role ones [14, 18, 19, 20, 21, 22, 37].

Such situation is also important for combined team of Ukraine – basketball players with hearing problems [23, 25, 32]. It is conditioned by the fact that there is relatively little quantity of sportswomen with hearing problems – candidates for combined team of Ukraine. That is why coach of combined team faces not only the problem of formation of team but also the problem of physical and technical-tactic training of sportswomen [5, 6, 8, 12, 16, 17, 34]. Coaches of combined teams of healthy sportswomen face such problems to less extent [20, 28, 29, 31, 35, 36, 38].

Individual approach in sportswomen's training is also of great importance [21, 22, 24, 30], as well as the problem of rational distribution of players by their functions, determination of optimal sportswomen's combinations in pairs, threes, when forming start groups for games and with replacements in games.

As a rule, in most of teams these tasks are solved by coaches in process of all many years' training process, basing on own experience and intuition. However, in combined teams, as we have already mentioned, demand in formation and coordination of team in relatively short terms complicates this task. In this connection it would be purposeful to use methods, which would permit to accelerate and raise effectiveness of this tasks' solution. [22, 23, 25, 27]. Among such methods there is method of multidimensional analysis (cluster, factorial, discriminative analysis and other) [9, 19], for realization of which it is necessary to work out algorithm of application of such methods.

The research has been fulfilled in compliance with “Combined plan of scientific-research works in sphere of physical culture and sports for 2011-2015” by topic 2.4 “Theoretical-methodic principles of individualization in physical education and sports” (state registration number 0112U002001) and in compliance with research works, which are financed by Ministry of education and science of Ukraine for 2013-2014 and 2014-2015 “Theoretical-methodic principles of application of informational, pedagogic and medical-biological technologies for formation of healthy life style” (state registration No. 0113U002003) and “Theoretical-methodic provisioning of formation of personality's healthy life style in conditions of educational establishment, in context of European integration” (state registration No. 0114U001781).

Purpose, tasks of the work, material and methods

The purpose of the research is working out and experimental proof of algorithm of sportsmen's distribution in groups for formation of tactic tasks in team kinds of sports with the help of method of multidimensional analysis.

The methods of the research: theoretical analysis and generalization of special literature, methods of psycho-physiological testing (determination of time of simple and complex direct and cross responses in different conditions of tests, tapping test), which was conducted with the help of device “Sport psycho-physiologist”; methods of pedagogic testing, which included tests for special physical and technical fitness; method of determination of competition functioning's effectiveness; pedagogic experiment; methods of mathematical statistics.

12 female basketball players with hearing problems of 20-25 years old age – members of combined team of Ukraine participated in the research. For comparative analysis we analyzed also results of testing and competition functioning of 12 female basketball players with hearing problems – members of combined team of Lithuania.

Results of the research

For solution of the set tasks we considered to be purposeful application of mathematic methods for determination of sportswomen's individual features, the most rational variants of their distribution by game roles and determination of players' optimal combinations for working in pairs, threes at trainings. For these purpose methods of multidimensional analysis are the most suitable, in particular cluster and factorial analysis, algorithm of whose application in sport teams is described in works [21, 22].

On the base of theoretical conception of individualization of training process in sports, developed by [21, 22], we determined female basketball players' groups by indicators of complex testing:

The conception implies application of algorithm, which consists of the following stages:

- testing of sportswomen with not less than 10 tests;
- hierarchic cluster analysis of tests' indicators;
- on the base of cluster analysis distribution of sportswomen in groups; analysis of characteristics of sportswomen of every group; formation of tactic tasks, depending on characteristics of every group.

In our research we, first of all, fulfilled hierarchic cluster analysis of indicators of psycho-physiological and pedagogic testing for formation of groups, combining the most similar by psycho-physiological and pedagogic indicators basketball players.

The structure of this series of researches is given in fig.1. At first stage we conducted determination of psycho-physiological potentials, special and technical fitness of sportswomen.

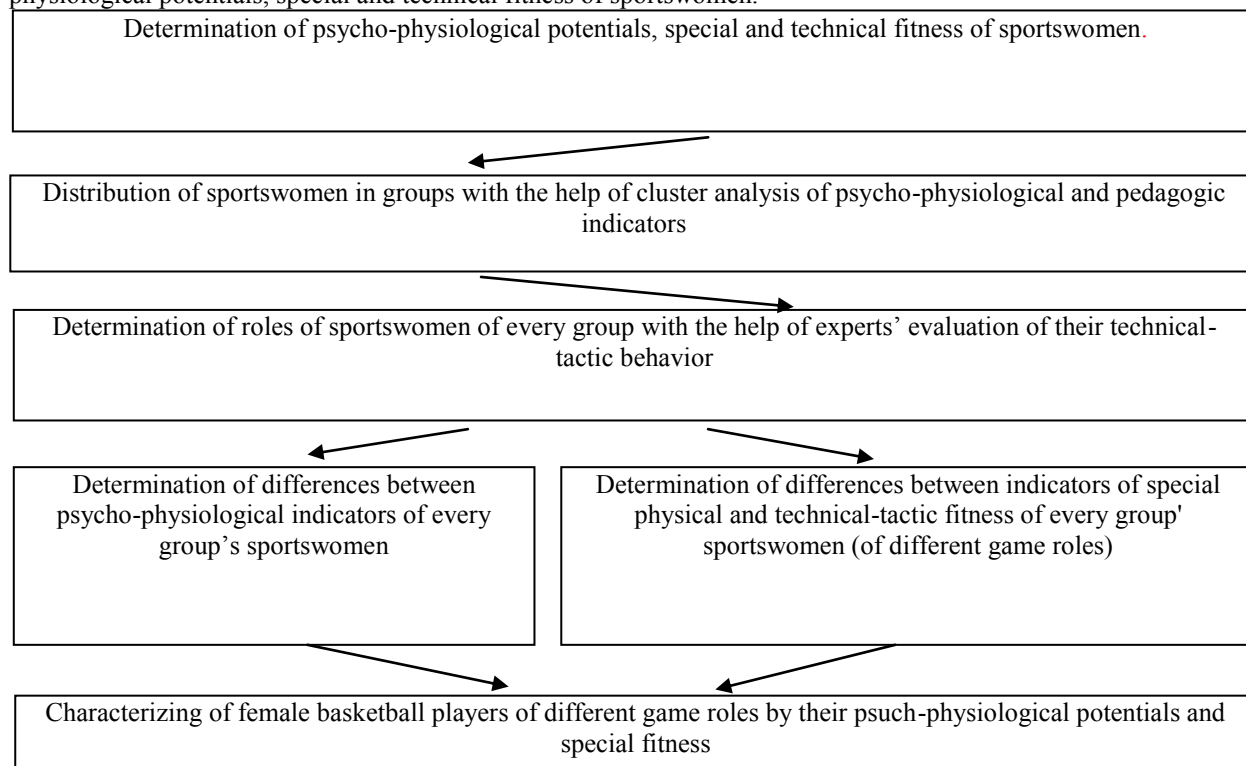


Fig.1. Schema of experimental researches for specifying of basketball players' game functions and formation of tactic tasks

Further, with the help of cluster analysis of psycho-physiological and pedagogic indicators we fulfilled distribution of sportswomen in groups and analyzed characteristics of sportswomen of every group with the help of experts' evaluation of their technical tactic actions. As a result every group was named in compliance with game function in basketball. After it we complexly determined differences between psycho-physiological indicators and indicators of pedagogic testing by every group, i.e. by different game functions, and formed characteristics of female basketball players with hearing problems by different game functions and psycho-physiological potentials and special physical and technical fitness.

Thus, for specifying of game functions of female basketball players with hearing problems – members of combined team of Ukraine – we used hierarchic cluster analysis of indicators of psycho-physiological and pedagogic testing [9]. In hierarchic cluster analysis every separate case forms, first, its separate cluster. At every step two separate clusters, the most close to each other, combine in one cluster.

Stages of clusters' formation are shown in fig.2. In dendrogram (fig.2) we can see that at first step sportswomen No.2 and No.5 were combined in one cluster.

This means that these sportswomen are close by structure of their psycho-physiological potentials and special physical and technical-tactic fitness that should be considered in trainings.

At the next stage of cluster analysis sportswomen No.4 and No.3 and so on will join them.

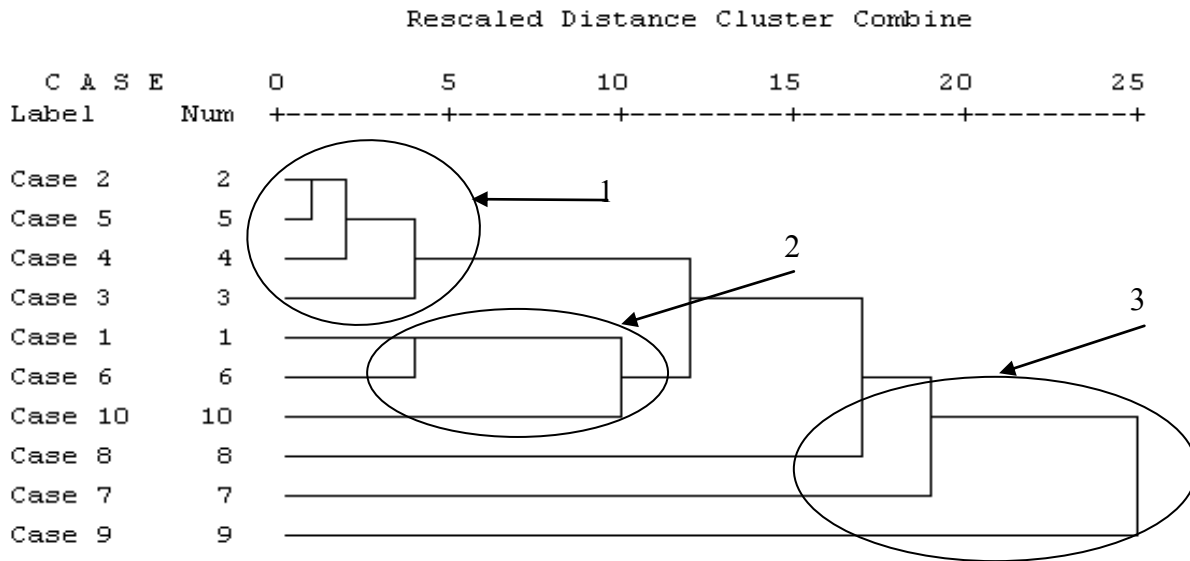


Fig.2 Dendrogram of cluster analysis of distribution in groups of Ukrainian combined team players with hearing problems, in compliance with indicators of complex testing: 1 – first cluster, forwards; 2 – second cluster, backs; 3 – third cluster, central players; Rescaled Distance Cluster Combine – Conventional scale of differences between players with their combining in clusters by indicators of complex testing; Case – the tested, conventional number; Num – number; Labe – level.

For detecting what quantity of clusters is optimal it is necessary to deduct number of step, on which cluster coefficients start to grow in non-linear way, from quantity of analyzed sportswomen. In our case it is step № 7 (fig. 4.3). That is why optimal quantity of clusters is 10-7=3.

So, we received 3 clusters, i.e. 3 groups of sportswomen-basketball players. In basketball it satisfies three main game functions.

In fig.2 we can see belonging of every player to certain cluster.

Thus, cluster analysis of indicators of psycho-physiological testing, of special and technical tactic fitness showed presence of 3 groups of sportswomen.

Experts' evaluation of basketball players' game functions showed that first group was composed of forwards (attackers), second group – of backs (defenders) and third – of central line players.

As far as in cluster analysis, alongside with indicators of special and technical tactic fitness psycho-physiological indicators participated (sportswomen were distributed in three groups of different game functions), we can make conclusion about high influence of psycho-physiological potentials on formation of sportswomen's game functions, while game function is usually determined, as a rule, by anthropometric characteristics of basketball players.

At the next stage we fulfilled comparison of formed groups of basketball players by psycho-physiological potentials and indicators of special and technical-tactic fitness. It should be noted that distinctions by psycho-physiological potentials are physiological basis for formation and manifestation of individual style of functioning [13, 26].

For example, higher indicators of forwards' quickness of response condition formation of their playing style, which requires quick responding to changing situation, quick taking of decisions. Besides, forward's playing style implies execution of accurate actions in quickly changing conditions. Physiological pre-conditions of such style's formation and manifestation are such indicators as quickness of work, quickness of response, quickness of run, jump endurance (see table 2).

Table 2

Indicators of psycho-physiological and pedagogic testing of different game functions' players with hearing problems – members of women combined basketball team of Ukraine

Test	Groups	Statistical indicators					
		\bar{X}	S	m	Compared groups	t	p
1	2	3	4	5	6	7	8
Simple sensor-motor response, left arm, \bar{X} , msec.	B	392.83	36.21	20.91	1-2	1.80	0.13
	F	350.45	56.58	28.29	1-3	-2.35	0.08
	C	485.7	58.21	33.61	2-3	-3.09	0.03
Cross sensor-motor response of choice of right arm and left eye, \bar{X} , msec.	B	391.9	17.15	9.90	1-2	4.95	0
	F	314.45	22.46	11.23	1-3	-0.23	0.83
	C	401.50	69.99	40.41	2-3	-2.08	0.16
Cross sensor-motor response of choice of left arm and right eye, \bar{X} , mc	B	348.97	27.75	16.02	1-2	0.29	0.79
	F	343.45	23.66	11.83	1-3	-1.99	0.12
	C	454.73	87.96	50.78	2-3	-2.49	0.06
Cross sensor-motor response of choice of left leg and right eye, \bar{X} , mc	B	459.3	69.22	39.96	1-2	2.53	0.05
	F	358.75	36.53	18.26	1-3	-0.61	0.58
	C	450.87	61.38	35.44	2-3	-2.51	0.05
Tapping test, left leg, 1 st stage, q-ty	B	62.33	3.21	1.86	1-2	-4.31	0.01
	F	98.75	14.03	7.02	1-3	-0.66	0.57
	C	64.67	18.04	10.41	2-3	-0.61	0.58
Tapping test, left leg, 2 nd stage, q-ty	B	47	3.61	2.08	1-2	-5.99	0
	F	88	11.20	5.60	1-3	-2.46	0.07
	C	60	3.61	2.08	2-3	-0.61	0.58
Tapping test, left leg, 3 rd stage, q-ty	B	51	8.66	5.00	1-2	-3.02	0.03
	F	79.75	14.43	7.22	1-3	-1.50	0.21
	C	67	3.61	2.08	2-3	-0.61	0.58
Tapping test, left leg, 4 th stage, q-ty	B	44.67	11.50	6.64	1-2	-5.89	0
	F	80.75	4.35	2.17	1-3	-1.56	0.19
	C	63.33	3.61	2.08	2-3	-0.61	0.58
Tapping test, left leg, 5 th stage	B	45.33	12.06	6.96	1-2	-3.15	0.03

Test	Groups	Statistical indicators					
		\bar{X}	S	m	Compared groups	t	p
	F	76.75	13.72	6.86	1-3	-1.60	0.18
	C	56.33	3.61	2.08	2-3	2.45	0.06
	B	85.33	20.01	11.55	1-2	-1.99	0.12
Tapping test, right arm, 2 nd stage, q-ty	F	100.25	7.68	3.84	1-3	1.80	0.13
	C	77.67	3.61	2.08	2-3	2.7	0.04
	B	78.67	15.63	9.02	1-2	-1.99	0.12
Tapping test, right arm, 5 th stage, q-ty	F	93.25	7.14	3.57	1-3	-0.61	0.58
	C	74.67	3.61	2.08	2-3	4.04	0.01
	B	85.33	21.73	12.55	1-2	1.80	0.13
Tapping test, right arm, 6 th stage, q-ty	F	98.25	14.97	7.49	1-3	-1.99	0.12
	C	56.67	6.03	3.01	2-3	3.6	0.02
	B	127	5.20	3.00	1-2	-4.24	0.01
Skipping, 1 minute, q-ty of times	F	145.5	6.03	3.01	1-3	1.80	0.13
	C	133.33	6.03	3.01	2-3	-1.99	0.12
	B	1.26	0.04	0.02	1-2	3.82	0.01
6 meters' run, sec.	F	1.13	0.05	0.02	1-3	-0.61	0.58
	C	1.37	3.61	2.08	2-3	-0.65	0.59
	B	22.67	1.53	0.88	1-2	-3.01	0.03
Rising of torso from lying position for 30 sec., q-ty of times	F	29.75	3.77	1.89	1-3	2.91	0.03
	C	22	4.93	2.85	2-3	-0.61	0.58
	B	36	2.65	1.53	1-2	-0.61	0.58
High jump from the spot, cm	F	33.25	3.61	2.08	1-3	3.82	0.02
	C	23.67	4.93	2.85	2-3	3	0.03
	B	5.63	0.23	0.13	1-2	-0.61	0.58
Throwing of filled ball from the spot, cm	F	5.7	6.03	3.01	1-3	-3.71	0.02
	C	6.9	0.54	0.31	2-3	1.80	0.13

B –backs; F – forwards; C –central line players; \bar{X} –mean arithmetic; S – mean square deviation; m –error of mean; t – Stjudent's criterion for comparison of means; p – level of significance for determination of confidence of differences.

It should be noted that central line players compensate insufficient quickness of response and quickness of works by higher absolute strength (see table 2), i.e. they throw filled ball at further distance.

From this it follows that for such sportsmen optimal variant of realization of their physiological potentials is training of actions, which do not require high variability and demand only strength in relatively similar actions that, just, is realized in functioning of central line players. Thus, physiological potentials are realized in certain abilities, which manifest themselves in formation of certain style of functioning, in our case, - game functioning. Analogous explanation can be given to higher jumping of defensive players (see tables 2).

Thus, we applied methods of multidimensional analysis for specification of game functions, detecting of the most optimal variants of players' combinations for realization of tactic combinations, for selection of partners for working in pairs, threes at trainings. On the base of received data we worked out system of training for female basketball players with hearing problems in annual cycle with application of innovative technologies, based on video-aids on game tactics and with application of light devices for increasing of effectiveness of sportswomen's control in the process of trainings. We determined model characteristics and scales for evaluation of indicators of special physical and technical-tactic fitness as well as competition functioning of qualified female basketball players with hearing problems, of different game roles.

Application of system for training of female basketball players with hearing problems in annual cycle with the help of innovation technologies rendered positive influence on indicators of physical and technical fitness, indicators of competition functioning and results in main competitions. Female basketball players of experimental group (combined team of Ukraine) confidently increased results of tests "Skipping, 1 minute, q-ty of times" (from 136.08 to 149.83 times, $p < 0.01$), "High jump from the spot, cm" (from 30.83 cm to 35.75 cm, $p < 0.05$), "Pressing ups in lying position for 30 seconds, q-ty of times" (from 28.17 to 33.67 times, $p < 0.01$), "Rising of torso from lying position for 30 seconds, q-ty of times" (from 26.17 to 34.17 times, $p < 0.001$), "Jumping for time, for 20 seconds, q-ty of times" (from 27.92 to 32.00 times, $p < 0.05$), "20 meters' run, sec.>"; they confidently improved results of tests "Speed techniques, sec." (from 35.00 sec. to 33.17sec, $p < 0.05$), "Penalty throws, q-ty of hits from 21" (from 11.42 to 14.17 times, $p < 0.05$), "3 scores' throws, q-ty of hits from 21" (from 5.58 to 8.33 times, $p < 0.01$), "2 scores' throws, q-ty of times from 21" (from 12.08 to 15.92 times, $p < 0.001$), "Middle distance throws, quantity of throws for 40 seconds" (from 7.33 to 8.42 times, $p < 0.01$), "Middle distance throws, q-ty of hits for 40 seconds" (from 2.67 to 4.92 times, $p < 0.001$), "Special endurance, q-ty of throws for 5 minutes" (from 81.5 to 88.5 times, $p < 0.01$), "Special endurance, q-ty of hits for 5 minutes" (from 32.42 to 44.17 times, $p < 0.001$), "Middle distance throws, q-ty of hits from 40" (from 18.92 to 23 times, $p < 0.01$). In control group (sportswomen from Lithuania) these changes are less expressed and in most cases are not confident.

Application of the worked out training system for female basketball players with hearing problems in annual cycle resulted in improvement of competition functioning's indicators. Female basketball players from experimental group (combined team of Ukraine) fulfilled confidently more throws and hits from long distance than Lithuanian basketball players (control group), who, before experiment, had equal to Ukrainian basketball players indicators and, in some cases, even better. Such indicators as "pick ups at own backboard, quantity per games" and "pick ups at adversary's backboard, quantity per game" also improved as well as quantity of interceptions; quantity of fouls of Ukrainian sportswomen reduced.

We registered positive influence of the worked out system for female basketball players with hearing problems in annual cycle with application of innovative technologies on results of main competitions. At 22nd Deaflympic game, by all indicators, except the last, sportswomen of Ukrainian combined team (experimental group) showed confidently higher results than combined team of Lithuania (control group). Accordingly, for the first time they won silver, moving aside combined team of Lithuania, which previously was ahead of combined team of Ukraine), to the third place. Improvement of intensity was reached owing to new system of communication between coach and sportswomen. The offered by us new means of training process's control helped to increase mobility, intensity and motor density of trainings of Ukrainian combined team; they facilitated increasing of speed and effectiveness of perception of information about tactic interactions and optimization of training process.

Conclusions:

1. We have worked out algorithm of sportsmen's distribution in groups for formation of tactic tasks in team kinds of sports with the help of multidimensional analysis (on example of women combined team of Ukraine-basketball players with hearing problems). Algorithm consists of the following stages: 1 – testing of sportsmen, including not less than 10 tests; 2 – hierarchic cluster analysis of indicators of testing; 3 – distribution of sportsmen in groups on the base of cluster analysis, analysis of characteristics of every group's sportsmen, formulating of tactic tasks, depending on characteristics of every group's sportsmen.

2. We have proved high influence of psycho-physiological potentials on formation of game roles of sportswomen, though, as a rule, game roles are determined exclusively by anthropometrical characteristics of basketball players.

3. It was registered that forwards (attackers) have higher indicators of quickness of response; central line players – higher level of absolute strength; defensive players have higher frequency of movements and jumping.

4. On the base of the received data we worked out training system for female basketball players with hearing problems in annual cycle, with application of innovative technologies. Application of training system for female

basketball players with hearing problems in annual cycle, with application of innovative technologies rendered positive influence on indicators of physical and technical fitness, competition functioning and results of main competitions.

In the future we offer to develop new technologies for disabled sportsmen, studying of influence of innovative technologies' application on efficiency of competition functioning, functional potentials, level of special physical and technical-tactic fitness of disabled sportsmen- representatives of other team kinds of sports.

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ALGORITHM OF PHYSICAL REHABILITATION OF ATHLETES IN POLYCLINIC STAGE OF TREATMENT OF OSTEOCHONDROSIS

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Annotation. *Purpose:* develop an algorithm which improves the physical rehabilitation of athletes with osteochondrosis on polyclinic stage of treatment. *Material:* processed of scientific literature and Internet. *Results:* this research analyzes traditional recovery of athletes with spinal osteochondrosis on polyclinic stage of treatment. The practical and clinical study showed that etiopathogenesis injuries and diseases of the musculoskeletal system of athletes of different specialties have similar evidences. Therefore, a recovery of sports working capacity during medical rehabilitation treatment does not differ from ordinary patients. We propose an algorithm of physical rehabilitation, aimed for the fast recovery of health of athletes and return them to the athletic training, and conducting therapeutic exercises with specific objects such as balancing disk and preventive "Osan". *Conclusions:* established that the physical rehabilitation of athletes at polyclinic stage of treatment similar to the rehabilitation of patients non-athletes, and improved algorithm for the physical rehabilitation of athletes with osteochondrosis in the polyclinic stage of treatment.

Keywords: osteochondrosis, spine, physical, rehabilitation, athlete.

Introduction

Sportsmen also face the problem of backbone osteochondrosis and connected with it difficulties in improvement of sportsmanship in certain kind of sports. Intensive loads result in micro traumas and traumas of sportsmen's backbone tissues, which, further, create preconditions for backbone osteochondrosis. As on the present time there has appeared a question of quicker rehabilitation of sport workability of sportsmen of different qualification. That is why development of physical rehabilitation programs for sportsmen, who have pain in back, has become urgent. It is necessary for sportsmen's quicker coming back to sports after traumas or backbone diseases [2, 5, 10, 12, 13, 15, 16].

At modern stage of osteochondrosis and its complication's treatment, doctors take measures with the help of conservative methods, oriented on elimination of pain syndrome, disorders of sphenomegaly spines and on prevention from progressing of dystrophy in backbone structures [1, 6, 7, 8, 9, 10, 13, 16].

The task of sportsmen's rehabilitation is recreation of their psycho-somatic health, general and special workability after diseases and traumas. Having many common features with rehabilitation of patients-non sportsmen and disabled people, sportsmen's rehabilitation, at the same time, is rather specific, first of all by its aims: recreation of specific motion skills that require other forms of organization, means and methods of rehabilitation [2, 3, 8, 13]. Different authors characterize measure, applied in treatment of patients with osteochondrosis, rather in general form; besides, there are no publications with description of details of physical rehabilitation means for definite kinds of sports.

Purpose, tasks of the work, material and methods

The purpose: development of algorithm, which would improve process of physical rehabilitation of sportsmen, having backbone osteochondrosis at polyclinic stage of treatment.

The tasks: analysis of modern status of physical rehabilitation, oriented on recreation of workability of sportsmen with degenerative- dystrophic changes of backbone in polyclinic conditions with methods of medical rehabilitation.

The methods of the research: analysis of scientific-methodic literature and Internet data.

Results of the research

Our purpose was working out of physical rehabilitation program for sportsmen with backbone osteochondrosis, which would include therapeutic physical culture with application of non-traditional equipment, such as balance disk and prophylactor "Osan".

In special scientific-methodic literature many authors underline that exactly complex therapy and correctly selected physical rehabilitation means and methods condition the best and the steadiest therapeutic effect [1, 3, 4, 8].

For effective usage of rehabilitation methods it is necessary to know mechanism of their influence on functional systems and organism's tissues; concerning sportsmen – on functional state, kind of sports, age, sex, - but it is the most actual at the stage of sport rehabilitation. Practical and clinic researches showed that etiopathogenesis of traumas and diseases of supporting motor system of different specialties sportsmen is realized in similar way. That is why recreation of sport workability in period of medical rehabilitation does not differ from treatment of ordinary patients [13].

Researches also showed that earlier application of physical therapy, ointments, different massages, therapeutic physical culture in complex system of rehabilitation facilitate quicker re-generation of traumatized tissues, weakening or elimination of pain, sores, acceleration of tissues' metabolism, recreation of sportsmen's workability [1, 3, 8, 10].

But there is difference between rehabilitation of sportsmen and treatment of ordinary people. It implies that rehabilitation is divided in three stages: stages of medical and sport rehabilitation and stage of sport training. Every of these stages have appropriate clinic characteristics, specific means and methods of recreational treatment. Correlation of

means of medical, sport rehabilitation and sport training in process of sportsmen's complex rehabilitation was worked out by M.I. Gershuberg..

Medical rehabilitation starts from determination of exact diagnose. The task of diagnostic in case of traumas (injures) of supporting motor system of sportsmen has its peculiarities: diagnose shall rest not only on clinic-anatomical data, but also on analysis of bio-mechanical, physiological, bio-chemical disorders; it is necessary to have clear knowledge of phase of traumatic process, which is determined by clinic of reactive changes (traumatic swelling, expressed pain, destructive inflammation symptoms against the background of reflection and trophic changes and so on).

Most authors distinguish acute, sub-acute and chronic phases of primary trauma and the phase of aggravation of chronic traumatic process (when sportsman consult with traumas specialist and neurologist after repeated traumas or with failures of achieved compensation); as well as stages of compensation, sub-compensation and de-compensation with transition to steady structural changes of de-generative character, when, sometimes, full recreation of sportsman's supporting motor system's function is complicated. Dozed physical exercises are necessary in acute or sub-acute period of disease. Physical exercises influence on elasticity of vertebral disks and all cartilage, which depends on organism's general tonus and, that is why, to some extent, can be improved with training in the form of therapeutic gymnastics.

At polyclinic stage of treatment of patients with osteochondrosis in acute and sub-acute periods commonly accepted schema of physical rehabilitation has such measures as medical therapy, reflex therapy, physical therapy, massage, in-bed motion regime (3-5 days on flat board in optimal unloading position) as well as application of immobilizing braces for several days [2, 8]. Such schema of rehabilitation can prolong the time of sportsman's coming back to sports; that is why working out of new approaches, considering physiological process during disease, is necessary for specification of applied means of rehabilitation process.

It is known that therapeutic physical culture is one of the most important and effective methods, which take special place in treatment and prophylaxis of backbone osteochondrosis. It is connected not only with ability to strengthen muscles and improve blood and lymph circulation but also with production of compensatory-adaptive mechanisms, oriented on recreation of physical balance in backbone. This effect of therapeutic physical culture permits to refer it to main methods of treatment of clinic symptoms of backbone osteochondrosis.

Table 1

List of procedures by motion regimes of sportsmen with osteochondrosis in period of medical rehabilitation

No/No	Description of procedure		Gentle regime	Gentle-training regime
1.	Physical therapy	Dia-dynamic therapy	1-5	5-10
		Darsonvalization	1-5	5-10
		Laser therapy	1-5	5-10
2.	Massage	Therapeutic massage	1-5	5-10
3.	Therapeutic physical culture	TG with CorDisk	1-5	5-10
		Prophylactor "Osan"	1-3	3-10

We have worked out the following schema of physical rehabilitation at polyclinic stage of treatment of sportsmen with backbone osteochondrosis in period of medical rehabilitation, which included the following procedures: physical therapy, therapeutic physical culture in the form of therapeutic gymnastic (TG) with application of balance disk and prophylactor "Osan" (see table 1).

Every procedure is rendered in sequence, which is presented in table 1. Exactly such sequence of procedure renders the best therapeutic effect on sportsman's organism. It is explained by the following:

1. Physical therapeutic procedures are oriented, mainly, on removal of pain and improvement of local micro-circulation of blood that removes swelling in motion segment of backbone, where inflammation and pain take place.
2. Therapeutic massage improves blood and lymph circulation, relax contracted muscles and removes pain.
3. Therapeutic gymnastic shall be trained only by previously prepared with earlier procedures organism; the main of these procedures were reduction of pain, improvement of blood circulation, elimination of swelling. Main task of TG is fixing of correct position of backbone, improvement of blood circulation, training of new motion stereotype and improvement of sportsman's general condition. Besides, practicing of TG with special equipment, such as balance disk, prophylactor "Osan" that facilitate unload backbone, renew backbone mobility and relax contracted muscles.

In polyclinic conditions of treatment it is rational to use gentle and gentle-training motion regimes for dozing of loads in TG. Therapeutic gymnastic, in first two motion regimes, ensures stretching and mobilization of backbone, as well as relaxation of contracted muscles. With selection of physical exercises we considered that they would facilitate not only improvement of blood and lymph circulation in backbone-motion segment but also reduce psycho-emotional tension of sick sportsmen.

Methodic peculiarities and recommendations for therapeutic physical culture's practicing in case of backbone osteochondrosis were the following. Gentle regime is prescribed in period of aggravation of disease. Its main specificity is combining of full rest and relaxation of muscles in zone of affected backbone segment with moderate tension of muscles and gentle movements of separate, often proximal segments of limbs and some torso muscles, which do not result in unpleasant sensations. In first three days main therapeutic factor is therapeutic gymnastic and orthopedic requirements, oriented on unloading of backbone. They are used as a mean, which weaken pain and negative vegetative vessels' symptoms. TG complex is recommended to be started from initial position "lying on back", then, on abdomen, then, gradually, come in kneel position "hands on floor" and "elbows on floor" and, finally, from standing initial position. Orthopedic procedures implied initial position "lying on back" with prophylactor "Osan" under back.

In gentle-training regime we prescribed exercises, oriented on relaxation of back muscles' contraction; besides, patients fulfill exercises for stretching and relaxation of backbone. Gradually, therapeutic gymnastic is completed with exercises for strengthening of back and abdomen muscles. Complex of therapeutic gymnastic was fulfilled on balance disk. Orthopedic position on prophylactor "Osan" shall be continued, but patients start to fulfill active movements of backbone in this position.

Conclusions:

1. It was determined that at polyclinic stage of treatment physical rehabilitation of sportsmen has similar features with rehabilitation of ordinary people. But the purpose of sportsmen's physical rehabilitation is the quickest possible return to sport trainings, improvement of physical skills, which are specific for different kinds of sports.
2. We have determined and improved algorithm of physical rehabilitation for sportsmen with backbone osteochondrosis at polyclinic stage of treatment with application of auxiliary equipment – balance disk and prophylactor "Osan".

The prospects of further researches in this direction imply testing of effectiveness of offered in this article algorithm of physical rehabilitation for sportsmen with backbone osteochondrosis in polyclinic conditions.

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THE STRUCTURE OF PHYSICAL FITNESS AND ITS CORRELATION ANALYSIS AT YOUNG PLAYERS AGED 16-17 YEARS AT THE STAGE OF BASIC TRAINING

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Annotation. *Purpose:* The questions about the importance of physical fitness of young players to improve the management and correction of the training process. *Material:* In the research participated 40 players aged 16-17 years of specialized youth football school of FC "Obolon-Brewery". Data for the study of physical fitness were teacher observations and teacher testing carried out under the direct training of young players. *Results:* It is shown that the structure of physical fitness among all the studied parameters there is a close correlation relationship, except for a parameter that characterizes the start speed. It was found that the above regularities indicate the advisability of excluding the studied parameters in the structure of physical fitness of young players to improve the efficiency of the training process at the base of specialized training. *Conclusions:* It is recommended to improve the starting speed to use non-gaming and technical and tactical exercises.

Keywords: young players, structure, physical fitness, control tests, correlation analysis.

Introduction

Modern football implies high level of players' fitness. Modern style of play means maximal possible speed, high reliability of technical-tactic actions with minimal mistakes.

Football player's physical fitness [2, 6, 14] is characterized by complex of quickness, speed-power qualities, endurance (general and special), relative strength, coordination.

In this connection, with sufficient stability of football players' technical sportsmanship, effectiveness of training's management is, to large extent, determined by coach's ability to monitor players' condition, to reach maximal individual indicators of physical and functional fitness of players of different roles and of team in the whole; to maintain this level during all competition period.

M.A. Godik [2] writes that in the process of many-years' training main forms of motion skills acquire specialized character.

Football is characterized by alternative competition conditions, high level of specific endurance. Distinctive feature of sport games, football in particular, is presence of great number of complex motion functions, which require high level of abilities to explosive forces, variable adaptation to changing conditions of competition struggle. Besides, football requires ability to resist tiredness without weakening of effectiveness of players' technical-tactic actions [3, 6, 7, 11].

That is why it is important, in this aspect, to understand the structure, i.e. combination of connections between components, type and form of inner organization of junior football players' physical fitness.

Some works [1, 8, 12, 13] regarded structure and dynamic of development of football players' motion qualities at different stages of sportsmanship's perfection.

Our researches showed that leading factor, which reflects level of junior football players' physical fitness, is aerobic component of endurance. The second by importance factors is anaerobic glycolitic component of endurance, the third – technical level's resistance to embarrassing factors [10, 15]. As per data of A.P. Zolotariov [4] sportsmanship of 14-17 years old football players to large extent depends on such factors as body mass and length, physical workability, speed-power qualities, quickness.

Besides, correlation analysis of indicators of physical fitness's different sides permits to determine the most informative indicator and it shall be considered with composing of programs for physical fitness's control. With it, age and specialization in game shall also be considered [13].

Thus, analysis of researches and publications shows that this problem has been being studied rather profoundly, however there is deficit of works, devoted to structure of junior, 16-17 years old, football players' physical fitness on the base of correlation analysis.

The work has been fulfilled in the frames of combined plan of scientific and research works in sphere of physical culture and sports for 2011-2015, of Ministry of education and science, youth and sports of Ukraine, by topic 2.3 "Scientific-methodic principles of perfection of sportsmen's training system in football, considering specificities of competition functioning", state registration number 0111U001722.

Purpose, tasks of the work, material and methods

The purpose of the research is to study the structure of physical fitness and determine interconnection of 16-17 years old junior sportsmen's indicators at the stage of specialized basic training.

The tasks of the research:

- on the base of analysis of scientific-methodic literature to study up-to-date situation of problem of football players' physical fitness's structure;

- with the help of correlation analysis to determine interconnection of indicators of junior football players' physical fitness and its structural features.

The methods of the research: analytical analysis of scientific-methodic literature, pedagogic observations, pedagogic testing, methods of mathematical statistics.

For evaluation of physical qualities we applied measuring system «Optijamp Next» (Micro-gate SRL-Italy), consisting of timer Racetime 2 Kit Light Radio and photocells Politemo Ligt Radio.

Organization of the research: pedagogic testing of physical fitness was conducted at SCJSOR (Sport children-junior school of Olympic reserve) "Obolon", Kiev, in 2012-2013. In the research 20 junior football players of 16-17 years old age took part. All they were participants of Ukrainian championship for children- junior football league teams. The received results were processed with the help of correlation analysis.

Results of the research and their discussion

Analysis of data of teams' physical condition plays important role in junior football players' physical fitness and successfulness of their participations in competitions.

Correlation analysis of main sides of junior football players' physical fitness is given in table 1.

Table 1

Correlation matrix of interconnections of indicators of junior football players' (16-17 years old age) physical fitness (n=40)

No.	Indicators	1	2	3	4	5	6	7	8	9	10
1	Length of body, cm	1									
2	Mass of body, kg	0.81	1								
3	PWC ₁₇₀ kgm/min, kg	-0.36	-0.37	1							
4	MCO, ml/min.kg	-0.48	-0.53	0.98	1						
5	15 meters' run from the spot, sec.	0.09	0.11	-0.06	-0.08	1					
6	15 meters' run from walking, sec.	0.13	0.16	-0.15	-0.17	0.61	1				
7	30 meters' run, sec.	0.03	0.02	-0.15	-0.14	0.60	0.69	1			
8	Shuttle run 7×50 m, sec.	0.33	0.29	-0.31	-0.34	0.38	0.55	0.38	1		
9	12-minutes' run, meters	-0.20	-0.17	0.53	0.52	-0.10	-0.28	-0.12	-0.47	1	
10	Vertical jumping, cm.	0.40	0.37	-0.13	-0.19	-0.14	-0.35	-0.45	0.02	-0.01	1

Notes: MCO – maximal consumption of oxygen; confident interconnections are marked in bold type (P<0.05).

As we see in table 1 analysis of correlation between physical fitness's indicators permits to determine that from 45 cases of correlation dependences there are 13 weak, 7 moderate and 2 with high dependence.

It should be noted that weak static correlation exists between anthropometric indicators (body length and mass) and tests, reflecting general physical workability (PWC₁₇₀) and aerobic efficiency – $r=-0.36$; $r=-0.48$ and indicators of tests "Shuttle run 7×50 m" and "Vertical jumping" – $r=0.33$; $r=0.40$. Indicators "Shuttle run 7×50 m" has weak interconnection with tests PWC₁₇₀, MCO and quickness (15 meters' run from the spot and 30 meters' run) accordingly: $r=-0.31$; $r=-0.34$; $r=0.38$; $r=0.38$. In test "12 minutes' run" also we can see weak correlation interconnection with indicators of "Shuttle run 7×50 m" $r=-0.47$. Indicator of "Vertical jumping" have weak correlation interconnections with physical condition's indicators, "15 meters' run from walking" and "30 meters' run" accordingly: $r=0.40$; $r=0.37$; $r=-0.35$; $r=-0.45$.

Mean statistic correlation interconnection exists between the following indicators: MCO and body weight $r=-0.53$, quickness "15 meter' run from the spot" and "15 meters' run from walking" and "30 meters' run", accordingly: $r=0.61$; $r=0.69$; special endurance "Shuttle run 7×50 m" and "15 meters' run from walking" – $r=0.55$; general endurance "12 minutes run" and PWC₁₇₀, MCO – $r=0.53$ и $r=0.52$.

Indicators of physical condition and general physical workability as well as aerobic efficiency have high level of connection in structure of physical fitness: $r=0.81$ и $r=0.98$.

Thus, the conducted correlation analysis of junior 16-17 years old football players' physical fitness resulted in determination, mainly, of moderate and low levels of interconnection that implies sufficiently close interconnection of physical fitness's level nearly by all indicators except indicator, which characterizes start speed.

It permits to consider that distribution of motion qualities in structure of junior football players' physical fitness at this stage was even. It permits to purposefully increase level of start speed with the help of special and technical-tactic exercises.

Conclusions:

1. Studying of physical fitness's structure and its correlation analysis (of junior football players) at stage of specialized basic training showed presence of rather clear structural features, which greatly influence on football players' physical fitness.

2. Management of training process at present stage of football's development can not be effective without objective data about junior football players' physical fitness, which would permit to individualize and correct their readiness to training and competition functioning.

The prospects of further researches imply study of above mentioned indicators of junior football players, depending on their role in team.

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DYNAMICS OF COMPREHENSIVE PHYSICAL FITNESS IN ARTISTIC GYMNASTS AGED 7-10 YEARSBoraczyńska S.¹, Boraczyński Tomasz¹, Boraczyński Michał¹, Michels Anna²Jozef Rusiecki Olsztyn University College, Poland¹M.G. Bublewicz No. 5 Sports Champion School, Olsztyn, Poland²

Annotation. *Purpose:* The aim of the study was to evaluate the somatic development and comprehensive physical fitness of artistic gymnasts aged 7-10 years. *Materials and methods:* Gymnasts (n = 307), split up into four age groups performed eight Eurofit tests. The results were evaluated in points according to the development standards prepared in scale T for the Polish girls population. *Results:* The gymnasts obtained the highest growth rate in balance test - FLB (13 points), arm and shoulder muscular endurance test - BAH (7 points) and speed of the upper limb movement test - PLT (4 points) out of eight physical fitness tests. *Conclusions:* High and very high level of performance in the six Eurofit tests and increased total number of points in the subsequent age groups of artistic gymnasts proved high effectiveness of training in shaping the key components of a comprehensive physical fitness in artistic gymnastics - balance, strength, endurance, speed and flexibility. Relatively little progress in isometric hand strength (HGR) and standing broad jump (SBJ) suggests a significant influence of genetic factors on the level of these abilities. The results provide an objective information useful in optimizing control system of training effects in comprehensive physical fitness and optimization of artistic gymnasts training at the comprehensive stage of sports training.

Key words: artistic gymnastics, training, control, women, physical fitness, Eurofit.

Introduction

Specialists dealing with the issues of training in gymnastics emphasize that sports results at different levels require athletes comprehensive fitness preparation [10, 12, 13, 15, 19, 22].

On the basis of the above information, it is logical to adopt the claim that improvement of the management process of training in artistic gymnastics should be based on the reliable control methods of training [10]. Despite the undubitable achievements in this field, the problem of objective control of the training process, especially the control of the effects of artistic gymnastics training, has not been finally resolved. Currently, there are no quantitative criteria for the somatic and physical fitness development of artistic gymnasts.

There is no current normative data for the long-term somatic and physical fitness development of girls practicing artistic gymnastics in the scientific literature. For this reason the study was undertaken which aim was to assess the somatic development and components of comprehensive physical fitness in artistic gymnasts aged 7-10 years.

An important premise of the proposed course of the study are the demands put forward by many specialists in the theory and practice of sport who have repeatedly highlighted the merits of continuous research in the course of sports training. This should enable to determine the growth rate of certain somatic traits and the development of various motor abilities and, consequently, to assess the impact of these abilities on development of sport's level in artistic gymnasts [2, 3, 10, 12, 18, 19].

It was assumed that the obtained results will provide useful information to optimize the selection and training control systems in women's artistic gymnastics at the stage of comprehensive and targeted training, in accordance with the basic requirements of control of training process. It was also assumed that the results of the study will enable an objective verification of the effects of sports training of tested artistic gymnasts in comprehensive physical fitness.

Material and methods

The tested group comprised of 307 girls aged 7-10 years, attending the sport classes at the No. 23 Primary School of Sports Championship in Olsztyn, Poland. Girls execute gymnastics training program compliant with the Polish Gymnastics Association. The selection of girls to I grade was based on the results of anthropometric measurements and a set of performance tests. Training experience of tested girls ranged from 1 to 4 years.

Tested gymnasts were split up into four groups (age categories) according to obtained chronological age (Table 1).

Tested artistic gymnasts represented the high sport's level, which each year has been confirmed by numerous medals in the Polish Championships.

All measurements were performed in the Jozef Rusiecki Olsztyn University College. The study was pursued in accordance with the Helsinki Charter of Human Rights and was approved by the local Ethics Committee. The study was based on results of studies pursued in 2007-2013, twice each year in April and October.

In tested gymnasts anthropometric measurements and body composition were determined.

Participants' body height was measured with a calibrated WB-150 medical weight/stadiometer (ZPU Tryb-Wag, Poland) accurate to within 0.1 cm. Body mass (accurate to within 0.1 kg) and body fat content (accurate 0.1%) were measured by BC 418 MA electronic body composition analyzer (Tanita, Japan) with the use of a bioelectric impedance analysis (BIA). Moreover, the skinfolds measurements were made in two locations to assess the body fat (triceps arm muscle, lower blade-bone angle) in accordance with standard procedure [16]. Measurements were made by

GPM caliper [SiberHegner & Co. Ltd., Switzerland]. Participants were dressed only in underwear and were barefoot during measurements. All anthropometric measurements were made by the same certified investigator and by international standard procedures.

Physical fitness was determined by the following eight tests included in the Eurofit physical fitness battery [5]:

1. Static Balance (FLB – Flamingo Balance). Balancing for one minute on one leg on a beam of set dimensions. Gymnasts performed this test standing on a wooden beam without shoes, which is a derogation from the standard procedure.
2. Speed of limb movement (PLT – Plate Tapping).
3. Flexibility. Reaching forward as far as possible from a seated position (SAR – Sit-and-Reach).
4. Explosive strength (SBJ – Standing Broad Jump).
5. The isometric hand strength (HGR – Hand Grip). The isometric hand strength was measured in static conditions with the use of the hand dynamometer DR4-P integrated with tensometric amplifier WTP3 and a computer program MAX_v_5.5 (JBA-Zbigniew Staniak, Poland).
6. Abdominal muscular strength and endurance (SUP – Sit-ups).
7. Arm and shoulder muscular endurance (BAH – Bent Arm Hang).
8. Running Speed - Agility. Shuttle run 10 x 5 m (SHR – Shuttle Run)

An assessment of cardio-respiratory endurance was not performed due to the research task. The reliability of performance tests was verified on a selected group of 46 girls at the age of 14. The obtained values of reliability coefficients (r_{it}) in the individual tests were above 0.86.

For all variables basic statistical parameters were calculated: arithmetic means (M), standard deviations (SD), coefficients of variation (CV), the minimum values (Min), the maximum values (Max) and the differences of results expressed as a percentage in relation to the youngest group of gymnasts (7 years). In order to estimate the effect of independent variables on the dependent variables the values of coefficients of determination (R^2) were calculated. Statistical analysis was executed by STATISTICA 7.1 software package (Stat Soft, Inc., USA).

Results

Table 1 shows the basic anthropometric characteristics of four tested groups of gymnasts. The somatic development was evaluated by current point tables (in scale T) of Polish girls population [7]. Gymnasts obtained the smaller number of points with respect to the body mass (BM) and body height (BH) in subsequent age groups. Number of points in BH decreased much faster in relation to the number of points in BM, which resulted in the increasing scores of body mass index (BMI) and lower scores of slenderness index (SI).

Table 2 shows the participants' results in the eight Eurofit tests. The results obtained in the individual tests are characterized by a great diversity, as evidenced by the value of the coefficient of variation (CV). The greatest variability was characterized by arm and shoulder muscular endurance test (BAH) - from 39.71 to 71.89% and static balance (FLB) - from 39.80 to 64.36%. The lowest variability was characterized by agility test (SHR) - from 6.60 to 8.97% and explosive strength test (SBJ) - from 9.21 to 10.78%.

Table 3 shows the percentage differences between the results of further groups of gymnasts in relation to the performance of the youngest group (gr. I). The largest differences were noted in the arm and shoulder muscular endurance test (BAH) - 204.75% and absolute isometric hand strength test (HGR) - 51.73%. Simultaneously in the same tests in which the slightest variation of results was observed within individual groups of gymnasts, the smallest differences between groups were showed in agility test (SHR) - 6.24% and explosive strength test (SBJ) - 25.22%.

The values of the coefficients of determination (R^2) of the results obtained by tested gymnasts in the individual tests according to age varied widely from 0.1465 in the relative isometric hand strength - HGR (N / kg) to 0.4677 in absolute isometric hand strength - HGR (N). Very varied results of the individual tests obtained groups of gymnasts in relation to the standards of the Polish girls population (Table 4). As expected, the tested gymnasts presented higher level of physical fitness compared to the untrained girls. The greatest differences were found in the arm and shoulder muscular endurance test (BAH), and a very high rating in the youngest group - gr. I (71 points) systematically increased in subsequent age groups, reaching 78 points in the oldest group - gr. IV. Gymnasts obtained very high point scores in the abdominal muscular strength and endurance test (SUP) - from 68 to 70 points and in the flexibility test (SAR) - from 64 to 66 points. Very dynamic improvement of the results in static balance test (FLB) draws attention. It should be emphasized that gymnasts performed test without shoes, which constituted a significant impediment. The purpose of this procedure was to avoid a situation in which most of the athletes perform the test faultlessly. Due to the non-standard procedure for performing this test the scores presented in Table 4 were inserted in brackets.

By the standards of the Polish population girls, examined gymnasts achieved the average level of absolute isometric hand strength - HGR (51-53 points). However, it should be noted that all of the tested groups of gymnasts were characterized by low body mass and thus low skeletal muscle mass. Allowedly, muscle strength correlates with their mass and therefore should also be included level and increase of the relative hand strength - HGR/kg in the assessment of the tested gymnasts' strength. The level of relative hand strength was higher by only 17.55% in the oldest group of gymnasts (group IV) in comparison with the youngest group (group I) (Table 3).

Table 1.

Basic anthropometric characteristics of artistic gymnasts aged 7-10.

Group	SP	Age (yrs)	BM (kg)	Pts.	BH (cm)	Pts.	BMI (kg/m ²)	Pts.	SI (cm/kg)	Pts.
I n = 94	M±SD	7.43±0.30	23.48±2.61	46	128.29±11.70	55	14.27±1.26	41	50.52±6.91	91
	Min-Max	7.00-7.90	17.30-39.80		112.3-158.5		13.32-19.31		35.37-64.74	
	CV (%)	4.05	11.12		9.12		8.83		13.68	
II n = 85	M±SD	8.45±0.29	26.10±3.75	46	130.54±8.74	49	15.32±1.37	45	48.82±6.08	80
	Min-Max	7.96-8.93	19.40-42.70		111.2-155.7		13.16-19.11		34.14-60.19	
	CV (%)	3.40	14.37		6.70		8.94		12.45	
III n = 71	M±SD	9.44±0.28	28.72±4.39	45	132.64±7.63	43	16.32±1.36	47	47.28±5.54	70
	Min-Max	8.99-9.91	18.70-46.40		112.2-135.3		13.70-19.82		32.97-59.89	
	CV (%)	3.0	15.29		5.75		8.42		11.72	
IV n = 57	M±SD	10.44±0.29	30.45±5.27	42	135.43±11.34	39	16.60±2.52	47	45.29±8.25	59
	Min-Max	10.00-10.93	19.80-51.10		116.2-161.1		13.12-23.48		28.55-60.24	
	CV (%)	2.78	17.30		8.37		15.18		18.21	

Explanations: SP – statistical parameters; CA – chronological age; BM – body mass; BH – body height; BMI – body mass index; SI – slenderness index; Pts. – point evaluation of variable based on the standards of somatic development of Polish girls population [7].

Table 2

The results of eight physical fitness Eurofit tests of artistic gymnasts aged 7-10.

Group	SP	FLB (n/60 s)	PLT (s)	SAR (cm)	SBJ (cm)	HGR (N)	HGR/kg (N/kg)	SUP (n/30 s)	BAH (s)	SHR (s)
I	M±SD	15.65±6.23	17.87±2.51	11.82±4.56	122.84±13.24	110.93±20.34	4.73±0.69	22.61±3.83	22.12±15.90	24.52±2.15
	Min-Max	5.-31	13.02-26.00	0.-21	98-166	71.0-178.0	2.81-6.24	14-29	1.80-73.00	20.59-29.90
	CV (%)	39.80	14.05	38.61	10.78	18.33	14.59	16.95	71.89	8.75
II	M±SD	11.17±8.82	15.82±2.08	13.11±3.47	131.89±13.67	132.04±22.69	5.06±0.67	25.64±3.57	30.71±16.64	23.62±1.80
	Min-Max	2.-31	11.55-21.00	5.-19	85-158	92.0-225.0	3.71-7.31	17-33	4.25-82.62	19.49-29.78
	CV (%)	52.10	13.14	26.48	10.36	17.19	13.32	13.90	54.18	7.63
III	M±SD	6.33±3.54	14.41±1.61	14.38±2.35	143.01±13.17	148.64±26.19	5.19±0.79	27.84±3.11	36.45±18.65	23.38±1.54
	Min-Max	1.-14	11.30-18.44	10.-19	117-175	100.0-225.0	3.81-7.49	20-34	8.81-89.11	20.22-27.22
	CV (%)	55.93	11.14	16.36	9.21	17.62	15.16	11.17	51.16	6.60
IV	M±SD	4.69±3.02	12.91±1.28	15.12±3.76	153.82±15.90	168.31±25.04	5.56±0.81	29.25±3.24	45.29±17.98	22.99±2.06
	Min-Max	0.-11	10.90-16.78	7.-25	112-183	124.0-230.0	4.23-7.67	20-36	18.24-106.64	19.27-28.87
	CV (%)	64.36	9.92	24.88	10.34	14.88	14.56	11.06	39.71	8.97

Explanations: FLB – Flamingo Balance, PLT – Plate Tapping, SAR – Sit-and-Reach, SBJ – Standing Broad Jump, HGR – Hand Grip, SUP – Sit-ups, BAH – Bent Arm Hang, SHR – Shuttle Run 10 x 5 m.

Table 3

Percentage differences of the results of eight physical fitness Eurofit tests in consecutive groups of artistic gymnasts at the age of 8-10 in relation to the results of gymnasts at the age of 7.

Group	FLB	PLT	SAR	SBJ	HGR	HGR/kg	SUP	BAH	SHR
I	100	100	100	100	100	100	100	100	100
II	71.37	88.53	109.8	107.37	118.90	106.98	113.40	138.83	96.33
III	40.45	80.64	120.44	116.42	134.26	109.94	123.13	164.78	95.35
IV	29.97	72.24	126.63	125.22	151.73	117.55	129.37	204.75	93.76

Table 4

Rating points (in scale T) of results of eight physical fitness Eurofit tests of artistic gymnasts aged 7-10 based on Polish girls population norms [8].

Group	FLB	PLT	SAR	SBJ	HGR	SUP	BAH	SHR	Points (Σ)
I	(38)	57	64	61	52	68	71	56	467
II	(42)	59	65	61	53	70	76	56	482
III	(50)	59	66	61	53	70	76	53	488
IV	(51)	61	66	61	51	68	78	52	488

Discussion

One of the fundamental objectives of gymnastics training at the initial stage of training is a comprehensive and harmonious development of physical fitness including the development of motor abilities (strength, speed, endurance, agility, flexibility, coordination and others). Simultaneously the importance of somatic built in gymnastics is emphasized [6, 10, 12, 15]. Di Cagno et al. [6] pointed out the relationship between somatic built and physical fitness of gymnasts and pointed to the need for diagnosis of somatic built indicators to identify fitness predispositions of children at the selection stage to gymnastics. Different conclusions arise from the Fjørtoft et al. [9] work which was aimed to assess the physical fitness of children aged 5-7, assessed by the Eurofit tests battery. This research shows that the basic somatic features – body height and body mass - did not have a significant impact on the results of the individual physical fitness tests. On the other hand, a strong correlation was found between the results of the individual tests and the age of the children.

In our research evaluation in points of body height and body mass of gymnasts decreased with age, which among other things was associated with a decreasing number of tested gymnasts in the subsequent years of the study. The decreasing number of gymnasts was mainly due to the resignation from artistic gymnastics and to a lesser extent from injury that prevented from taking part in the research. Lower body height makes it easier to perform technically difficult evolutions in artistic gymnastics. Therefore tendency for the relative (relative to development standards) decrease in body size, found in our study, should be considered as a positive effect of natural selection. In the recent study Camargo et al. [4] analysed the physical growth and body composition of 136 Brazilian rhythmic gymnastics athletes relative to their level of somatic maturation. The z scores for mass were negative during all ages according to both WHO and Brazilian references, and for body height were also negative for all ages according to WHO reference but only until 12 years old according to Brazilian reference. The conclusion was these athletes had a potential to gain mass and body height several years after peak height velocity, which indicated late maturation. Thereupon, one should keep in mind the significant impact of biological development pace both on the physique dimensions, as well as physical fitness. This implies the need for a practical application of the biological age determination in girls at selection stage in gymnastics. This will enable the identification of girls with the most beneficial features of the somatic built and facilitate an objective assessment of physical fitness in terms of predictive value.

Specialists dealing with the issues surrounding gymnastics training emphasize that sports results at the highest level require comprehensive physical and mental preparation [2, 10, 13, 15]. Zaporozhanov et al. [21] recommend complex of five the most informative indicators for evaluation of gymnasts' special fitness, which meet specific requirements of artistic gymnastics and metrological requirements of reliability and informative character. They include indicator of relative force in elbow joints; stability in Romberg test after rotating around longitudinal axis of the body; anticipation response to moving object; sum of ranges of the tested in this complex. Kochanowicz [10] proposed a complex set of indicators to assess motor preparation at the initial stage of training in gymnasts aged 6-7. These included an evaluation of balance function, agility and special technical skills. The basis for selecting these indicators were results of author's earlier studies on the physical fitness of gymnasts [11, 13].

The results of numerous works have shown that physical fitness is improving with age during childhood and adolescence, but the pattern of improvement is not identical for all motor tasks. Moreover, a very large variability of the dynamics of results in individual tests of physical fitness was shown in our study. Very large differences between tested groups, identified in the static balance test (FLB) were undoubtedly the result of numerous physical exercises aimed at the development of this ability.

Balance exercises are an important factor in stimulating the development of vestibular function and proprioceptive sensation, which in total resulted in a rapid improvement of the balance system functions. In addition, through a number of studies it was revealed that as the number of years of training increase, the ability to control balance is affected positively [1, 11, 17]. For instance, Akin [1] found the significant effect ($P=0.000$) of 12-week gymnastics training on static balance and slalom dynamic balance in 4-6 years of age pre-school students, while there was no significant change observed in their age-matched controls.

The evaluation of the results obtained by the tested gymnasts from the youngest group (gr. I) on the basis of development standards for the Polish girls population [8] showed high and very high levels of performance in the six Eurofit tests at the beginning of training program what confirms the accurate selection of the girls to the artistic gymnastics. At the same time, gymnasts from the oldest group (group IV) also obtained high and very high level of performance in the six Eurofit tests. Furthermore, the evaluations expressed in points increased with age in the four tests, and the total number of points increased in subsequent age groups. This demonstrates the high efficiency of training in key components of physical fitness in artistic gymnastics - strength endurance, balance, speed, and flexibility. An unexpected result of the study was an average level of agility (SHR) in each group of gymnasts. Agility is regarded by experts as one of the leading motor abilities in artistic gymnastics [10, 15].

According to Malina et al. [14] the results of the standing broad jump, shuttle run and the bent arm hang increases linearly with age in both sexes up to the age of adolescence. Considering few hours training daily of tested gymnasts, involving exercises aimed at development of agility, the reasons for lack of substantial progress in the shuttle run is unclear. This points to the need for in-depth analysis of the training process with particular attention to methods, measures and the size of the training loads in terms of improving the effectiveness of training in the field of comprehensive agility. Also the study conducted by Boraczyński et al. [3] showed no statistically significant progress in terms of agility of 7-year-old girls after completing a 12-month artistic gymnastics training program.

The above results of selected studies prove high importance of diagnosis of physical fitness in artistic gymnastics at the selection stage, as well as in later stages of sports development. At the same time, experts highlight that some of the psycho-physical properties only slightly subject to the shaping in the process of longtime sports training [12, 15, 20]. For this reason, it is logical to seek candidates with high predispositions in the field of relevant in gymnastics motor skills and abilities at the selection stage to artistic gymnastics.

Zaporozhanov et al. [18] on the basis of the results of Eurofit tests in artistic gymnasts at the age of 7.7 and 9.3 distinguished four tests (indicators) with the highest predictive value - the speed of upper limb movement (PLT), standing broad jump (SBJ), agility (SHR) and the relative isometric hand strength (HGR). The results of these tests in the least extent differentiated tested groups, reflecting the high genetic conditions of abilities that determine the results of highlighted tests. In other studies, carried out on two groups of artistic gymnasts at the age of 6.9 and 10.0 the same tests as the most useful in assessing fitness predispositions in artistic gymnastics were indicated [2].

In the light of the results presented in this work, the Eurofit battery of tests allows to obtain reliable data useful in the evaluation of a comprehensive physical fitness and effectiveness in artistic gymnastics training at the initial stage of sports training.

Conclusions

Relative (in relation to development standards) decrease with age body height and body mass in tested gymnasts indicates the validity of the determination of biological age of girls at the selection stage in artistic gymnastics. This will enable the identification of girls with the most beneficial features and proportions of somatic built and facilitate the objective assessment of physical fitness in terms of predicting value.

High and very high level of performance in six Eurofit tests obtained by girls in the first year of training (gr. I) proves an accurate selection of these girls to artistic gymnastics.

High and very high level of performance in six Eurofit tests and increasing total number of points in the subsequent age groups of artistic gymnasts proved highly effective workouts in shaping the key components of a comprehensive physical fitness in artistic gymnastics - balance, strength endurance, speed and flexibility.

Relatively little progress in terms of isometric hand strength (HGR) and standing broad jump (SBJ) suggests a significant influence of genetic factors on the level of these abilities.

Reasons for the average level of agility (SHR) in tested groups of artistic gymnasts are unclear. This points the need to verify the gymnasts training program under the terms of greater training efficiency of shaping this ability.

The results provide an objective information useful in optimizing control system of training effects in terms of comprehensive physical fitness and optimization of artistic gymnasts training at the comprehensive stage of sports training.

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THE PHYSICAL AND MOTOR DEVELOPMENT OF 9-YEAR-OLD CHILDREN ATTENDING FOOTBALL CLASSES IN "FOOTBALL SCHOOL FOR CHILDREN"

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Annotation. *Purpose:* The purpose of the study was to determine the physical development and physical fitness of the boys at the age of 9 years old attending football classes. *Material:* The study covered 12 boys at 9 years old attending football classes in "Football school for children" in Jabłonowo Pomorskie. The assessment of the physical development was conducted by examining height and body weight and, on this basis, the somatic built indicator was calculated according to Rohrer index. To evaluate physical fitness, the Physical Fitness Index by Zuchor was used. *Results:* The studied exceed with height and weight their peers from the Kujawsko-Pomorskie Voivodeship. The level of physical fitness of the studied boys aged 9 years old did not show much diversity. *Conclusions:* The results improvement was not observed in most physical fitness tests.

Keywords: physical, development, fitness, football, children.

Introduction

The vast majority of the researchers accept physical fitness as the major feature of physical health [1, 2].

Technical progress and related automation and mechanization processes contribute to the partial elimination of muscle. This affects the increase in risk by reducing the overall physical fitness.

In order to counteract the factors it is necessary to responsibly promote the benefits of motor activity, as well as encourage (especially children and young people) to participate actively in selected outdoor sport. The basics of physical culture are involved during the physical education classes in elementary school, where the fundamental task is to develop and raise the level of physical fitness. In order to verify the effects of a teacher of physical education classes, tests on the development of physical fitness of children and adolescents are used.

The purpose of the study was to determine the physical development and physical fitness of the boys at the age of 9 years old attending football classes.

Materials and methods.

The study covered 12 boys at 9 years old attending football classes in "Football school for children" in Jabłonowo Pomorskie. Sport classes took place twice a week and lasted 60 min. In school the studied performed a program of physical education in terms of 3 classes a week with a focus on the evolution of overall physical fitness. Prior to the study all children were considered to be healthy by a school nurse.

Assessment of the physical development was conducted by examining height and body weight and, on this basis, the somatic built indicator was calculated according to Rohrer, index specified by the ratio of weight to height. The classification of this indicator indicates the degree of slenderness [4].

$$Mb \times 100/P^3$$

Mb - body weight, gram;

P – height, centimeter.

Using the typologies of Kretschmer according to the scale given by E. Curtis it was assumed that the individuals have a building depending on the indicator:

± - 1.28 representing the leposomatic type;

-1.29 -1.48 representing the athletic type;

- 1.49 - ± representing the pycnic type.

The height of the body was measured with antropometer, and body weight was measured with medical scale.

To evaluate physical fitness, 5 samples of the Physical Fitness Index by Zuchor were used.

- speed test (quick run for 10 seconds with high lifting of knees and clapping under raised leg (number of claps),

- jumping test (long jump from the place - the distance is measured by the jumper with his/her own feet. The result will be rounded: less than half a foot down, more - up),

- arms strength test (overhang with straight arms, overhang on one hand),

- flexibility test (slope in front),

- abdominal muscles strength test (lifting legs just above the floor and making "cross scissors", as long as it is possible.

Prior to starting the tests, the children were informed in detail about doing the exercises, and immediately prior to doing it, the coach did 15-minute warm-up.

The measurement of physical development was carried out once (in December 2012). The first physical fitness test was carried out in December 2012, and the second in March 2013.

In order to balance the results of the tests, the basic statistical methods were used.

The carried out analysis of the results showed that the greatest height, and body weight has K.K. (respectively 149 cm, 49.8 kg). The lowest belongs to M.G. (134 cm), while weight of K.P. (29.2 kg). (tab. 1) The largest slenderness belongs to Ł.G. (1.17), and the lowest to K.N. (1,58) (tab. 1). The analysis showed that the leptosomatic type belongs to three, the athletic type - five, while the pycnic type - four boys.

Table 1

The results of physical development of boys at the age of 9 years old.

No.	Studied parameters	Studied pupils											
		D.M.	K.N.	M.W.	M.G.	K.K.	Ł.G.	K.P.	N.L.	P.N.	K.M.	M.B.	S.M.
1.	Height of the body (cm)	139	138	145	134	149	145	135	142	138	141	137	140
2.	Body weight (kg)	39.9	41.7	44.3	29.9	49.8	35.9	29.2	41.5	35.9	39.2	39.4	38.9
3.	Rohrer index.	1.49	1.58	1.45	1.24	1.5	1.17	1.19	1.44	1.35	1.39	1.53	1.41

On the basis of table 2 it can be seen that the average height and weight and Rohrer index amounted to respectively 140,25 kg, 38.6 kg and 1,39.

Table 2

Numeric characteristics of height and weight, the result of somatic bult according to Rohrer index.

No.	Studied statistical	Volumes parameters	the studied 9 years old (n-12)
1.	Height of the body (cm)	M	140.25
		Min	134
		Max	149
2.	Body weight (kg)	M	38.6
		Min	29.2
		Max	49.8
3.	Rohrer index.	M	1.39
		Min	1.17
		Max	1.58

The basis for movement abilities in sport is the proper fit of the beneficial somatic features and functional movement apparatus, as well as other systems and mental features [6].

The results of the first stage of the study (December 2012) showed that in the first sample the best result was obtained by N.L. (33 claps), and the weakest result was obtained by S.M. (27 claps) (tab. 3). The next test of long jump - the best results was obtained by M.W. (8 feet), and the weakest was obtained by M.B. (5 feet). In the third test the best result was obtained by M.G., K.K., K.P., keeping up hanging with one hand for 10 seconds, while the others overhang for 10 seconds, but with both straight hands. In the next test the best exercising student touched the ground with all fingers of both hands (Ł.G.); the weakest result was obtained by five boys - touching the toes with the fingers of both hands. In the last test - abdominal muscles strength, "cross scissors" was done for the longest period of time by N. L. (for 43 seconds), and the shortest time was taken by P.N. (2 seconds).

Table 3

Physical fitness index by K. Zuchora – studies of December 2012.

No	Samples	the studied											
		D.M	K.N	M.W	M.G	K.K	Ł.G	K.P	N.L	P.N	K.M	M.B	S.M
1.	Speed (number of claps)	30	31	33	29	28	32	29	33	30	31	30	27
2.	Jumping (number of feet)	6	6	8	6	6	7	6	6	7	7	5	6
3.	Strength of straight arms	10	10	10	10	10	10	10	10	10	10	10	10

	hands (s)												
	Overhang on one hand (s)				10	10		10					
4.	Flexibility (slope in front)	2	3	3	2	3	4	2	3	2	2	3	3
5.	Abdominal muscle strength (s)	28	23	13	15	20	12	13	43	9	24	28	15

The results of the second stage of the study (March 2013) showed that in the first sample the best result was obtained by N.L., M.W. (34), and the weakest result was obtained by K.K. (28 claps) (tab. 4). The next sample of long jump - the best results was obtained by M.W. (8 feet), and the weakest was obtained by D.M. (5 feet). In the third test the best result was obtained by M.G., K.K., Ł.G., K.P., keeping up hanging with one hand for 10 seconds, while the others overhang for 10 seconds, but with both straight hands. The greatest flexibility was demonstrated by Ł.G. in the following sample (touched the ground with all fingers of both hands), the weakest (touching toes with fingers) - D.M. and K.M. In the test - abdominal muscles strength, "cross scissors" was done for the longest period of time by N. L. (for 44 seconds), and the shortest time was taken by P.N. (11 seconds).

Table 4

Physical fitness index by K. Zuchora – studies of March 2013.

No	Samples	the studied											
		D.M	K.N	M.W	M.G	K.K	Ł.G	K.P	N.L	P.N	K.M	M.B	S.M
1.	Speed (number of claps)	31	31	34	30	28	31	29	34	30	31	31	29
2.	Jumping (number of feet)	5	6	8	6	7	7	6	6	7	7	6	6
3.	Strength of straight arms hands (s)	10	10	10	10	10	10	10	10	10	10	10	10
	Overhang on one hand (s)				10	10	10	10					
4.	Flexibility (slope in front)	2	3	3	3	3	4	3	3	3	2	3	3
5.	Abdominal muscle strength (s)	27	24	14	16	19	13	14	44	11	24	27	17

The assessment of physical fitness involved the standards, which were used for the study that uses the five physical fitness test (tab. 5) differ from those that belong in the course of carrying out six tests of physical fitness by K. Zuchora.

Table 5

Assessment of physical fitness in points

Age of the studied	Assessment of physical fitness (points)					
	Minimum	Sufficient	Good	Very good	High	Outstanding
9-10 years	5	9	12	15	18	21

By comparing the test results of both stages, it must be said that young footballers improved their results in the part of the carried out tests (tab. 6), for example in speed test S.M. improved by 6.9%, but there are also boys, who deteriorated their effects, e.g. in the long jump from the place, 16.3%, there are also those, who did not improve. In the first stage of the study the greatest number of points was obtained by two boys (13 points), M.W. and Ł.G. (level - good). While at least five exercisers (10 points - sufficient level). In the second stage of the study (March, 2013), the best result was obtained by Ł.G. (14 points - good level), and the least, reaching the average level, D.M. (9 points).

Table 6

Quantitative and qualitative assessment of physical fitness – the study of March 2013.

No.	Samples	the studied											
		D.M.	K.N.	M.W.	M.G.	K.K	Ł.G	K.P.	N.L	P.N	K.M.	M.B.	S.M.
1.	Speed (point)	4	4	4	4	3	4	3	4	4	4	4	3

2.	Jumping (point)	1	2	4	2	3	3	2	2	3	3	2	2
3.	Strength of straight (point)	1	1	1	2	2	2	2	1	1	1	1	1
4.	Flexibility (point)	2	3	3	3	3	4	3	3	3	2	3	3
5.	Abdominal muscle strength	1	1	1	1	1	1	1	2	1	1	1	1
The number of obtained points		9	11	13	12	12	14	11	12	12	11	11	10
Assessment of fitness		satisf a ctory	satisf a ctory	good	goo d	goo d	goo d	satisf a ctory	goo d	goo d	satisf a ctory	satisf a ctory	satisf a ctory

Discussion

The topic related to the dynamics of development of the somatic characteristics and physical fitness was taken by many researchers [7, 8, 9, and 10].

Measurement of motor characteristics in the sense of a stand alone is impractical because each motor activity is a component of many mutually conditional physiological functions of the body [11, 13, 14, 15]. Accurate and reliable tests are necessary in the course of the conscious management of physical development of children and adolescents, because it makes it easier to control the methods and means of action.

By comparing the results of physical development test of the group of 9-year-old children with the studies of M. Napierała (2008), it can be noted that the studies footballers exceed their peers from the Kujawsko-Pomorskie Voivodeship in height and weight (Napierała 2008 respectively 137,45 cm and 33,21 kg).

The studied children improved their results in the majority of tests; however, the deterioration of the results was seen as well. The test to measure the arms strength was the most difficult. Only 3 boys in the first stage of the study overhang with one hand for 10 seconds, and in March the test was completed correctly by 4 exercisers.

Conclusions

- The level of physical fitness of the studied boys aged 9 years old did not show much diversity.
- Most of the tests of physical fitness did not observe the results improvement.
- There are cases of deterioration of test results, however, more young players improved.

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THE STRATEGICAL FRAMEWORKS OF THE PHYSICAL REHABILITATION IN SURGICAL TREATMENT OF THE PATIENTS WITH LOW BACK PAIN

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Annotation. *Aim of work* was to develop strategic foundations of physical rehabilitation in the surgical treatment of patients with lumbar and sacral vertebrogenic compression syndromes. *Methods* are applied in our research: analysis of literature and theoretical research methods (analysis, interpretation and synthesis) of scientific and manual literature on the study. Abstraction (or idealization, or schematization) is an allocation of the essential foundations. There was an experimenting with schemes (as a development of their content, check reasonableness and practicality) during the development of concepts, practical models and physical rehabilitation programs. *Materials:* researching performed on the basis of analysis of a medical data of 542 patients, that treated on the base of SO "Institute of Neurosurgery named after acad. A.P. Romodanov NAMS of Ukraine" and rehabilitation department of the SO "Institute of Traumatology and Orthopedics NAMS of Ukraine". *Results:* effectiveness of the surgical treatment depends on the timely, differentiated, adequate application of physical rehabilitation which should be based on the principles of continuity and duration of effects, which requires developing a plan for physical rehabilitation. A plan which developing, should be based on the results of the rehabilitation's diagnosis and including the need for rehabilitation and the rehabilitation prognosis. *Conclusions:* the developed integrated assessment of rehabilitation potential and the need to determine the amount and intensity of physical rehabilitation.

Keywords: physical rehabilitation, back pain, rehabilitation, diagnosis, prognosis.

Introduction

A back pain (BP) is a common problem in the modern society. By the outlook for a return to work is commonly good in this case, it's nearly from 10 to 25% of patients with BP are absent from work in a long term, so this is the risk for social and financial situation of workers [14]. A lot of these patients have a long history of rehabilitation, including various types of treatment, mainly aimed at the pain alleviating. At the same time, according to Ludeke C Lambeck [15], the main goal of rehabilitation is to restore the functioning of the human in private and work life and to decrease a pain.

V.D. Troshin [12], based on a system and cybernetic entity stages of afferent synthesis, decision-making, the formation of the acceptor action of the efferent synthesis, the formation of action and evaluation of the results achieved by P.K. Anokhin [1] highlights in the rehabilitation of neurological patients six stages, there are:

- assessment of the rehabilitation situation,
- formation of the rehabilitation' diagnosis,
- prognostication of the functional status,
- rehabilitation program construction,
- rehabilitation interaction,
- evaluation of the results.

The concept should be based on a set of systems approaches, that's crucial for the development of integrative and individualized the physical rehabilitation programs and prevention of relapse of the disease.

The effectiveness of surgical treatment certainly extents depend from timely, differentiated, appropriating using of physical rehabilitation and it should be based on the principles of continuity and duration of effects, which requires the development of a rehabilitation plan [6, 14].

Rehabilitation plan is the algorithm of the rehabilitation process (or necessary actions and it's frequency and duration) from the onset to full recovery (compensation functions), compiled by a team of rehabilitation agencies, with the active participation of the patient, based on an objective assessment of the rehabilitation potential of the diagnosis and rehabilitation (fig. 1).

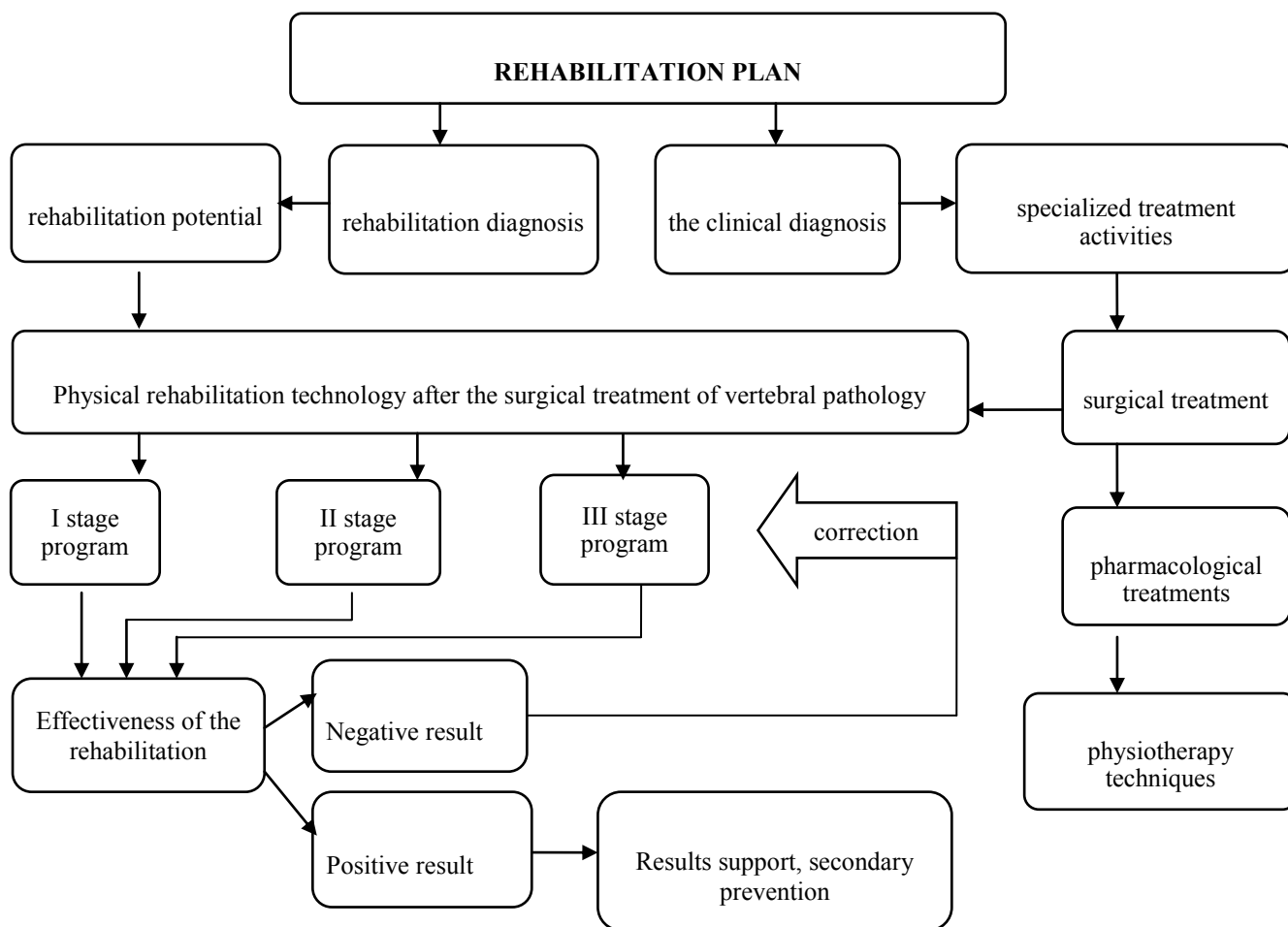


Fig. 1. Strategic framework of the rehabilitation process for patients after the surgical treatment of back pain

In our opinion, the development of this plan should be based on the results of the rehabilitation diagnosis that includes:

- need for rehabilitation,
- rehabilitation prognosis.

Purpose, tasks of the work, material and methods

Aim of this work was to develop strategic foundations of physical rehabilitation in the surgical treatment of patients with lumbar and sacral vertebrogenic compression syndromes.

Methods are applied in our research: analysis of literature and theoretical research methods (analysis, interpretation and synthesis of scientific and manual literature on the study. Abstraction (or idealization, or schematization) is an allocation of the essential foundations. There was an experimenting with schemes (as a development of their content, check reasonableness and practicality) during the development of concepts, practical models and physical rehabilitation programs.

Researching performed on the basis of analysis of an medical data of 542 patients, that treated on the base of SO "Institute of Neurosurgery named after acad. A.P. Romodanov NAMS of Ukraine" and rehabilitation department of the SO "Institute of Traumatology and Orthopedics NAMS of Ukraine".

Results of the researches

The features of the motor system pathology in individuals with herniated intervertebral discs require specialized methodical approach in the assessment of compensation of the lost functions and the principles of recovery.

Together with doctor should be formed the neurosurgical diagnosis and defined "rehabilitation diagnosis" and "rehabilitation prognosis". The statement of rehabilitation diagnosis is carried out through: the rehabilitation examination (anamnestic information, inspection and palpation), the studies of intact sensory and motor functions, the results of objective research tool. Examination should be performed by physiotherapist through the general clinical principles, by the form and substance, should be without any differences from a neurological or orthopedic examination, but it has some problems.

The single one, that the neurologist primarily assesses the type of lost (or damage) of any functions on the basis of which articulates the topical (or anatomical) diagnosis. The main objective of the physiotherapist is

identification of *the saved* anatomical and functional structures, definition of the initial level of compensation of lost function and prediction of further recovery.

By the figurative expression of Potekhin L.D. [11], physiotherapist should be identified "no that is what is absent, but what is get." And as the untapped the anatomical and functional potential of the patient ("what is get") can not be consciously used in the rehabilitation process, the success of rehabilitation generally determined by the quality inspection of the rehabilitation and action oriented.

The diagnosis of the vertebral lesions in patients referred for surgery of herniated disc removal can get certain difficulties for neurosurgeons and spine specialists. The most frequently in the lumbar spine ascertain defeat on the L4-L5 and L5-S1 levels, it can be with a acute pain and paresis of the lower limbs flaccid. However, under the diagnosis as a "slack paresis of the lower extremities" hides different clinical variants with its combination of fixed and reflex changes with combination of radicular and vascular deposition in the various proportions. Patients with the same level of destruction and the syndromical diagnosis may have different movement possibilities.

The difficult structure of motor defect during the vertebral disease is caused not only by mechanical damage of the nervous tissue, roots and spinal membranes, but also developing transneurological and vascular changes, as well as secondary degenerative processes takes place in the nerve trunks, muscles, skin, internal organs and motor system [6]. The asymmetry of the damages [4], disruption of specific and non-specific afferent inputs, destruction neuromuscular links probably bring to a complex set of sensory and motor defects, the clinical picture is determined by the defeat of one system in combination with the partial safety of others.

In these conditions, according to M. Leontiev [9], physiotherapist should see any other diagnostic problems than neurosurgeon before.

According to the WHO data (World Health Organization, 1980), in all subjects, including neurological, there are three levels of the consequences of disease or injury, are there follows:

The first one is the level of **neurological defect**, as a motor, sensory, tonic, psychological disorders, which can be detected in the clinical examination of the disease in the patient.

The second level is dysfunction (or disability) it can cause neurological damage, as walking disturbances, self-service.

The third level is the outcome level (or handicap) includes the violations of civil and social activities that occur as a result of neurological damage and disorders [8].

In recent years, there is put into practice the concept as a "health-related quality of life", it means the quality of life, considered as an integral characteristic, which should be guided in evaluating the rehabilitation effectiveness for some patients and disabled [3, 8]. Of course, all of these diseases outcomes are interrelated: damage causes some disability; it brings to a social restrictions and impairment of quality of life [2].

The data that obtained by rehabilitation inspection is the basis for setting the rehabilitation goals, rehabilitation plan and evaluation of results. Thus, the understanding of modern restorative treatment for the disabled patient is not a passive recipient of treatment and there would be an active participation in the process of treatment by the patient, as the main line of treatment for rehabilitation interventions used movement and patient counseling, assistance in the using of aids. This approach provides the most good and long lasting results. The rehabilitation program for patients with motor and functional disorders as a result of vertebral disorders is essential for the successful rehabilitation. Modern rehabilitation measures allow using saved compensatory potential to achieve the greatest possible effect, provided adequate surgical and neurological care.

Rehabilitation need. The first step in the planning is identifying the rehabilitation needs for the people in the form of aid. This requires the understanding of the indications for medical rehabilitation [2]. The common indications for medical rehabilitation are presented in the report of the WHO Expert Committee on Disability Prevention and Rehabilitation [1983]. There are a significant reduction in functional ability, decreased ability to learn, particularly vulnerable to the environmental influences; violations of social relations, breach of employment.

M.V. Bogolyubov [10] draws to the fact that for achieving a full recovery, there is no need for rehabilitation. If the effects of the disease are still hampering the existence (physical or social) of the patients or integrating it into society, there is a need for rehabilitation for this patient. The author emphasizes that if the need arises not when the disease is detected in the course of a disease, the need for this one should be promptly identified and appropriate measures, should be initiated well in advance. Only an objective assessment of functional reserve capacity and the patient's body carried by a doctor can give adequate information about his professional competence. And there needed further examination, testing a patient for professional suitability.

According to V.A. Isanova [7], there comes the rehabilitation need, if as a result of injury or illness there can be a risk of temporary or prolonged impaired functional ability, there is the threat of prolonged restriction or worsening of the patient under the influence of negative environmental factors.

In this case, a clear answer, which contingents of disabled people in the first place need for the rehabilitation, the literature does not exist. Some scientists believe that the medical rehabilitation should be part of the healing process for all patients at risk of long-term disability, while others believe that the institutions of rehabilitation should be used only for those with very severe injuries, only for people with disabilities [2, 8]. The most reasonable is to assume the point of view that shows the rehabilitation of those patients who have the disease due to a high risk of persistent reduction of social and consumer activity has already formed or disability [2].

In our country, at this moment, there is an insufficient number of rehabilitation facilities with limited bandwidth. Therefore, the main line becomes urgent to prioritize the provision of rehabilitative care to patients with certain forms of diseases.

The integrated assessment of the rehabilitation need for patients with vertebral pathology aimed at surgical treatment and consisted from the following criteria: as the presence of paresis of the lower extremities, the presence of spinal deformity, the presence of sub-optimal dynamic stereotype, the presence of pain in the spine and / or lower extremities, lower social mobility household identified changes after surgery and the postoperative period. The scale was made on the basis of a five-point evaluation scale of vertebral symptoms. For each parameter is assigned a certain number of points - from 1 to 5. The total score determines the level of rehabilitation needed.

About the definition of "rehabilitation potential" term there are different points of view. If V.A. Isanova [7] thinks that under the rehabilitation potential implied a stable physical and mental condition of rehabilitant, his high motivation towards the upcoming rehabilitation treatment, V.M. Dornichev [5] considers the patient's rehabilitation potential is the scientifically founded line that limits the possible recovery of scarce (disturbed) physiological functions in specific clinical case. Relying on the definition by V.M. Dornichev [5], as applied to patients with vertebral pathology going to surgery, we identified factors and levels that determine rehabilitation potential in this case of patients.

Rehabilitation prognosis is a reasonable likelihood of achieving the goals of rehabilitation in a certain period of time, given the nature of the disease, its course, individual resources and compensatory capacities of the patient, the presence of sufficient rehabilitation potential. Rehabilitation prognosis for each patient was determined on the basis of an integrated assessment of rehabilitation potential and necessity. Based on the rehabilitation need, rehabilitation potential, rehabilitation prognosis and the objective of the research that include clinical neurological examination, functional impairment and quality of life for each patient was put the rehabilitation diagnosis that determines further care rehabilitation.

We have developed a system of assessment of rehabilitation potential and the need for permits, firstly, for determining the amount and intensity of physical rehabilitation activities, and secondly, during the monitoring conducted to identify the adequacy of rehabilitation. The more emphasized motor deficit level billows locomotion, the less opportunity to choose recovery procedures, both because of complexity of the process and due to the characteristics of rehabilitation effect on the patient's rehabilitation low prognosis.

Conclusions.

The level of movement disorders, spinal deformity, the level of pain and of social constraints significantly affects both the level of health of the patients during the surgical treatment of vertebral pathologies, and the choice of the rehabilitation means for these patients, that requires the development of an objective measure of the integral rehabilitation prognosis.

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