

ISSN (English ed. Online) 2311-6374
ISSN (Ukrainian ed. Print) 1991-0177
ISSN (Ukrainian ed. Online) 1999-818X

**MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
KHARKIV STATE ACADEMY OF PHYSICAL CULTURE**

**SLOBOZHANSKYI
HERALD
OF SCIENCE AND SPORT**

Scientific and theoretical journal

Published 6 times in a year
English ed. Online published in October 2013

№ 4(66)

Kharkiv
Kharkiv State Academy of Physical Culture
2018

P 48

UDC 796.011(055)"540.3"

Slobozhanskyi herald of science and sport : [scientific and theoretical journal]. – Kharkiv : KSAPC, 2018. – № 4(66). – 61 p.

English version of the journal “**SLOBOZANS`KIJ NAUKOVO-SPORTIVNIJ VISNIK**”

The journal includes articles which are reflecting the materials of modern scientific researches in the field of physical culture and sports.

The journal is intended for teachers, coaches, athletes, postgraduates, doctoral students research workers and other industry experts.

Contents Themes:

1. Physical education of different population groups.
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4. Human health, physical rehabilitation and physical recreation.
5. Biomechanical and informational tools and technologies in physical education and sport.
6. Management, psychological-educational, sociological and philosophical aspects of physical education and sport.

Publication of Kharkiv State Academy of Physical Culture
Publication language – English.

The journal is included in the list of professional publications in Ukraine, which may publish results of dissertations (Decree of Presidium of SCADT Ukraine:

№3–05/11 from 10.11.1999.

№1–05/34 from 14.10.2009.

Order Ministry of Education and Science of Ukraine №1081 from 29.09.2014.

Certificate of State Registration – KB №12221-1105P from 17.01.2007).

ISSN (English ed. Online) 2311-6374

ISSN (Ukrainian ed. Print) 1991-0177

ISSN (Ukrainian ed. Online) 1999-818X

Key title: Slobozhanskyi herald of science and sport

Abbreviated key title: Slobozhanskyi her. sci. sport

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Physical Culture, 2018



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Use of research methods in the process of pulmonary rehabilitation and physical therapy of persons with chronic obstructive pulmonary disease (review of clinical guidelines)

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To date, the analysis of research methods and indicators on the basis of which the assessment of important areas of the physical, functional and psychoemotional state of patients with chronic obstructive pulmonary disease (COPD) at different stages of physical therapy is relevant.

Purpose: *to analyze and systematize recommendations on the use of research methods in the process of pulmonary rehabilitation and physical therapy in chronic obstructive pulmonary disease.*

Material & Methods: *the available clinical guidelines for the diagnosis, treatment and pulmonary rehabilitation of patients with COPD are available. 13 clinical guidelines were analyzed.*

Results: *selected research guidelines and categories were evaluated in selected clinical guidelines: diagnostic criteria, criteria for participation of patients in the pulmonary rehabilitation program, prognostic criteria, and selection criteria for pulmonary rehabilitation and physical therapy strategies, effectiveness markers. In clinical guidelines, the methods of research that recommend the evaluation of patients with COPD in the treatment and recovery process are grouped as follows: research methods and indicators of the functional state of the respiratory and cardiovascular system, estimates of the level of dyspnea, quality of life and the manifestation of COPD symptoms, the level of physical performance and integrated performance.*

Conclusion: *most recommendations on the use of methods for studying patients with COPD are justified for diagnosis, prediction and selection of the strategy of drug treatment and oxygen therapy. Most of the recommendations are not sufficiently focused on using research methods and indicators as prognostic criteria and markers of the current and long-term effectiveness of physical therapy. Groups of research methods and indicators have been identified, with the help of which it is recommended to evaluate patients with COPD at the stages of diagnosis, patient selection, predicting the course of the disease, choosing a strategy of the pulmonary rehabilitation program and evaluating its effectiveness.*

Keywords: *chronic obstructive pulmonary disease, COPD, pulmonary rehabilitation, physical therapy, clinical setting.*

Introduction

Chronic obstructive pulmonary disease (COPD) has been on the list of priority diseases in the health care system of Ukraine [1] and the world [18] for more than a year. Pulmonary rehabilitation (PR) with its mandatory component of physical therapy (PT) is recommended for patients with COPD at all stages of treatment [19].

In PT, it is customary and necessary to control the initial, current and final state of the patient, due to which results are predicted, the selection and dosage of the means of PT, the assessment of their effectiveness and the correction of interventions. Accordingly, the research methods used by the physical therapist when working with patients with COPD should be informative, reproducible, easy to perform, correlate with the patient's quality of life, symptoms and clinical course of the disease.

Today, the analysis of research methods and indicators, on the basis of which the important areas of the physical, functional and psycho-emotional state of patients with COPD are evaluated at different stages of PT, is relevant.

Relationship of research with scientific programs,

plans, themes. The work is carried out in accordance with the theme of the Master Plan of the research work of the Lviv State University of Physical Culture for 2016–2020. "Theoretical and methodological foundations for the physical rehabilitation of persons with disabilities with disorders of the musculoskeletal system and respiratory system" (Minute No. 8 dated 04.19.2016).

Purpose of the study: to analyze and systematize recommendations on the use of research methods in the process of pulmonary rehabilitation and physical therapy in chronic obstructive pulmonary disease.

Material and Methods of the research

A review of available clinical guidelines and protocols for diagnosis, treatment, management and pulmonary rehabilitation of patients with COPD has been conducted. The search was carried out in the scientific evidence database PubMed and PEDro. Analyzed available publications as of November 13, 2017 (Table 1).

Search criteria are the keywords "Chronic obstructive pulmonary disease". In PubMed, the search was limited to publications for the last 5 years on installations (guideline) for treat-

ment and management, pulmonary rehabilitation and physical therapy for patients with COPD.

Table 1
Quantitative results of the search for publications

Publications database	Search words	Found / Added to analysis
PubMed	«Chronic obstructive pulmonary disease guideline» Search for the last 5 years	572 / 12
PEDro	«Chronic obstructive pulmonary disease»	17 / 9

The study, added to the review, met the following criteria: chronic obstructive pulmonary disease, a review, recommendations or practical instructions from the general principles of treatment, pulmonary rehabilitation or PT in COPD.

Seized: systematic examinations; abstracts of conferences; articles that are not available in full; textbooks; clinical trial protocols have been registered; national adaptation of the recommendations of the World Health Organization (WHO) GOLD (Global Initiative for Chronic Obstructive Lung Disease).

In addition, the publications were withdrawn, did not contain general recommendations on the treatment, management, rehabilitation and physical therapy of patients with COPD. Not taken into account the publication on surgical intervention study of the influence of drugs and medical interventions; research of other pathologies in combination with COPD; the study of structural, functional changes in COPD.

Results of the research

Analyzing the available clinical guidelines (including the PR Protocols), we were looking for answers to the following questions:

- what indicators and research methods can be criteria for patient participation in the program of PR, the appointment of a specific program or funds PT;
- which indicators can be prognostic criteria that can be used to predict the effectiveness of PT;
- what indicators can be markers of effectiveness of application of PT;
- with the help of which indicators it is possible to estimate the necessity of correction of physiotherapeutic intervention.

13 clinical guidelines (minutes) were analyzed, among them the Order of the Ministry of Health of Ukraine No. 555 (dated June 27, 2013). "Chronic obstructive pulmonary disease: Adapted clinical setting based on evidence" [2].

Categories of indicators and research methods that are evaluated in the recommendations of clinical guidelines (Table 2):

1. Diagnostic criteria – the most important clinical signs and/or laboratory data, on the basis of which a reasonable diagnostic conclusion about a disease can be made. In addition, this group included research methods and indicators to determine the stage, the severity of COPD, the level of symptoms at the diagnostic stage.

2. Criteria for the participation of patients in the PR and PT program – indicators that are recommended to be considered for referring a patient to participate in the PR and PT program.

3. Prognostic criteria are indicators or a group of indicators that provide an opportunity to predict the effect of PR and PT, the duration of pulmonary rehabilitation and physical therapy, the level of restoration of the function of external respiration, physical working capacity and the growth of the quality of life of the patient with COPD.

4. Criteria for choosing the strategy of PR and PT – research methods and indicators, which allow to objectively choose one or another strategy or program of PR and PT.

5. Effective markers – indicators that may indicate changes in the functional state of a person are sensitive to physiotherapeutic intervention and correlate with clinically relevant indicators of the state of external respiration, COPD symptoms, physical working capacity, level of functioning and quality of life. Effective markers are indicators that allow us to assess the impact of the program of physical therapy as a whole, each individual session, and even an individual intervention, is applied.

In the analyzed clinical guidelines, the most prominent are the diagnostic criteria for COPD, with different details given in ten of 13 sources (see Table 2). The main method of research in this category is spirometry, which is indicated in all 13 installations, and in three of them – as the only diagnostic method [3; 7, 14]. Since there is only a weak correlation between the spirometry index – the forced expiratory volume in the first second of expiration (FEV_1), symptoms, and impairment of the patient's health, it is necessary to symptomatically evaluate [10; 11]. In this regard, along with spirometry, it is recommended to use instruments at the diagnostic stage to determine the degree of symptoms of the disease (CAT, CCQ ©), dyspnea (mMRC), quality of life (SGRQ) [17] and physical performance [12; 21]. According to the clinical setting [22], the estimates of spirometry, symptoms of dyspnea and symptoms (mMRC, CAT) allow the patient to be assigned to one of the three groups for which drug therapy algorithms are developed. According to GOLD-2017 [8], the results of spirometry, recording of exacerbations (including hospitalization) and mMRC and CAT indicators are taken into account for the distribution of patients into four clinical groups (A, B, C, D). It allows individualization of therapy.

The protocol for the treatment of COPD [13] recommends the use of spirometry, in particular, the FEV_1/FVC indicator for diagnostic purposes. In this clinical setting, there are no recommendations to apply other quantitative assessments of the manifestation of symptoms during a certain time, however, in the discussion and justification of the protocol it is indicated that mMRC and CAT questionnaires may be useful. Systematic tracking of changes using these questionnaires can help identify the development of concomitant comorbid conditions in the early stages and identify patients who are recommended for a pulmonary rehabilitation program.

In the H. Kankaanranta protocol (H. Kankaanranta, in 2015) [12], great attention is paid to the diagnosis of COPD and the assessment of the clinical severity of the disease, and later becomes the basis for choosing a specific treatment regimen. When di-

Table 2

Research methods and indicators by which it is recommended to evaluate patients with COPD

Protocols, year	Categories of indicators				
	diagnostic criteria	criteria for participation in the program of PR and PT	prognostic criteria	criteria for selecting a strategy for PR and PT	effectiveness markers
Global Initiative for Chronic Obstructive Lung Disease (GOLD) 2017 [8]	Spirometry, mMRC, CAT, CCQ®	–	Spirometry, mMRC, CAT, CCQ®	Spirometry, mMRC, CAT	Spirometry, CAT, CCQ®
Ian Yang, 2017 [21]	Spirometry (FEV ₁ /FVC), mMRC, CAT, 6MWD, shuttle walk test	–	–	–	Spirometry, 6MWD, shuttle walk test, SpO ₂
H. Kankaanranta, 2015 [12]	Spirometry (FEV ₁ /FVC), CAT, mMRC, 6MWT	–	–	–	–
Hyoung Kyu Yoon, 2014 [22]	Spirometry, mMRC, CAT	–	–	–	–
2014 [13]	Spirometry (FEV ₁ /FVC)	–	–	–	–
Maria Rosa Gell Rous 2014 [9]	–	mMRC	–	SpO ₂	mMRC, initial and dynamic indices of dyspnea, oxygen cost diagram, CRQ, Borg scale, SGRQ, questionnaire SF36 or SF12, CAT
Blair Anderson 2013 [3]	Spirometry	–	–	–	–
C. E. Bolton, 2013 [4]	–	–	Charlson index	HADS, MRC	–
E. W. Russi 2013 [17]	Spirometry (FEV ₁ , FEV ₁ /FVC), mMRC, CAT, SGRQ	–	Spirometry, BODE index	–	–
A. Qaseem 2011 [14]	Spirometry	Spirometry	–	–	–
M. Rudolf 2010 [7]	Spirometry	MRC	BODE index	SpO ₂	–
Davoren A. Chick 2010 [6]	Spirometry (FEV ₁ , FEV ₁ /FVC)	–	BODE index	–	–
Andrew L. Ries 2007 [15]	–	–	–	–	quality of life assessment

Remark:

CAT – COPD Assessment Test;

CCQ – COPD Control Questionnaire;

MRC – Medical Research Council Questionnaire;

mMRC – Modified British Medical Research Council Questionnaire;

SGRQ – questionnaire hospital of St. George for the assessment of respiratory function;

HADS – hospital anxiety and depression scale;

6MWT – 6 minute walk test;

6MWD – distance traveled when performing 6MWT;

ECG – electrocardiography;

BODE index – integral index containing FEV₁, 6MWD, mMRC, body mass index;

SpO₂ – oxygen saturation in peripheral blood;

SF36 or **SF12** – non-specific questionnaires for assessing the quality of life, complete (SF36) and abbreviated (SF12) versions;

FEV₁ – forced expiratory volume in the first second of expiration (FEV₁);

FEV₁/FVC – the ratio of volume of forced exhalation for the first second (FEV₁) to the indicator of forced vital capacity of the lungs (VC).

agnosing COPD, spirometry is recommended with a test for bronchodilation. This criterion is also associated with the risk of mortality. The level of symptoms and quality of life was proposed to be assessed using the CAT® and mMRC questionnaires. Another diagnostic criterion for assessing the ability to withstand physical activity is the 6-minute walk test. (6MWT).

Patient participation criteria in the PR program are the least

described. On the one hand, this may be due to the fact that the PR program is recommended to offer all stable patients with dyspnea, which limits physical activity despite medical treatment, and patients who were hospitalized due to exacerbation [13; 14; 15]. Accordingly, if there are no contraindications or cautions to PR and PT [7], then patients with COPD are encouraged to participate in the pulmonary rehabilitation

program. According to scientists (A. Qaseem 2011) [14], it is recommended that PR should be prescribed to patients with FEV_1 ($FEV_{1\%}$), less than 50% of their due. At the same time, clinicians consider it necessary for PR for patients who have manifestations of COPD and restrictions on performing exercises with FEV_1 exceeding 50% [14].

So, M. Rudolf (M. Rudolf 2010) [7] indicates that PR should be offered to all patients with COPD who consider themselves functionally limited, which usually corresponds to shortness of breath with a score of 3 points and above MRC questionnaire. It is noted that the HR program is not suitable for patients who cannot walk, have unstable angina, or have recently suffered a myocardial infarction. In particular, Maria Rosa (Maria Rosa Gyll Rous, in 2014) [9] notes that patients should be carefully selected for participation in the HR program. Candidates for participation in the PR program are patients with COPD with dyspnea with a score of 2 or higher mMRC (level 1A). In addition, for the initial assessment of candidates for PR specialists of the multidisciplinary team are encouraged to conduct a study. In particular, the pulmonologist should conduct an initial clinical, radiological and functional assessment of the patient. The use of physical therapy involves a preliminary electrocardiography, 6-minute walk test, a test with a maximum load (shuttle walk test or bicycle ergometry) [9].

Predictive criteria were specified in five protocols. As a prognostic criterion in the installation [4], it is recommended to use the Charlson Comorbidity index (comorbidity index). The Charlson Comorbidity Index was developed and approved as an indicator of the risk of mortality up to one year and the severity of the disease [16]. This indicator, which takes into account the influence of comorbidities [5], does not in any way predict the possible results of PT. Thus, this indicator can be used by a physical therapist in his practice to assess the severity of the disease and predict the patient's mortality, but not as a prognostic criterion for the effectiveness of PR or PT.

If earlier it was believed that the main manifestation of COPD is dyspnea and evaluating its manifestations using mMRC is sufficient to predict the future risk of mortality, then already in GOLD-2017 [8] for this it is recommended to further evaluate the manifestation of symptoms of the disease using methods such as CAT and CCQ® According to the account of these indicators in the classification scheme of separation of patients in the "ABCD" group is important not only for diagnosis, but also for prediction [8].

In the installations of M. Rudolf [7] and Davoren A. Chick (Davoren A. Chick 2010) [6], it is recommended to consider the integral index BODE (contains body mass index, FEV_1 , mMRC and 6MWD results) as a prognostic factor.

When choosing the strategy of the PR and PT programs, it is recommended to consider the results of the assessment of the level of anxiety and depression (HADS) [4], dyspnea (MRC) [4; 8] and level of education (knowledge of the disease) [15], spirometry and manifestation of disease symptoms (CAT) [8]. The recommendations mainly concern the introduction of certain corrective elements (for example, psychological support, educational components) into the PR programs. Pulse oximetry is used to estimate the need for the use of supplemental oxygen [7; 9]. In particular, patients in whom SpO_2 decreases to 90% or less, can benefit from supplemental oxygen during a session of exercise. Accordingly,

the results of pulse oximetry are recommended for determining the need for oxygen therapy [7].

In the clinical setting [4], the results of the mMRC questionnaire are suggested to be taken into account in choosing the type of PR. In particular, patients who are functionally limited to shortness of breath with a score of 2 points on the MRC questionnaire are recommended to be referred for participation in the LR program (Evidence Class D). Patients score 3–5, which are functionally limited to shortness of breath, should be attributed to the ambulatory version of PR. Patients with an MRC score of 5 points do not leave the home, do not offer routine control and PR out of the home (grade B) [4]. In this clinical setting, it is recommended to evaluate the level of anxiety and depression in the HADS questionnaire. It was found that the use of PR leads to a significant reduction in anxiety and depression in those patients who had "obvious" or "probable" anxiety or depression at an initial stage [20]. According to this indicator for the PR, it is possible to identify patients who need to be referred for support and management of depression to a psychologist [4].

According to the practical installation [15], education of patients with COPD should be an integral component of pulmonary rehabilitation. Accordingly, when a patient is not well informed about his condition, the educational component in the Republic of Latvia becomes mandatory and should contain information about self-control, prevention and treatment of exacerbations.

In the protocol GOLD-2017 [8], it is proposed by spirometry, mMRC and CAT to assign a patient to a specific group according to the classification scheme, which can facilitate the selection of individual treatment methods.

Markers of effectiveness of PR and PT. In the practical setting [15], a number of studies have been conducted on the dynamics of the quality of life indicator over a period of 10 days to two years after the use of PR. It is indicated on the improvement of the quality of life index (QL) after the application of the PR program from 4 weeks to 6 months. It is noted that, unlike other indicators, a high level of quality of life in comparison with control groups is maintained (though decreasing) to two years. Accordingly, the quality of life indicator can be used as an indicator of the effectiveness of PR and PT.

Evaluation of the results of PR and its effectiveness, according to the clinical setting [9], is based on an analysis of the perception of dyspnea, quality of life and physical performance. The prevalence of a particular research method of the presented indicators was not noted. To assess the level of dyspnea, the following research methods were proposed: a mMRC questionnaire, a baseline index of dyspnea (Baseline Dyspnea Index – BDI) and a transitional index of dyspnea (Transition Dyspnea Index – TDI), an oxygen cost chart, a CRQ questionnaire section on dyspnea. It is indicated that for assessing dyspnea on exertion, the Borg scale is most often used before and after the exercise test.

An assessment of the quality of life can be performed using CRQ, SGRQ, CAT, SF36 or its short version SF12. Changes in physical fitness are recommended to be evaluated using a 6-minute walk test. An alternative can be a shuttle walk test, but preference is given to bicycle ergometry with submaximal load [9].

In the clinical setting of Ian Yang (Ian Yang, 2016) [21], it is indicated that tests with a load on the cardiorespiratory system can be useful for differentiating the causes of shortness of breath (due to cardiac or respiratory illness), may help to identify other causes of constraints and to be useful for monitoring the results of medical or rehabilitation interventions. In particular, the 6MWD and shuttle tests allow you to evaluate blood oxygenation during exercise.

Summing up the analysis of selected clinical guidelines, it should be noted that only in GOLD-2017 [8] there is information on which tools can be used as diagnostic, prognostic criteria and criteria for selecting and monitoring the effectiveness of PR and PT. This does not apply separately to the PR process or the practice of PT, but to the healing and recovery process in COPD as a whole. In the remaining clinical guidelines there were recommendations on examination methods based on only one or two criteria. Yes, of course, mainly recommendations on the selection of examination tools relate to diagnosis, verification of the severity of the disease, and spirometry is the main method of research [3; 8; 14]. All recommendations on the use of diagnostic and therapeutic research methods are fairly general and do not define a specific list of indicators and research methods that should serve as tools for establishing a rehabilitation diagnosis, prognosis and monitoring the effectiveness of PT.

The research methods presented in clinical guidelines and individual indicators that are recommended to evaluate patients with COPD in the treatment and rehabilitation process can be grouped into the following groups (Figure 1):

1. Methods of investigation and indicators of the functional state of the respiratory and cardiovascular systems.
2. Assessment of the level of shortness of breath.
3. Assessment of quality of life and symptoms of COPD.
4. Assessment of the level of physical fitness.
5. Integral indicators.

To understand the complete picture of the physical, functional and psychoemotional state of a patient with COPD, it is advisable to use at least one of the research methods from each group.

As diagnostic criteria use methods for assessing the functional state of the respiratory and cardiovascular systems, indicators for assessing the level of dyspnea, quality of life and physical performance. The conclusion about participation in the PR program is mainly based on research methods and indicators of the functional state of the cardiorespiratory system and the assessment of the level of dyspnea. The prognostic criteria can be research methods and indicators from the group of the functional state of the cardiorespiratory system, assessment of the level of dyspnea and symptoms of COPD, and integral indicators. The research methods for all groups, except for integral indicators, are recommended to be used to select the PR/PT strategy and evaluate its effectiveness.

Conclusions / Discussion

Most of the recommendations for the use of research methods for patients with chronic obstructive pulmonary disease are reasonable for diagnosing, predicting and choosing a strategy for medical treatment and oxygen therapy. In the

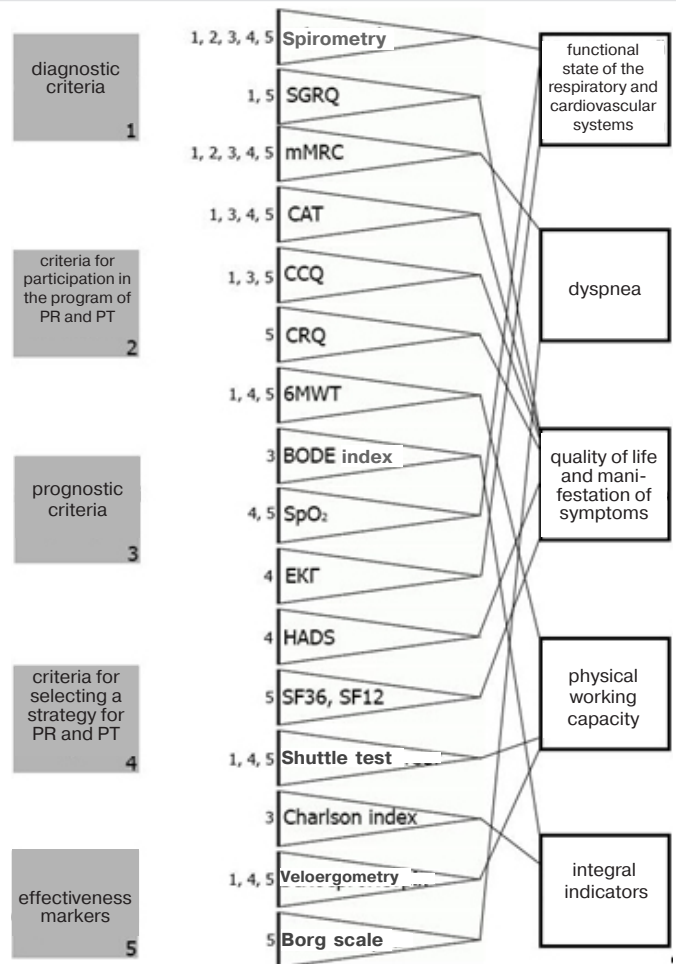


Figure 1. Categories and groups of indicators by which it is recommended to evaluate patients with COPD (analysis of clinical guidelines)

analyzed clinical recommendations, prognostic criteria are presented to predict the risk of exacerbations and mortality. Indicators on which to estimate (predict) the possible effect of intervention, in particular, physical therapy, not considered.

Most of the recommendations are not sufficiently focused on the application of research methods and indicators as prognostic criteria and markers of current and long-term effectiveness of physical therapy. All research methods described in the analyzed clinical guidelines, physical therapists can use in their practice. It is necessary to determine the value of each of the presented indicators in the process of PR and PT, to justify and methodically ensure the process of their use at all stages of pulmonary rehabilitation and physical therapy.

There are groups of research methods and indicators, with the help of which it is recommended to evaluate patients with COPD in the stages of diagnosis, selection of patients, prediction of the course of the disease, the choice of the strategy of the program of pulmonary rehabilitation and evaluation of its effectiveness.

Prospects for further research. Analyze the research methods and indicators that are most often used to evaluate patients with COPD in the process of pulmonary rehabilitation and physical therapy according to the proposed division into groups.

Conflict of interests. The author declares that no conflict of interest.
Financing sources. This article didn't get the financial support from the state, public or commercial organization.

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Received: 03.07.2018.

Published: 31.08.2018.

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Based on the experience of physical rehabilitation of children with cerebral palsy using Bobat-therapy

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Purpose: to determine the effectiveness of using Bobat-therapy in the program of physical rehabilitation of children with cerebral palsy.

Material & Methods: theoretical analysis and generalization of literary and documentary sources; the use of diagnostic scales "Test cards of motor abilities of children", "Munich Functional Diagnostics", "The Gross Motor Function Classification System" and the method of mathematical data processing.

Results: despite the presence of a large number of methods of physical rehabilitation of children with cerebral palsy, the problem of choosing the most effective one arose. As a result of modern scientific research of scientists from different countries, Bobat-therapy is found to be an effective method in the physical rehabilitation of children with cerebral palsy. However, there is a problem with the definition of criteria for differentiating the use of Bobat-therapy products, and also with the creation of an algorithm for their use, have not previously been investigated.

Conclusion: according to the results of our scientific research, the program of physical rehabilitation of children with cerebral palsy using the Bobat-therapy method, taking into account the developed algorithm of differentiated use of Bobat-therapy, is effective, as evidenced by the data obtained. For example, the children of the OG noted the improvement of motor functions in the "The Gross Motor Function Classification System" system, the motor capabilities behind the "Test Card for Children's Motor Capabilities" and the normalization of the psychophysical state behind the "Munich Functional Diagnostics".

Keywords: Bobat-therapy, cerebral palsy, physical rehabilitation, motor unctions, psychophysical state.

Introduction

According to modern scientific research, a rapid growth of childhood disability has been noted, caused by damage to the central nervous system and, as a result, pathological changes in the cerebral cortex, the development of paresis, paralysis, hyperkinesia, dystonia and ataxia, which are characteristic of diseases such as cerebral palsy (Cerebral palsy). Various forms of cerebral palsy and features of their clinical manifestations justify the need for a differentiated approach to the choice of an effective method of physical rehabilitation [1; 4; 6].

Among the modern methods of physical rehabilitation (Voyta therapy, Neurokinesiotherapy, System of intensive neurophysiological rehabilitation, Dosage proprioceptive correction, etc.), Standard (therapeutic gymnastics, medical massage, physiotherapy, etc.) and innovative (Bobat-therapy, Feldenkrais, kinesiteyp, etc.) modern scientists highlight the method of Bobath therapy [3; 7].

The first method of Bobat therapy was created in the 30 s and 40 s of the twentieth century by the Czech physiotherapist practitioner Bertha and physician Carl Bobat, the main means were the treatment of the position and application of physical exercises aimed at blocking the action of pathological reflexes on the musculoskeletal system used in the physical rehabilitation of patients undergoing stroke and craniocerebral trauma. Later, in the 50 s, the Bobath-therapy method was enriched in the areas of ergotherapy and speech therapy thanks to the efforts of the Bobath Helen Muller and the gymnastics for newborns, which was developed in the 80 s by their

pupil Maria Keln, after which the method began to be used in physical rehabilitation of children with cerebral palsy of different ages [5; 9].

In the 21st century, Bobat therapy is a modern means of physical rehabilitation of children with cerebral palsy, which is widely used in countries such as Germany, Switzerland, USA, Armenia, Slovenia and Ukraine, where in recent years it is used as the leading method in the physical rehabilitation of children with cerebral palsy. However, the differentiation of Bobat therapies according to the levels of motor abilities, motor functions and psychophysical condition of children with cerebral palsy was not previously investigated, nor was the complex of special physical exercises developed by the Bobat-therapy method and the algorithm of differentiated use of Bobat-therapy in the program of physical rehabilitation of children with Cerebral palsy [2; 11].

Relationship of research with scientific programs, plans, themes. The work was performed in accordance with the theme of the "Summary Plan of Research Work in the Field of Physical Culture and Sports for 2011–2015". On the topic 3.7 "Improvement of biomechanical technologies in physical education and rehabilitation taking into account individual peculiarities of human motility" (state registration number 0111U001734), topic 3.13. "Theoretical and methodological foundations of health of forming technologies in the process of physical education of different groups of population" (state registration number 0116U001615).

Purpose of the study: to determine the effectiveness of us-

ing Bobat-therapy in the program of physical rehabilitation of children with cerebral palsy.

Material and Methods of the research

Theoretical analysis and generalization of literary and documentary sources; The use of diagnostic scales: the Children's Motor Performance Test Card (CTRMD), the Munich Functional Diagnostics (MFD), the The Gross Motor Function Classification System (GMFCS), the method of mathematical processing of data.

Results of the research

As a result of the research, for the implementation of the theoretical provisions of the experimental program of physical rehabilitation of children with cerebral palsy using Bobat-therapy, we determined the criteria for differentiating Bobat-therapy and developed an algorithm for using them in the program of physical rehabilitation of children with cerebral palsy.

The generalization of the obtained scientific data prompted the formation of the organizational and methodological conditions for the practical implementation of a physical rehabilitation program using the Bobat-therapy method in the process of physical rehabilitation of children with cerebral palsy:

The program of physical rehabilitation of children with cerebral palsy using the Bobat-therapy method provided for the observance of certain conditions: organizational (creating favorable conditions for practical implementation of the program) and social (familiarization with the program of physical rehabilitation of parents and their children with cerebral palsy formation and development of children with motivation, the use of means physical rehabilitation, ensuring constant monitoring of the psychophysical state of children with cerebral palsy).

The program of physical rehabilitation of children with cerebral palsy using Bobat-therapy has its own components: organizational (provides for an assessment of the feasibility of using the program in the process of physical rehabilitation of children with cerebral palsy and the conditions for its implementation); diagnostic (determines the motor functions of children with cerebral palsy by GMFSS system, motor abilities on CTRMD and psychophysical condition behind the MFD); methodical (planning remedial measures and creating training programs using the Bobat-therapy method control and correction (aimed at evaluating intermediate results) effective (aimed at diagnosing indicators of physical development, motor capabilities, motor functions of the psychophysical state).

Three stages of the practical implementation of the program solved certain tasks. At the preparatory stage, disorders of psychomotor development are identified; parents were informed about the results of the study, stimulated adaptation of the child's body to physical stress, developed and defined complexes of special physical exercises. At the correctional stage, the correction of motor disorders and psychophysical condition, improvement of motor functions and motor capabilities was carried out. The study of psychomotor development changes was implemented at the supporting (stabilizing) stage.

The main component of the evaluation of the effectiveness of the proposed experimental program for the physical reha-

bilitation of children with cerebrovascular disease using the Bobat-therapy method was the study of the psychophysical development of the child with the determination of the correspondence of his profile with the polo-age standards on the diagnostic scales of development: motor functions (GMFCS) motor capabilities (CTRMD) of the psychophysical state (MFD).

The effectiveness of the program was studied according to the developed criteria. At the final stage of the formative experiment, a comparative analysis of performance indicators by the method of mathematical data processing was carried out.

The three components of the algorithm for practical implementation of the program of physical rehabilitation of children with cerebral palsy using the Bobath-therapy method, aimed at correction of motor disorders, improvement of motor function and development of motor abilities, became three stages of practical realization: selection of funds according to their scientific substantiation of efficiency; systematization of the organization of practical classes, their structure, practical implementation and experimental testing; the definition of the criteria for the effectiveness of the practical implementation, containing a list of indicators, which were carried out both as a current control, and a general assessment of approbation.

In accordance with the organizational and methodological conditions established by us for implementing the program of physical rehabilitation of children with cerebral palsy using the Bobat-therapy method, we selected and grouped Bobat-therapy products into complexes of special physical exercises aimed at correcting motor disorders, improving motor function and motor development. possibilities in the process of physical rehabilitation of children with cerebral palsy, taking into account the degrees of motor functions in the GMFS system, levels of psychophysical state according to the MFD and atelnyh capabilities CTRMD. According to the obtained results, an algorithm was developed for using the Bobat-therapy products in the program of physical rehabilitation of children with cerebral palsy using the Bobat-therapy method.

The Bobat-therapy was in turn divided into: *basic* special exercise (treatment by position, exercise, breathing exercises, self-service training, games, exercises for tactile sensation development, articulation gymnastics, exercises for small motility, relaxation exercises) *additional* –complexes of special physical exercises, depending on the degree of motor functions in the GMFSC system, psychophysical condition by levels of MFD and motor capabilities by levels of CTRMD.

In the algorithm for the use of Bobat-therapy tools in the program of physical rehabilitation of children with cerebral palsy, Bobat-therapy classes were conducted individually, in the presence of parents, in a specialized room. To determine the volume and intensity of physical exertion, the following criteria were used: the degree of motor abilities in the GMFCS system, the level of motor abilities in CTRMD, and the level of psychophysical condition in the MFD, according to which the motor mode was determined and the initial positions, speed, speed of special exercises, the number of repetitions were determined, the total number of special physical exercises in the complex, the type, nature and degree of difficulty, the amplitude of movements, the duration is busy I breaks between exercises and special physical, as well as the density of oc-

cupation and the emotional factor.

The duration of the lesson was 30–50 minutes on average, depending on the degree of motor abilities in the GMFCS system and motor mode. Physical activity of children with cerebral palsy during classes Bobat-therapy was regulated by motor regimens. Under the conditions of the rehabilitation center, during the course of physical rehabilitation, a sparing-training regimen was used in children with 1, 2 GMFCS degrees for the first three months of the rehabilitation course and for children with 3 degrees GMFCC during the entire 6-month rehabilitation course. According to the results of the current and express controls and according to the indicators of instrumental methods of research, in children of 1, 2 degrees of GMFCS, in the last 3 months of the rehabilitation course, a training motor mode was used.

The first three months of physical rehabilitation using the Bobat-therapy method for children 1 and 2 degrees for GMFCS had an adaptation character, the main task of which was to prepare for increasing loads, regulate muscle tone, reduce the effect of pathological reflexes on the musculoskeletal system, and the like. The means of physical rehabilitation that were used during the training sessions of the Bobat therapy in the sparing-training motor mode were static and dynamic special physical exercises aimed at: relaxation, self-service training, fine motor skills, the development of tactile sensations and basic physical qualities, the formation of basic motor skills, general developmental, restorative, therapeutic, prophylactic and exercise general preparatory character, articulation gymnastics and the like. Also in the classroom Bobat-therapy used breathing exercises, elements of the treatment position and games. The method of conducting was individual. The main focus of the training was on the development of paravertebral muscles, muscles of the stabilizers of the upper and lower limbs, ensuring the development of intermuscular coordination and contribute to the stabilization of the body in space, etc. starting positions: lying, sitting, on all fours, on the knees, calculating the number of repetitions of each exercise, averaged 5–10 times, the pace of the movement – slow and middle and amplitude – and incomplete medium. Dynamic exercises alternated with static stresses, relaxation exercises and the like. Motor occupation density reached 75%. Classes consisted of introductory, main and final parts.

When training motor mode was carried out and the form of training, which consisted of introductory, main and final parts, and under the previous mode, but added more complex special physical exercises and games aimed at strengthening the muscular system, the development of basic motor skills and physical qualities. There was also an increase in the number of breathing exercises. The main tasks of physical rehabilitation were ranked as: strengthening the muscles of the back and torso, the formation of motor skills, consolidation of the experience of physical activity, the development of basic physical qualities. Classes were held individually, the duration is not significantly increased and amounted to 40–50 minutes, motor density – 75%. The dosing of the load was also carried out by regulating the duration of the procedure, changes in initial positions: lying, sitting, on all fours, on the knees, standing, calculating the number of repetitions of each exercise, increased on average and amounted to 10–15 times, the pace of movement performance was slow and average and amplitude – incomplete and medium.

For children with cerebral palsy, the level of motor capabilities of which responded to the 3rd degree in the GMFCS system, physical activity was regulated only within the scope of the sparing-training regime. The method of conducting classes was individual. The main focus of the training was on the development of paravertebral muscles. The means that were used during the Bobat-therapy in this motor mode for this category were special physical exercises: physical exercises; exercises on the regulation of muscle tone self-education training; treatment by position. Physical rehabilitation had an adaptation direction, the main task of which was to regulate muscle tone, reduce the effect of pathological reflexes on the locomotor system, prevent the development of contractures and deformations, training for self-care and care for a child with special needs, and the like. Dosing of the load was also carried out by regulating the duration of the procedure, averaging 35 minutes, changes in the initial position (lying on the abdomen to the back or sides) by calculating the number of repetitions of each exercise, averaging 3–15 repetitions, performing exercises was initially carried out in a slow, and in further – at an average pace with the help of a specialist in physical rehabilitation. The motor density of the classes reached 75%. The classes also consisted of three parts: introductory, main and final.

The main signs of the adequacy of the load were: the absence of unpleasant feelings and overwork, the desire to continue training, the pleasure of training and the like. The following control methods were identified under the influence of physical stress on the psychophysical state of children with cerebral palsy during Bobat therapy: rapid control to assess the immediate effect when the child's reaction to physical stress during physical rehabilitation or the effects of special physical exercises on the locomotor apparatus was studied and the mental state of the child; routine control was carried out at least once every 7–10 days; staged control was carried out to assess the effectiveness of a 6-month physical rehabilitation course, for which children were examined at the beginning and at the end of the course. It should be noted that during any session of Bobat-therapy, a specialist in physical rehabilitation followed the psychophysical condition of the child using such control methods as interrogation and visual observation. As a result of the survey, people learned about their state of health and general condition during the lesson and after it, and visual observation of the effect of physical exertion was carried out by direct observation of the child during the lesson. Also separately studied and discipline, interest, emotionality, external manifestations of overwork (sweating, coloring of the skin, coordination of movements, attention, etc.).

To determine the effectiveness of our proposed physical rehabilitation program for children using Bobat-therapy, a 6-month pedagogical experiment was conducted where the main group (MG) and the control group (CG) were formed by random selection.

During the determination experiment, we found that the most common among the examined children were motor disorders: delay in the formation of motor skills (sitting, turning over, standing, walking), the presence of pathological motor stereotypes, delay in the development of chain statokinetic reflexes. The obtained data became the basis for the formation of MG and CG. CG consisted of 34 children, of which 7 (20,6%) children had cerebrovascular disease in the form of double hemiplegia, 4 (11,8%) had hyperkinetic form, 16

(47,1%) were spastic diplegia, and 7 children (20,6%) – spastic form of hemiparesis; MG – 35 children, of which the form of double hemiplegia occurred in 6 (17,1%), hyperkinetic – 4 (11,4%), spastic diplegia – 18 (51,4%), spastic hemiparesis – 7 (20%). Surveyed were distributed by random sampling, the groups had no statistically significant differences in the studied parameters ($p > 0,05$).

CG consisted of children with cerebral palsy who were undergoing physical rehabilitation using standard approaches during the 6-month course of rehabilitation at the Odessa Regional Center for Rehabilitation of Disabled Children charity fund (ORCRDC) "Future". During the course of physical rehabilitation children of CG received 72 procedures of medical gymnastics and medical massage and 48 classes in soft modular and sensory rooms (sensory integration).

The MG children underwent physical rehabilitation according to the program developed by us using the Bobat-therapy method, which was introduced into the physical rehabilitation process of children with cerebral palsy, who underwent rehabilitation during the 6-month course at the "Future" center. The children of OG during the course of physical rehabilitation received 72 classes of Bobat therapy, sensory integration, 48 lessons in a soft modular room and 48 lessons in a sensory room; 24 procedures kinesiotherapy; 120 procedures of physiotherapy (cryotherapy, sinusoidal modulated currents, interference currents, laser radiation).

Analyzing changes in the levels of motor capabilities in the GMFCS system in children of MG (Table 1), it is necessary to dwell on the main positive effects, which showed an increase of more than twice from 22,9% to 48,6% of the number of children able to sit on the floor and lie down from sitting provisions, as well as walking without additional means of transportation. Positive dynamics was also observed at intermediate levels, which indicates the effectiveness of the program of physical rehabilitation using the Bobat-therapy method. At the same time, children with a total limitation of motor function and the inability to move independently at the end of the course of physical rehabilitation were not observed at all.

Table 1
Changes in levels on the GMFCS scale for children with cerebral palsy in the course of physical rehabilitation, %

Level of GMFCS	MG		CG	
	at the beginning	at the end	at the beginning	at the end
I level	8/22,9	17/48,6	0/0	0/0
II level	5/14,3	6/17,4	7/20,6	6/17,6
III level	12/34,3	7/20,0	14/41,2	16/47,1
IV level	7/20,0	5/14,3	9/26,5	11/32,4
V level	3/8,6	0/0	4/11,8	1/2,9

At the same time, in the children's CG group, the distribution of the level of motor function disturbance significantly differed and was characterized by the prevalence of children with 3 levels of GMFCS (41,2%) at the start of the study, and in each of the 9th children 5 levels were recorded, the main difference being the absence of children with level 1 disturbances of motor function. Despite the weekend differences at the beginning of the course of physical rehab, the main task was to assess

the impact of the methods used. With this in mind, it can be argued that the significant effect of the traditional approach to physical rehabilitation was to increase the options of Levels 3 and 4 on the GMFCS scale, with the number of children with whom at the end of the experiment was 79,5%. It should be noted separately that, with the decrease of children with 5 levels of motor function abnormalities in one child, there was no increase in the GMFCS score up to level 1.

To assess the psychophysical status of children with cerebral palsy, an MFD was carried out, which included establishing a correspondence between the child's age (in months) and the development of a separate psychophysical ability. The results obtained in the form of the correspondence of the existing psychomotor development in percent to the proper (corresponding chronological age of the child) at the beginning and at the end application in the course of physical rehabilitation of the Bobat-therapy (Table 2).

Taking into account the indicated indicators of the percentage

Table 2
Usual data on the correspondence of the psychomotor development to the chronological age of the child in the MG and CG at the beginning and at the end of the course of physical rehabilitation, %

Parameters	MG		CG	
	at the beginning	at the end	at the beginning	at the end
Upright walk	78,2	81,7	54,9	60,7
Fine motor skills	76,5	78,6	55,9	62,4
Perception	73,5	74	50,9	56
Active speech	76	76,9	51,7	56,7
Speech understanding	81,2	77	55,1	60,7
Social age	73,4	74,1	48,3	53,5
Independence	70	72,1	44,8	50,7
Psychological age	74,9	74	47,5	53

of psychomotor development of children depending on the children due, taking into account the average age of children, which was $51,4 \pm 11,8$ months at the beginning of the course, a considerable lag of development was noted according to various indicators, on average was characterized by more than 12 months 18,8% (for understanding speech) up to 30% (for independence) from chronologically determined. As can be seen from Table 2, the majority of indicators on the effect of the course of physical rehabilitation using Bobat therapy showed a slight improvement, but according to the parameters of "speech comprehension" and "psychological age", the inconsistency with age norms was slightly increased, which indicated a certain continuation of the delay in the mental development of this group of children. In general, taking into account the results obtained, it should be noted that a positive trend was observed in increasing the degree of a child's motor capabilities, namely, erect posture and fine motor skills. The latter somewhat increased the possibility of independence of the child. So, according to the results of the study, the algorithm for the differentiated use of Bobat-therapy in the program of physical rehabilitation of children with cerebral palsy is effective.

Analyzing the average assessments of motor abilities of children of exhaust MG to the results of the CTRMD at the begin-

ning and at the end of the physical rehabilitation program for all of their indicators, an improvement was noted in the basic starting positions under study: supine – from 3,9±1,2 to 4,8±0,5 points ($p<0,01$), lying on the stomach – from 3,8±1,2 to 4,8±0,5 points ($p<0,01$), due to the ability to independently take and hold the position. The ability to occupy and be kept in a sitting position is confirmed by positive changes in the indicator from 3,7±1,1 to 4,6±0,7 points ($p<0,05$), and in the starting position by four, the indicator increased from 3,8±1,0 to 4,4±0,8 points ($p<0,05$). Weighted improvements were noted in the starting positions: kneeling from 3,4±1,3 to 4,3±0,8 points ($p<0,05$), while walking from 3,3±1,2 to 4,1±0,8 points ($p<0,05$), standing on one leg from 3,0±1,3 to 3,9±1,0 points ($p<0,05$), certifying the influence of Bobat-therapy on the development of focal abilities by improving the proprioceptive sensitivity and function of the vestibular apparatus and proves the effectiveness of their use in the physical rehabilitation of children with cerebral palsy according to the results of the assessment of their motor capabilities.

In children of the CG, there was a slight improvement in motor abilities in the main initial positions studied: supine – from 3,8±0,8 to 4,1±0,7 points ($p<0,05$), lying on the stomach – from 3,7±0,8 to 4,0±0,7 points ($p<0,05$), while sitting – from 3,4±0,8 to 3,6±0,6 points ($p>0,05$), standing on four – from 3,3±0,8 to 3,6±0,9 points ($p>0,05$), while squatting – from 3,0±0,8 to 3,4±0,8 points ($p>0,05$), kneeling from 2,9±0,8 to 3,1±0,8 points ($p>0,05$), while walking – from 2,5±1,0 to

2,9±0,8 points ($p<0,05$), standing on one leg – from 2,2±1,0 to 2,4±0,8 points ($p>0,05$).

Conclusions / Discussion

The positive effect of the physical rehabilitation program using the Bobath therapy method is evidenced by changes in motor abilities of children with cerebrospinal fluid, such as sitting and self-walking with the GMFCS diagnostic scale, which exceeded the MG contingent in the CG. The effectiveness of the use of Bobat-therapy is shown by the indicators of motor capacity of children with cerebrovascular disease on the diagnostic scale of CTRMD, that in children MG significantly exceeded the indicators of children of CG in the main investigated baseline positions.

As a result of the research, the algorithm of differentiated use of Bobat-therapy in the program of physical rehabilitation of children with cerebrovascular disease using the Bobat-therapy method is effective, confirming the obtained data on the increase of indicators of psychophysical status of children MG according to the MFD.

Prospects for further research are related to the determination of the effect of the PR program of children with cerebrovascular disease with the use of Bobat-therapy on the development of physical characteristics of children with cerebral palsy.

Conflict of interests. The authors declare that no conflict of interest.

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

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Received: 07.07.2018.

Published: 31.08.2018.

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Changes in the level of coordination preparedness of gymnasts 10–12 years as a result of the use of special exercises on the simulator "Bosu Balance Trainer"

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Purpose: to substantiate the effectiveness of using the developed exercise complexes on the simulator "Bosu Balance Trainer" ("BOSU") for the development of the coordination preparedness of female athletes of 10–12 years in rhythmic gymnastics.

Material & Methods: the study involved female athletes 10–12 years old engaged in rhythmic gymnastics. The control and experimental groups consisted of 12 gymnasts. To solve the problems, the following research methods were used: theoretical analysis and generalization of literary sources; pedagogical observations; testing; pedagogical experiment; methods of mathematical statistics.

Results: based on the results of the study, a positive effect of the developed exercise complexes on the BOSU simulator on the development of the coordination preparedness of female athletes aged 10–12 in rhythmic gymnastics was revealed.

Conclusion: the use of the developed exercise complexes on the BOSU simulator in the rhythmic gymnastics training process positively influenced the development of the level of coordination preparedness of female athletes of 10–12 years.

Keywords: rhythmic gymnastics, gymnasts 10–12 years, testing, simulator "Bosu Balance Trainer" ("BOSU"), exercise complexes.

Introduction

Rhythmic gymnastics by the nature of motor activity belongs to difficult-coordination sports and requires athletes to display a wide range of motor skills, skills and qualities, especially at the stage of basic training, when a gymnast must master a large number of difficult coordination exercises and form stable and reliable technical skills and successfully show them in competitive activities. Therefore, in modern conditions of training young athletes there is a need to develop effective methods aimed at developing physical qualities, namely coordination abilities, the level of which, according to experts, significantly affects the performance of competitive activities [1; 2; 3]. The rapid complication of the technique of the sport leads to increased requirements for the development of coordinating readiness of gymnasts, which are especially important in connection with the complexity of the structure of motor activity and the need to memorize the large volume of relatively independent movements [4; 5]. With the introduction in 2017 of the new rules of competitions FIG [6] in rhythmic gymnastics the priority direction was the development of complex technical bases of competitive programs. This is possible only under the condition of modernization and improvement of the efficiency of the training process, which is directly dependent on the means used in the classes with athletes [2; 4; 5]. Experts [7–10] that the introduction of the training process of various technical tools and training devices is an effective way to increase the development of coordination abilities of female athletes. Recently, various types of training on an unstable surface with the use of additional equipment (balance training) have become very popular. One of such simulators is the universal balancing platform – Bosu Balance

Trainer ("BOSU"). BOSU resembles a large ball, cut in half, mounted on a rigid plastic base and tightly inflated with air. The name of the simulator "BOSU" – "Balance-trainer" is fully consistent with one of his appointments – training the vestibular apparatus and body coordination [11; 12]. The balancing platform "BOSU" is used not only in fitness programs: aerobics, power loads, pilates, stretching, but also actively used in professional sports: basketball, mountain skiing, snowboarding, gymnastics, tennis and martial arts. Athletes use these "balls" to improve muscle strength, coordination capabilities and balance development [11]. In this regard, the use of auxiliary means to increase the level of development co-ordination preparedness is a priority area in the training process of gymnasts.

Purpose of the study: to substantiate the effectiveness of using the developed exercise complexes on the simulator "Bosu Balance Trainer" ("BOSU") for the development of the coordination preparedness of female athletes of 10–12 years in rhythmic gymnastics.

Material and Methods of the research

The study involved 24 athletes aged 10–12 years. The study used the following methods: theoretical analysis and synthesis of literary sources; pedagogical observations; pedagogical testing – "Juggling with tennis balls" (number of times), test "Arabesque on the knee" (s), test "Passe with closed eyes" (s), test "Yule" (s), "Three rolls-passe" (s), "Combination of movements with arms, torso and legs" (points), "Static equilibrium by the method of Yarotsky" (s) pedagogical experiment and methods of mathematical statistics.

Testing of the level of coordination abilities of young gymnasts was held twice – at the beginning and end of the training year. According to the results of the initial testing, the group of gymnasts was divided into control (n=12) and experimental (n=12), taking into account the absence of reliable differences in the indicators of coordination tests. Both groups of young gymnasts trained in accordance with the curriculum for rhythmic gymnastics [13]. However, in the training sessions of the athletes of the experimental group included specially developed exercise complexes on the simulator "BOSU" (Figure 1), aimed at developing coordination abilities.



Figure 1. "BosuBalanceTrainer" ("BOSU") – universal balancing platform

The proposed method (sets of exercises on the "BOSU" simulator) provided for complications of the exercises on the "BOSU" simulator due to: different positions of the hands and head; asymmetric hand positions and head tilts; exercise only with the support of the simulator "BOSU"; performing exercises on socks and without visual control; use of various jumps increase in the number of repetitions; increase in the time of retention of a static body position increase in the amplitude of movements. As part of the developed methodology for developing the coordination abilities of gymnasts 10–12 years old, the main pedagogical principle "from simple to complex" were used. That is, if at the first stages of learning the exercise proved difficult to perform – it was simplified and, conversely, with careful study and mastering – complicated. In addition to performing the developed exercise complexes on the BOSU simulator, this device was used in training sessions and for the elaboration of competitive elements, namely, equilibrium. Also, this simulator was used in exercises (part of the lesson at the machine) in classical choreography and in some exercises of folk choreography.

Results of the research

To test the effectiveness of using the developed exercise complexes on the BOSU simulator, a re-testing of the gymnasts of the control and experimental groups was carried out at the end of the experiment. A comparative analysis of changes in the level of coordination preparedness of young gymnasts during the study is presented in Table 1.

As can be seen from the results of the study, in the test "Juggling with tennis balls" on the right hand, athletes of the CG showed the average group result $7,33 \pm 0,71$ times, and athletes of the EG – $9,17 \pm 0,58$ times. The difference between these indicators, according to Student's criterion, is not statistically significant, since $t_p < t_{gr}$ (Table 1). When performing this test on the left hand, the average group result of the CG gymnasts was $4,83 \pm 0,26$ times, and the EG gymnasts – $5,75 \pm 0,44$ times. Comparison of these results by the Student's criterion shows that the difference between these group average values is also statistically insignificant ($>0,05$). Thus, the obtained indicators characterizing the spatial-temporal parameters of movements indicate an improvement in the results in the experimental group in relation to the control by 21% for the right and 16% for the left hand. The results of the study indicate that when performing the "Arabesque on the knee" test on the right, young athletes from the control group showed a result of $80,42 \pm 2,28$ s, whereas with the experimental one – $92,33 \pm 4,63$ s. The difference between these indicators is statistically significant because $t_p = 2,31 > t_{gr} = 2,07$. When performing this test on the left gymnast of 10–12 years showed the following results: CG – $50,08 \pm 2,92$ s and EG – $64,58 \pm 4,58$ s. In the process of comparative analysis of the indicators of development of resistance to the preservation of the posture – equilibrium ("Arabesque on the knee"), there was a significant improvement in the results ($p < 0,05$) in the experimental group in relation to the control (improvement of the result in the experimental group – 13% on the right and 21% on the left leg). The following indicators of the development of resistance to posture (balance) preservation also underwent significant shifts over the study period. When performing the "Passe with closed eyes" exercise on the right leg of the girl, the control group showed an average result of $42,08 \pm 1,89$ s, and the experimental one – $51,08 \pm 3,45$ s. Similar results were observed when performing this test task on the left: the female athletes of the CG – $23,75 \pm 1,98$ s, and the female athletes of the EG – $33,25 \pm 1,58$ s. The result of

Table 1
Changes in the level of coordination preparedness of gymnasts 10–12 years old at the end of the study
($t_{gr} = 2,07$ since $p < 0,05$)

No. i/o	Test name	$\bar{X} \pm m$		t_p	p
		Result CG (n=12)	Result EG (n=12)		
1.	Juggling tennis balls on the right, number of times	$7,33 \pm 0,71$	$9,17 \pm 0,58$	1,98	$>0,05$
2.	Juggling tennis balls on the left, the number of times	$4,83 \pm 0,26$	$5,75 \pm 0,44$	1,79	$>0,05$
3.	Test "Arabesque on the knee" on the right, s	$80,42 \pm 2,28$	$92,33 \pm 4,63$	2,31	$<0,05$
4.	Test "Arabesque on the knee" on the left, s	$50,08 \pm 2,92$	$64,58 \pm 4,58$	2,67	$<0,05$
5.	Test "Passe with closed eyes" on the right, s	$42,08 \pm 1,89$	$51,08 \pm 3,45$	2,29	$<0,05$
6.	Test "Passe with closed eyes" on the left, s	$23,75 \pm 1,98$	$33,25 \pm 1,58$	3,74	$<0,05$
7.	Test "Yula", s	$5,83 \pm 0,39$	$7,50 \pm 0,56$	2,43	$<0,05$
8.	"Three rolls – passe" on the right, s	$45,25 \pm 3,13$	$59,83 \pm 5,10$	2,44	$<0,05$
9.	"Three rolls – pass" on the left, s	$30,42 \pm 1,56$	$38,17 \pm 3,25$	2,10	$<0,05$
10.	Combination of movements with arms, torso and legs, points	$6,67 \pm 0,25$	$8,08 \pm 0,42$	2,91	$<0,05$
11.	Static equilibrium by the method of Yarotsky, s	$30,17 \pm 0,89$	$37,25 \pm 2,93$	2,31	$<0,05$

the comparison of these indicators indicates a statistically significant difference ($p < 0,05$). Thus, the results shown by the EG gymnasts are 19% more on the right, and 29% more on the left leg than the results shown by the CG gymnasts (Table 1). It should be noted that the introduction of the experimental group of the developed exercise complexes on the BOSU simulator into the training process improved their result in the Yula test by 22% relative to the control group. So, the athletes of the CG showed the result of $5,83 \pm 0,39$ s, whereas the athletes of the EG – $7,50 \pm 0,56$ seconds. The difference between these indicators is statistically significant because $p < 0,05$. The obtained indicators, which also characterize the level of development of posture (balance) preservation – the test "Three rolls – passe" on the right and left legs, indicate an improvement in the results in the experimental group relative to the control by 24% and 20%, respectively. In accordance with the student's criterion, the differences between the average results shown by the gymnasts in these tests are statistically significant, since $t_p > t_{gr}$ (Table 1). In the test "Combination of movements with arms, torso and legs" athletes from the control group at the end of the study showed an average result – $6,67 \pm 0,25$ points, and from the experimental group – $8,08 \pm 0,42$ points. The difference between these indicators is statistically significant ($p < 0,05$). This means that the results in the experimental group in relation to the control objectively improved. Their increase was 17%. As the research materials show, in the test "Static equilibrium by the Yarotsky technique" young athletes from the control group showed a result of $30,17 \pm 0,89$ s, whereas with the experimental one – $37,25 \pm 2,93$ s. Thus, the results obtained by gymnasts show that the difference between their average values is statistically significant, since $t_p = 2,31 > t_{gr} = 2,07$. Thus, the results of this test allow us to state the improvement in the level of development of the coordination abilities of gymnasts 10–12 years of the experimental group by 19% relative to the control (Table 1).

However, at the end of the experiment, the results of the All-Ukrainian tournament on rhythmic gymnastics "Spring Swallows" were analyzed, where the gymnasts of the experimental and control groups participated (Table 2).

According to the data in the table, gymnast No. 1 CG performed the exercises with a hoop and a ball (subjects of choice) with a score of 18,05 and took 12th place out of 17 ri-

vals of her current; gymnast No. 1 of the EG performed the exercises with a rope and a hoop, with a score of 21,5 and took the 5th place out of 14 rivals of her current, etc. (Table 2).

So, according to the results of the All-Ukrainian tournament on rhythmic gymnastics "Spring Swallows" in individual all-round in performing two types of competitive combinations, it should be noted that the increase in the level of coordination training of gymnasts aged 10–12 years positively influenced their technical preparedness (Figure 2).

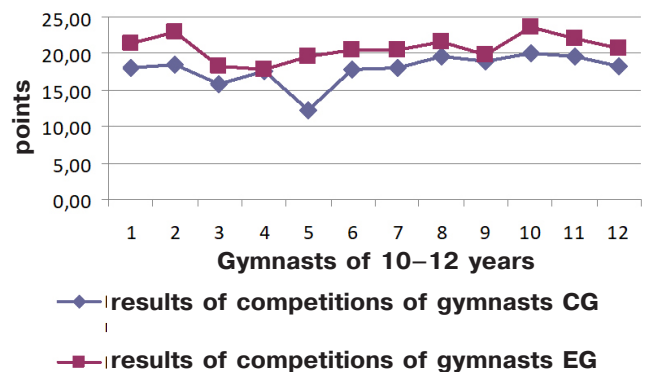


Figure 2. Results of the All-Ukrainian tournament on rhythmic gymnastics "Spring Swallows" gymnasts 10–12 years at the end of the study

Conclusions / Discussion

The results of the studies completed are supplemented by the theoretical positions formulated in the works of T. Yu. Krushevich [14], V. N. Platonov [8], R. I. Andreeva [15], that the coordination abilities of a person are very diverse and specific, but they can be differentiated on separate types on features of manifestation, criteria of estimation and factors which condition. The conducted research confirms the data of R. Andreeva [15], A. H. Deineko, I. V. Krasova [1] on the constant complication of the programs of performances of gymnasts of 10–12 years in connection with regular changes in the rules of competitions [6]. We also agree with the statement of experts [2; 4; 5; 15; 16] that in connection with early specialization, reduction of terms of training and the complication of sports equipment for young gymnasiums high requirements

Table 2 Results of the "Spring Swallows competition" of gymnasts from the control and experimental groups at the end of the study

Results of gymnasts CG			Results of gymnasts EG		
	Σ (sum of points)	Place		Σ (sum of points)	Place
№ 1	18,05	12 (17)	№ 1	21,5	5 (14)
№ 2	18,6	11 (17)	№ 2	22,9	4 (11)
№ 3	15,9	11 (11)	№ 3	18,35	6 (15)
№ 4	17,7	7 (17)	№ 4	17,93	5 (12)
№ 5	12,2	9 (9)	№ 5	19,75	4 (11)
№ 6	17,75	4 (12)	№ 6	20,55	4 (13)
№ 7	18,15	8 (11)	№ 7	20,55	6 (9)
№ 8	19,65	4 (10)	№ 8	21,7	6 (12)
№ 9	18,95	7 (12)	№ 9	19,85	5 (9)
№ 10	20,0	4 (6)	№ 10	23,7	5 (12)
№ 11	19,55	4 (7)	№ 11	22,15	4 (11)
№ 12	8,35	6 (8)	№ 12	20,7	3 (9)

in terms of manifestation of coordination abilities are presented. This necessitates the search for new ways and means by which it is possible to teach gymnasts better and faster to manage their movements.

The conclusions of R. I. Andreeva [15], A. Ya. Mullagildinoy [5], Zh. A. Belokopytov, V. A. Lavrent'eva, L. K. [16], V. V. Bayer [17] and other scientists were confirmed. that the improvement of coordination abilities in rhythmic gymnastics is one of the most promising areas of technical training for athletes.

The results of our research complement the data of scientific works on the use of various means and methods for improving coordination abilities in the training process of young gymnasts, which increase the development of coordination of movements in them, help to improve orientation in space and time and stability to maintain balance, improves their technical readiness [1; 5; 15; 16]. The data presented by us is confirmed by the results of the conducted research, namely, the average group estimation for the individual combined event in the performance of two types of competitive combination at the All-Ukrainian tournament on rhythmic gymnastics "Spring swallows" of athletes CG was 17,90 points, athletes EG – 20,80 points.

The results of the entire complex of studies carried out confirm the findings of many experts that the development and improvement of coordination qualities is important and inalienable in the complex training process in rhythmic gymnastics, but at the same time remains one of the least developed sections of the training of athletes [4; 5; 15; 16].

Specialists V. Ye. Vodlozerov and S. P. Evseev emphasize that the introduction of various technical means and training devices into the training process is the main direction of its im-

provement. Special various simulators will effectively develop various motor skills and abilities of athletes, improve technical skills, skills and physical qualities, create the necessary conditions for precise control and management of the most important parameters of the training load [9; 10]. But for the first time, we are considering the effectiveness of using the developed exercise complexes on the Bosu Balance Trainer (BOSU) simulator to develop the coordination abilities of female athletes 10–12 years old.

Thus, the results of this study showed the effectiveness of the use of the BOSU simulator for the development of coordination training for gymnasts of 10–12 years (the difference between the mean-group results shown by gymnasts of CG and EG in most test assignments is statistically significant). Also, their technical readiness improved significantly, which was confirmed by the results of the "Spring Swallows" competitions (the average group score in the individual all-round of athletes of the CG was 17,90 points, and athletes EG – 20,80 points). This is due both to the general developmental influence of the developed sets of exercises, and to the fact that the movements of the athletes received greater accuracy, which contributed to the implementation of competitive exercises at a higher technical level.

Prospects for further research. Due to the fact that the use of special exercises on the BOSU simulator had a positive result in the development of coordination skills of gymnasts 10–12 years old and contributed to the improvement of their technical preparedness, we plan to develop and implement exercises on this simulator in the training process of gymnasts 6–8 years at the initial preparation stage and examine their effectiveness.

Conflict of interests. The authors declare that no conflict of interest.

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

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Received: 09.07.2018.

Published: 31.08.2018.

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Peculiarities of the influence of psychological characteristics of boys and girls of different age groups on the formation of the need for achieving success

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In the article aspects of the gender approach in physical education of schoolchildren are considered.

Purpose: *studying the influence of the psychological characteristics of the personality of schoolchildren of different age groups on the formation of the need to achievements.*

Material & Methods: *the study was conducted with a contingent of schoolchildren of grades 3–11. The total number of respondents was 628 people (young men – 282, girls – 346), of which 126 respondents (97 boys and 29 girls) are engaged in a certain sport. Standardized testing using S. Bem's method "Masculinity – Femininity" was used, a test and a questionnaire by Yu. M. Orlov "Need for Achievements", methods of mathematical statistics.*

Results: *level of the need to achieve the success of schoolchildren of different age groups was studied, the gender type of the respondents' personality was determined. The relationship between the level of the need to achieve the success of schoolchildren and the features of their psychological sex was determined.*

Conclusion: *differences in the levels of the need to achieve success for boys and girls of different age groups, who are engaged and do not go in for sports, are revealed. It is shown that it is necessary to consider the gender approach in education not from the point of view of a gender policy providing equal rights for men and women, but from the point of view of studying their psychosocial characteristics for creating adequate organizational and methodological conditions in the process of physical education.*

Keywords: *schoolchildren, boys, girls, physical education, gender differences, masculinity, femininity, androgyny, the need to achieve.*

Introduction

The active social transformation that is happening now in Ukraine fundamentally changes the established ways of life, moral and ethical standards and ideological constructions that define. This process is characterized by significant changes in various areas of the economy, culture, science and education. Especially significant transformations are traced in the education system in general and in physical education, in particular, in which the ideas of humanization are actively manifested [1; 6; 10].

In recent years, domestic scholars have made a significant breakthrough in the field of theoretical understanding of gender issues. A large fund of scientific knowledge has already been accumulated in philosophy, history, sociology, psychology, law, linguistics, etc. When considering the problems of physical education of youth through the prism of gender, Ukrainian and foreign scholars note the interconnections of gender and personal-oriented approaches as the basis of humanization of the educational and educational process [1]. It should be noted that gender issues in the field of physical culture and sports are not very common today: there are almost no references to it in new programs and textbooks for secondary and higher professional education, rarely there are special courses in schools and universities.

The issue of gender can no longer be ignored without risk-

ing the appearance of an insufficiently professional teacher, administrator or scientist. Their inclusion in the content of the humanities meets the requirements of the modern level of education [13]. Despite the fact that gender concerns a new field of scientific knowledge and very slowly covers the academic environment, there is a sufficient amount of scientific and pedagogical literature, which, due to its importance, can be used as a foundation for modern research in the field of the problem that is being studied. Thus, in carrying out an analysis of scientific and pedagogical literature, in our scientific research we rely on achievements in the field of physical education, pedagogy and psychology in the context of organizing the education and upbringing of children, adolescents and youth in the process of their gender socialization, as well as modern gender theories, revealing a whole range of problems related to the implementation of gender equality in society in general and in the youth environment, in particular. The fact that men are different from women not only physiologically, but also in a number of psychological features of character, is known at the level of ordinary consciousness for quite a long time [3]. Specialists of physical culture and sports science have been engaged in the study of the needs, motives and interests in the sphere of physical culture of different groups of people for several decades [7–10]. However, in the context of our study, these concepts should be considered as components of the system of value orientations of a person, determining the formation of physical culture of a person and society. The needs

in the structure of value orientations are central. The category of "need" is used to draw a parallel between recognized and actual values. According to L. Rubinstein, a person needs something is outside her [14]. Human needs can not satisfy all material and spiritual values, accordingly, the person is oriented to those of which are subjectively significant [12]. Valuable orientations related to needs determine the nature of the behavior and the direction of the activity of schoolchildren, stimulate their general and cognitive activity [15].

The analysis of real practice showed that for today there is no productive experience of the implementation of the gender approach in physical education of schoolchildren and there is a number of spontaneous development of gender research beyond targeted directed pedagogical impact [7–9; 17; 19]. This requires the search for scientifically based theoretical provisions on the possibility of influencing this process during the educational and educational activities, conditioning the relevance of the theme of research we have chosen. Also, in accessible literature, we did not find scientific papers that studied the influence of the psychological characteristics of boys and girls on the formation of the need for achievement in age and gender, and substantiates the relevance of our scientific research.

Relationship of research with scientific programs, plans, themes. The scientific work is carried out within the framework of the topic approved by the Ministry of Education and Science of Ukraine: code 1.2 Ф. "Historical and organizational and methodological foundations of the formation of a gender approach in the education of children, adolescents and young people", state registration number 0117U002386.

Purpose of the study: studying the influence of the psychological characteristics of the personality of schoolchildren of different age groups on the formation of the need to achievements.

Material and Methods of the research

The study was carried out with a contingent of schoolchildren of grades 3–11 with a representativeness of the sample. The total number of respondents was 628 people (boys – 282; girls – 346), of which 126 respondents (97 boys and 29 girls) are engaged in a certain sport (swimming, basketball, volleyball, athletic gymnastics, wrestling, taekwondo). The rest of the students attend only physical education classes. The results of the studied stratified according to the age periods of the physiological development of children and biological sex. The reliability of the differences between the individual results is calculated at the level of reliability $p < 0,05$ to $p < 0,1$, which indicates the possibility of their account in the development of practical recommendations for teachers of physical culture, as well as for further interpretations.

Research methods – analysis of scientific and methodological literature, test questionnaire by Yu. M. Orlov "The Need for Achievements", questionnaire S. Bem (BSR), methods of mathematical statistics.

Results of the research

The motivation for sporting activities is based on biological and social factors, as well as on the factors determined by man's needs. In order to better understand the causes that

stimulate the activity of schoolchildren in the field of physical culture and sports, we analyzed not only the motives, target settings that are satisfied in the field of physical culture and sports, but the level of the need for achievement of the success of boys and girls.

The need for achievement is characterized by a common desire for a constant search for ways to improve both qualitative and quantitative indicators [20]. Thus, it can be assumed that those pupils who have a stronger need for achievement.

According to the results of the test, it was established that the level of need to achieve with age becomes higher in boys than in girls (Table 1). But in girls it decreases with age. It was determined that the greatest number of girls who have a high level of need for success, falls on the 6th and 8th grades (29,6% and 27,7% respectively), the young men – on the 10th and 11th grades (25,0% and 26,8% respectively). Girls with a low level of achievement need more than boys, except for those who study in the 3rd grade (31,0%) and the young men of the 8th (30,9%). Studying the age characteristics of the need for achievements of schoolchildren, it is revealed that with the age of girls with a low level of needs in the achievement becomes more, young men – less.

Table 1
Level of need for success of schoolchildren of 3–11 grades

Grade	Sex	High		Average		Low	
		n	%	n	%	n	%
3	b	6	20,69	14	48,28	9	31,03
	g	2	8,00	20	80,00	3	12,00
5	b	2	9,52	18	85,71	1	4,76
	g	11	20,75	38	71,70	4	7,55
6	b	15	30,00	31	62,00	4	8,00
	g	16	29,63	38	70,37	0	0,00
7	b	2	5,88	27	79,41	5	14,71
	g	0	0,00	32	82,05	7	17,95
8	b	8	14,55	30	54,55	17	30,91
	g	15	27,78	33	61,11	5	9,26
9	b	20	22,22	60	66,67	10	11,11
	g	10	18,18	39	70,91	6	10,91
10	b	3	25,00	9	75,00	0	0,00
	g	2	13,33	10	66,67	3	20,00
11	b	11	26,83	27	65,85	3	7,32
	g	14	21,54	42	64,62	9	13,85

Comparing the level of the need for the success of respondents who are engaged in and not engaged in sports, it is determined that among the female athletes there were not those who have a high level of need for success (Table 2). The study found that all of them have an average level of need for achievement. Also, we have found that the majority of girls who do not go in for sports have a low level of need for achievement. It is worth noting that young men with low level of needs in achievements are also not engaged in sports in their majority.

Studying the level of need in achieving success for schoolchil-

Table 2
Level of need to achieve (respondents involved in sports), %

Grade	Sex	High	Average	Low
8-9	b	22,58	67,74	9,68
	g	0,00	100,00	0,00
10-11	b	37,50	57,50	5,00
	g	0,00	100,00	0,00

dren of different age groups, in the first stage of our research, we only stratify by sex. But, in our opinion, the formation of motivation for physical activity and the values of physical culture can also depend on the gender characteristics of boys and girls. And physical culture, of course, can be one of the means of gender socialization of schoolchildren. Therefore, the data obtained require separate, additional research on the impact of the psychological gender on the level of need for success, which can significantly affect the formation of the motivational priorities of schoolchildren in physical education and sports.

The next step in our study was to determine the gender type of personality of the respondents. To address this issue, standardized testing was conducted according to Sandra Bem's "Masculinity – Femininity" method. The questionnaire she proposed (BSR) is one of the most widely used tools in science for measuring how a person evaluates himself in terms of gender [2]. Sandra Bem examines masculinity and femininity not as an alternative, but as independent qualities. Masculine type is characterized by the most distinct qualities of such personality qualities as irreplaceability, persistence, property, propensity to protect their own views, tendency to risk, analytical composition of thinking, self-confidence, self-sufficiency. The feminine personality type is more intrinsic to such qualities as shyness, tenderness, remoteness, compassion, ability to comfort, cordiality, softness, gullibility and love for children. The masculine and feminine qualities and character traits, which are manifested in the combination of traditionally male and female characteristics in one person, are

equally inherent in the androgynous personality type [2].

Applying the technique of S. Bem, it was found that there are a small number of "pure" psychological types that determine masculinity and femininity. The overwhelming majority of boys and girls, regardless of age, have IS androgynous personality type. Among 332 young men, 93,7% have an IS indicator of the androgynous type. Only 5,2% of boys have a gender identity of the masculine type and 1% are characteristics of the feminine type. Among the 360 girls – 71,8% are related to the androgynous personality types, 28,2% – to feminine, 1,1% of girls have masculine characteristics. Considering the general data that was obtained when determining the main IS index of respondents, but the fact that the overwhelming majority of schoolchildren was attributed to androgynous personality types, for more detailed information, we first conducted a cluster analysis of the IS Masculinity – feminine test. According to its results, three clusters were obtained which fully reflect all the values of the IS parameter under study. Thus, all respondents, androgynous ($-1 < IS < 1$) psychotype, entered the first cluster. Their number was 51,02% of the total number of respondents. The second cluster included respondents with masculine psychotype ($IS < -1$) and respondents with androgynous with signs of masculine psychotype ($-1 < IS < -0,46$). Their number amounted to 15,72% of all respondents. By the third cluster, the respondents included feminine and androgynous psychotypes with feminine signs ($0,58 < IS < 1,86$). Their number was 33,26% of respondents. We considered the groups of respondents with different levels of need for achievement relative to falling into the corresponding cluster (Table 3–8). According to the results of the study, the following differences and peculiarities of the relationship between the general level of the need to reach schoolchildren of different age groups and their belonging to the psychological gender. Among schoolchildren of 5–7 grades, more boys than girls have a higher level of need to achieve. Most of them are representatives of the masculine psychotype. In children of this age the average level of the need to achieve prevails. For the most part – these are representatives of the androgynous psychotype. Girls 11–13 years old with a high level of need to achieve most have feminine qualities of character (Table 3, 4).

Table 3
Level of need to achieve success of respondents according to the psychological type (boys, 11–13 years, n=105)

Level classification	n	%	IS androgynous type		IS masculine type		IS feminine type	
			n	%	n	%	n	%
– high	20	18,10	13	19,12	4	22,22	3	15,79
– average	68	64,76	44	64,70	10	55,56	14	73,68
– low	17	17,14	11	16,18	4	22,22	2	10,53
	105	100	68	100	18	100	19	100

Table 4
Level of need to achieve success of respondents according to the psychological type (girls, 11–13 years, n=146)

Level classification	n	%	IS androgynous type		IS masculine type		IS feminine type	
			n	%	n	%	n	%
– high	23	15,75	4	7,69	2	50,00	17	18,89
– average	110	75,34	44	84,62	2	50,00	64	71,11
– low	13	8,91	4	7,69	0	0,00	9	10,00
	146	100	52	100	4	100	90	100

Table 5
Level of need to achieve success of respondents according to the psychological type (boys, 14–15 years, n=145)

Level classification	n	%	IS androgynous type		IS masculine type		IS feminine type	
			n	%	n	%	n	%
– high	28	20,00	13	15,48	10	23,81	5	26,32
– average	94	64,14	58	69,04	27	64,29	9	47,36
– low	23	15,86	13	15,48	5	11,90	5	26,32
	145	100	84	100	42	100	19	100

Table 6
Level of need to achieve success of respondents according to the psychological type (girls, 14–15 years, n=109)

Level classification	n	%	IS androgynous type		IS masculine type		IS feminine type	
			n	%	n	%	n	%
– high	24	21,10	10	18,18	6	28,57	8	24,24
– average	73	67,89	43	78,18	11	52,38	19	57,58
– low	12	11,01	2	3,64	4	19,05	6	18,18
	109	100	55	100	21	100	33	100

For boys of 14–15 years, the number of respondents with masculine type increases from 17% to 28%. The average level of need for achievement are boys with masculine and androgynous qualities of character. The high level of need for achievement in most is inherent in masculine youths (Table 5). In girls of 14–15 years, the number of those who belong to the masculine type increases from 3% to 19% and the number of feminine type schoolgirls is halved: from 61% to 30,3%. In girls of this age, the average level of need for achievement prevails. Most of them have IS with androgynous type. A high level of need for achievement is also to a large extent schoolchildren with androgynous traits of character, and a low level – with feminine ones (Table 6).

In high school students, the picture changes somewhat: the number of boys and girls with a high level of need for achievement increases. Boys – attributed to the masculine psycho, girls – to feminine. Among girls of the senior classes the middle and high levels of need for achievements prevail. Most of them have IS of androgynous and feminine type (Table 7, 8).

Conclusions / Discussion

Analysis of various scientific positions indicates that recently it has been customary in science to clearly distinguish between constitutional and sociocultural aspects in distinguishing between male and female, linking them with the concept of gender. On the distinction between the concepts of "gender" and "sex", it is worth noting that the first concept is the biological difference between a man and a woman, while gender is a social [5]. Gender is different from sex, because it represents the characteristics of the personality behavior, components, and is not a homogeneous entity. Recognition for femininity and masculinity, as personal characteristics of independence and the possibility of combination in one person, allowed to move away from the biological opposition of male and female and go to sex-role types [19]. Let us turn to the results of authoritative scientific research on this issue. According to the observations of E. P. Ilyina, the need for physical activity in men is higher than in girls. Moreover, in physical education classes, highlighting students in grades 1–11 with high, medium and low levels of physical activity,

he found highly active among young people, and low active among young women [5]. As illustrated by the data of I. V. Groshev, the positive attitude of schoolchildren to pursuing sports with age is somewhat reduced, but not very significant, which gives the right to affirm a steady interest in sports during the whole period of study [4]. Most psychologists studying the genesis of psychological sex, state role preferences already in the second year of life. Without a doubt, with age, these preferences develop significantly and deepen in the representatives of both sexes. In support of this, we refer to the conclusions of I. G. Kelishev, who, studying the interest of secondary school students in physical education lessons, individual exercises and various sports, reveals a number of trends. In particular, he points to the dependence of a positive attitude to the lessons of physical culture on age: it decreases markedly among senior pupils. This is especially pronounced in women. [4]. Studying the motive of achievement in men and women, D. Spence and R. Helm-rach focused on three areas – improvement, competition and achievement of results. In the analysis of the student sample, they found that women are dominated by the motivation for achieving the result, and for men – improvement and competition. In other groups of subjects (athletes, businessmen, psychologists), the differences between men and women in the motivation to achieve results and improvement were lower, but in terms of competition, they remained statistically significant. Scientists also noticed that in men the motive of competition is significantly higher than that of women [4]. Exploring the psychosocial adaptation of the personality of a teenage girl, A. Miliakov notes that the need for achievement is one of the basic needs for a complex of fundamental human needs: self-development – self-affirmation – self-esteem, the effective development of which determines the level of psychosocial adaptation. The scientist emphasizes that the need for achievement is manifested as a desire to compete with oneself in achieving more significant results, as a general desire from improvement in all areas of activity to experiencing success in any activity that is significant to a person [11]. So, as a result of a theoretical analysis of the sociological and psychological-pedagogical literature, according to the results of a scientific experiment, it was proved

Table 7
Level of need to achieve success of respondents according to the psychological type (boys, 16–17 years, n=53)

Level classification	n	%	IS androgynous type		IS masculine type		IS feminine type	
			n	%	n	%	n	%
– high	14	26,42	4	12,90	7	43,75	3	50,00
– average	36	67,92	26	83,87	7	43,75	3	50,00
– low	3	5,66	1	3,23	2	12,50	0	0,00
	53	100	31	100	16	100	6	100

Table 8
Level of need to achieve success of respondents according to the psychological type (girls, 16–17 years, n=80)

Level classification	n	%	IS androgynous type		IS masculine type		IS feminine type	
			n	%	n	%	n	%
– high	16	20,00	5	15,15	1	100,00	10	21,74
– average	52	65,00	25	75,76	0	0,00	27	58,70
– low	12	15,00	3	9,09	0	0,00	9	19,56
	80	100	33	100	1	100	46	100

that in the age aspect there are quite significant differences between the levels of the need to achieve success for boys and girls. This indicates age-related changes in targets and needs, thanks to which schoolchildren achieve their life goals. For the first time, a cluster analysis of the IS parameter of the test by S. Bem "Masculinity – Femininity" was conducted and differences in the level of need in the achievements of schoolchildren of different age groups were established. According to the results of the study, the features of the relationship between the general level of the need to reach schoolchildren of different age groups and their belonging to the psychological sex were revealed. Also, a comparative analysis was made of the level of need for success among schoolchildren who are engaged in and are not engaged in grade.

Thus, summing up the above, it should be noted that the study of gender differences and differences in the field of physical culture and sports is the basis for systematization of data on

the gender approach in education, the definition of the limiting and stimulating factors that influence the formation of the individual physical culture of persons with different psychological symptoms sex. The obtained results give us the right to assert that in order to formulate a certain strategy for attracting young people to systematic physical education, studying the needs, interests, motives, value orientations in the field of physical culture, their relation to motor activity, one can not focus only on one of the indicators of biological or psychosocial systems, it is necessary to take into account not only the physiological, but also the morpho-functional features of schoolchildren, but also the entire complex of biosocial personality traits, a gender approach to the process of school physical education.

Our further research will focus on the identification of gender specifics in the formation of value orientations of young people in the field of physical culture and sports.

Conflict of interests. The authors declare that no conflict of interest.

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

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Received: 11.07.2018.

Published: 31.08.2018.

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Role and importance of choreography in gymnastic and dance sports

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Choreographic component is mandatory for the construction of competitive programs in gymnastic and dance sports, and when presenting an assessment for the performed composition, choreography is one of the criteria, according to one of the types of training in these sports there is choreographic.

Purpose: *the establishment of the role of choreography in the training of athletes in gymnastic and dance sports, and its importance in the evaluation of competitive activities.*

Material & Methods: *for the conduct of this study, the following methods were used: theoretical – analysis and generalization of literary sources; sociological – questioning. The study was conducted with specialists who develop gymnastic and dance sports. In the questionnaire, experienced trainers in sports aerobics, cheerleading and acrobatic rock and roll took part in the number of 24 respondents (8 from each of the presented sports). An important aspect in the preparation of successful athletes in gymnastic and dance sports is the rational combination of different types of training in the multi-year training process.*

Results: *because of the weak theoretical basis in these sports there is a lack of research on this issue, indisputably practitioners have a question about the degree of influence of the choreography on the final result, and the inclusion in the training process of the necessary amount of its funds. The conducted research has allowed to generalize answers of respondents to questions of the questionnaire on the role and significance of choreography when building a training process with athletes in gymnastic and dance sports.*

Conclusion: *obtained results do not indicate that today choreography is an integral component of both the training process and the competitive activity. But in each of the sports presented there is an ambiguous attitude of practitioners to the choreographic preparation and inclusion of its resources in the training process.*

Keywords: *gymnastic, dance sports, choreographic training.*

Introduction

Recently, the group of difficult-coordinating sports, in which competitive programs are performed for musical accompaniment, has received its rapid development. This group includes acrobatic rock and roll, sports dances, cheerleading, aerobics (aerobic gymnastics) and other types of gymnastics. These kinds of sports are components of the world sports and recreation industry, which in turn develops in Ukraine [13]. The perfection of the exercises has an appearance for these kinds of sports, which certainly influences the promotion of a new contingent to practice..

Each of these types of sports activities has its own characteristics, both in the construction of competitive programs, mandatory requirements for the components of competitive programs, evaluation criteria, and as part of athletes competing [5; 6; 12]. But there is also an integral component that combines these sports and this component is choreography.

In the training process, choreography in the represented sports is one of the types of training, and in competitive activity when evaluating athletes' performances, choreography is one of the evaluation criteria [2]. So, due to the inclusion in the training process of the means of choreography, the skill of athletes to perform exercises increases, in turn, influences the final result of their competitive evaluation.

The process of development and formation of these kinds of sports is necessarily connected with the constant complication of competitive exercises, since with the increase of sportsmanship an athlete has his own "handwriting" based on the school of movements [4; 8].

Modern competitive programs in gymnastic and dance sports require the development of leading physical qualities and functional capabilities from an athlete and is a synthesis of acrobatic exercises, gymnastics and choreography. Performing exercises primarily requires proper posture, balance, movement dynamics and graceful execution of movements [1].

Sports programs at competitions should be diverse in construction and structure, and reflect the balance between elements of complexity (in gymnastic forms) or basic figures and acrobatic elements in dance sports, which are combined with each other in a stylistically colored dance choreography.

It is also of great significance in constructing programs that makes sense, the dynamics of the performance of elements and connections, the rhythm and style of musical work, the costumes of athletes, etc. [10; 14]. So, thanks to the harmonious combination of all the components, the emotional color and the style of execution, the program becomes entertaining and bright, in turn gives an advantage in evaluating the performances of each athlete or the entire team..

At this stage of the development of sports that are in the stage of its formation, the question of the rationality of the combination of training components for athletes is definitely becoming a coach before the trainer [7].

So, despite the fact that some gymnastic and dance sports are on the path to their development and the formation of the theoretical basis has no logically completed and scientifically sound system of many years of training of athletes. In particular, there is a lack of information about the significance of choreography in the development of sporting skills in these types of sports. Therefore, there is a need to supplement already existing materials with regard to the value of choreography in each of the sports represented.

Relationship of research with scientific programs, plans, themes. The work performed was carried out in accordance with the Consolidated Plan of Research in the Field of Physical Culture and Sports for 2011–2015. On topic 2.6 "Theoretical and methodological foundations of improving the training process and competitive activity in the structure of long-term training of athletes" (state registration number 0111U001168) and the initiative theme of the department of dance sports, fitness and gymnastics "Theoretical and methodological foundations for the development of system-forming components of physical culture (sports, physical recreation, fitness)" for 2017–2020.

Purpose of the study: the establishment of the role of choreography in the training of athletes in gymnastic and dance sports, and its importance in the evaluation of competitive activities.

Objectives of the study: 1. To lead the analysis of literary sources on the importance of choreography in the training process and the competitive activities of athletes in gymnastics and dance sports. 2. According to the sociological method of research (questioning) to determine the attitude of specialists to the value of choreographic preparation, the inclusion of its funds in the training process of athletes.

Material and Methods of the research

The study was based on an analysis of the regulations of the All-Ukrainian competitions in acrobatic rock and roll, cheerleading and sports aerobics. 24 specialists took part in the survey (8 each from acrobatic rock and roll, cheerleading and sports aerobics).

To conduct this study, the following methods were used: theoretical analysis and generalization of literary sources and the sociological method of research (questioning).

Results of the research

At the present stage of development of gymnastic and dance sports, competitive compositions are a synthesis of technique and aesthetics of performing a dynamic complex of complex coordination exercises [12].

The training of qualified athletes in gymnastic and dance sports should certainly have stages of many years of training and only a rational combination of all components of sports training during all stages leads to the desired result. At each stage, starting with the initial, an essential condition

for the training of athletes is the inclusion of choreography in the training process [9]. The value of choreographic training with each stage of many years of training will certainly grow, so that, reaching the highest point of athletic preparedness, athletes demonstrate compositions that represent a fine line of art and sport.

Speaking about the basis of choreographic training in gymnastic and dance sports, many authors primarily refer to the classical exercise, the school of ballet [4; 11]. The entire system of classical exercise is built on appropriately selected exercises that are systematically repeated and gradually become more complex. In the process of their implementation, the body acquires strength and flexibility, and movements become graceful, plastic and aesthetically complete [3].

It is also impossible not to touch upon the issue of aesthetic abilities and musical awareness in preparing athletes in these sports, because one of the criteria for deriving a final assessment of the composition done at competitions is the ability of an athlete to display the rhythmic structure of movements. And these abilities are developed in the process of choreographic training. Because the choreography of the program (or dance composition) is a physical reflection of the musical work.

The musical accompaniment of exercises in gymnastic and dance sports is diverse. These are excerpts from ballets and symphonies, and small works (preludes, sonatas; music of the song genre: jazz, folk, etc.). The use of such a wide range requires athletes to possess various choreographic forms [1].

The main content of the tools used in the lessons of choreography, are movements of classical, folk and ballroom dance. Plastic movements are distinguished into an independent group. Of great importance is the rhythm, which teaches the ability to coordinate their movements with music. The next group of means is pantomime, and it is an integral part of educating the expressiveness of movements. And finally, specific groups of movements, such as acrobatic, elements of sports-gymnastic style, including building, rebuilding, applied and general developing exercises [11].

However, for an athlete to succeed in each of the gymnastic and dance sports, a strictly metered inclusion of the means of choreography is necessary, since excessive use of the means of choreography slows down the learning process and prevents the correct performance of certain elements of the sport from being displayed.

In these sports, the elements of technology and elements of choreography are closely combined, and often the elements of choreography are evaluated by the judges as a technical and choreographic component of the program. But in each sport, their combination is different.

Another reason for the uncertainty of the content of choreography in the training process in these sports is their history of origin. Referring to the sources, we can say that some of the sports considered in the article, have received their development in other sports or recreational activities, while others go to the dance art with their roots.

Until today, among the specialists developing various types

of gymnastic and dance sports there is an open discussion question, what constitutes the essence of these sports – performing a complex of acrobatic and gymnastic exercises accompanied by music, or performing dance compositions with the inclusion of acrobatic and gymnastic elements. At the same time, everyone agrees that the aesthetic component of program implementation is crucial in evaluating the complex competitive programs of qualified athletes in any of the sports presented.

So, to solve this question, we analyzed the answers of specialists to the questionnaire questions, where questions concerning the attitude of specialists to choreography in the preparation of athletes, the inclusion of its funds in the training process and their dosage were considered.

The first question considered the attitude of coaches to saying that choreographic training is closely related to technical training, therefore it should be an integral and important part of the training process.

87,5% of sports aerobics and acrobatic rock and roll experts agreed with this opinion, and 12,5% of respondents in these sports answered that they partially agreed with this opinion.

Cheerleading specialists have a different opinion – 75% of the coaches agreed with this statement, and 25% – partially.

To the question: "Do I need to use a separate choreography activity in a training process with beginners?" 75% of respondents in aerobic exercise indicated that in the training process with beginners they conduct a separate choreography class; 25% of respondents answered no, but they include elements of choreography in the training process.

In acrobatic rock and roll, 37,5% of coaches indicated that they were conducting a separate choreography lesson, and 50% of the respondents did not answer, but they included elements of choreography in the training process, and 12,5% answered that they did not use the funds Choreography in the training process with beginners.

In cheerleading, 12,5% of the coaches answered that they begin a separate lesson in choreography with beginners; 75% of coaches do not conduct, but include elements of choreography in training; 12,5% of respondents answered that in training at the initial stage in this kind of sports, choreography classes are not included.

The next question was that choreographic training takes a leading place in the formation and development of pupils' creative abilities.

2,5% of sports aerobics and cheerleading experts gave a positive answer; 25% believe that it is only through choreographic preparation that the creative abilities of students develop; 12,5% of respondents had their own answer.

In acrobatic rock and roll, 50% of respondents answered that choreographic training occupies one of the leading places in the formation and development of creative abilities of pupils; 50% disagreed with this opinion.

Next, the analysis of the specialists' response to the question: "Does the athlete affect the basic choreographic prepared-

ness for the speed of mastering with complicated technical motor activities?"

In sports aerobics, 87,5% of respondents said that the presence of basic choreographic training accelerated their mastery of complex motor activities, while 12,5% answered that the time for mastering technical actions depends not only on the availability of basic choreographic preparedness.

In acrobatic rock and roll, 62,5% of coaches answered this question that for athletes to master complex technical actions, they must have basic choreography; 25% indicated that not always; the answer of 12,5% was the statement that it does not matter.

In cheerleading, 75% of respondents agreed that the presence of basic choreographic training affects the speed of mastering the complex techniques of this sport; 12,5% of respondents indicated that not always; 12,5% of respondents answered no.

To the question that the basis of motor activities of a sport is based on the basics of classical dance, 50% of sports aerobics experts agreed with this opinion; 50% had a different opinion.

In acrobatic rock and roll 25% of respondents answered positively; 62,5% partially agreed with this opinion, responding that classical dance is indeed the basis, but in their sport they pay more attention to modern choreography; 12,5% of respondents did not agree with this opinion..

In cheerleading, 37,5% of responses were positive; 50% partially agreed; 12,5% of respondents answered negatively.

To the question: "Can choreographic training be included in basic types of training for athletes in gymnastic and dance sports?", 12,5% of sports aerobics specialists agreed with this opinion; 87,5% of respondents consider choreographic training as an auxiliary type.

In acrobatic rock and roll, 12,5% of respondents gave a positive answer; 75% of the respondents do not quite agree with this statement; 12,5% consider that choreographic training can not be attributed to the main types of preparation.

In cheerleading, 50% of the responses were positive; 37,5% neutral; 12,5% of coaches believe that this is an auxiliary type of training for athletes in this sport.

Conclusions / Discussion

To date, there is a significant divergence of opinion of specialists in gymnastic and dance sports on the role and place of choreography in the training process of athletes. Due to the weak theoretical basis in the studied sports, there is not enough research on this issue. Practitioners in the preparation of athletes raises the question of the degree of influence of choreography on the final result and the inclusion in the training process of the required amount of its funds. The study made it possible to summarize the respondents' answers to questions about the importance of choreography when building a training process with athletes in gymnastic and dance sports.

As a result of the analysis of scientific and specialized literature on gymnastic and dance sports and competition regulations, it was found that choreography influences the final result of competitive activity and directly affects the assessment that an athlete gets when performing a competitive program. According to this prerequisite for the preparation of athletes in gymnastic and dance sports is the inclusion of choreography in the training process.

After analyzing the answers of respondents in gymnastic and dance sports, an ambiguous attitude of practitioners to choreographic training and the inclusion of its resources in the training process of athletes in the sports presented were es-

tablished. As we can see, according to the results of the survey, the majority of trainers agree that choreographic training is very important and an integral part of the training process of their pupils, however, regarding the analyzed sports, we observe a significant divergence of opinions of the respondents. This fact indicates that these sports require a more detailed study of this issue and the search for new ways to solve it.

Prospects for further research: to analyze the performances of the best athletes of the world in their categories, to identify the content of elements of choreography in competitive programs and find out their impact on the final assessment.

Conflict of interests. The authors declare that no conflict of interest.

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

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Received: 12.07.2018.

Published: 31.08.2018.

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

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

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

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

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

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

Introduction

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

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

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

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

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

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

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

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

Material and Methods of the research

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

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

Results of the research

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

The arising contradictions between physical activity and the

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

Conclusions / Discussion

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

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

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

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

Conflict of interests. The authors declare that no conflict of interest.

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

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Received: 14.07.2018.

Published: 31.08.2018.

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Improvement of special physical readiness of the Juvenal category athletes from acrobatic rock'n'roll using functional training tools

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Purpose: to develop and experimentally substantiate the method of improving the special physical readiness of the athletes of the Juvenal category with acrobatic rock'n'roll using the means of functional training.

Material & Methods: theoretical analysis and generalization of data from special scientific and methodological literature, pedagogical observation, pedagogical testing, pedagogical experiment, methods of mathematical statistics. The survey involved 40 athletes (20 sports pairs of the Juvenal category).

Results: the use of the means of functional training of the experimental technique has improved the level of special physical readiness of athletes.

Conclusion: the positive effect of the means of functional training in the components of speed, power and speed-strength training on the dynamics of the level of special physical readiness of athletes from acrobatic rock'n'roll.

Keywords: acrobatic rock'n'roll, special physical readiness, functional training.

Introduction

Modern trends in the development of acrobatic rock'n'roll as a complex co-ordinated sport are characterized by an increased number of varieties of choreographic movements in the direction of style, increased intensity of basic exercises, acrobatic elements, structure and content of competitive programs in accordance with the requirements of the Regulations of the World Rock and Roll Confederation (WRRRC, 2016) [7; 11].

Scientists (G.P. Artemyeva, N.P. Bateeva, P.N. Kizim, L.S. Lutsenko, A. Ya. Mullagildina, V.S. Terekhov) noted that the most important importance in training athletes for acrobatic rock'n'roll has a level of development of high-speed, power and speed-strength abilities, morphological parameters, biomechanical performance of the machinery, efforts that affect the performance of the basic movement and acrobatic elements (figures), both during contact execution and unsupported movement.

The research of special motor fitness and physical qualities of rock'n'roll athletes was conducted by L.S. Lutsenko, A.Ya. Mullagildina. The features of morphological parameters were investigated by G.P. Artemyeva. The biomechanical characteristics of the technique for performing the basic main course were investigated by P.N. Kizim and V.S. Terekhov. Biomechanical indicators of the technique of performing acrobatic elements (figures) in the unsupported movement of a partner of a sports pair were explored by N.P. Bateeva.

The same time, the influence of indicators of the level of speed, speed-strength and strength and power qualities, as well as the level of general and special endurance on the special physical preparedness of the rock'n'roll athletes category Juvenal remains unclear, which is extremely important for in-

creasing the efficiency of their training [10; 13; 15].

Performing basic rock'n'roll dance movements and acrobatic figures requires the manifestation of individual motor qualities, both during the training process and in competitive activities. It is important to determine which motor quality after loading is more affected by the technique of performing basic rock and roll dance movements and acrobatic figures. This will allow to develop a combination of different motor qualities and perfection of the elements of the technique of basic rock'n'roll movements, acrobatic figures and correction of the training process [8; 12; 14; 16].

The analysis of special scientific and methodological literature showed the problems of the level of special physical fitness of athletes of acrobatic rock and roll at the stage of preliminary basic training, is the relevance of this study.

Relationship of research with scientific programs, plans, themes. The work is carried out in accordance with the Consolidated Plan of research work in the field of physical culture and sports for 2016–2020. On the topic: "Psycho-sensory regulation of the motor activity of athletes of situational sports" (No. 0116U008943).

Purpose: to develop and experimentally substantiate the method of improving the special physical readiness of the athletes of the Juvenal category with acrobatic rock'n'roll using the means of functional training.

Material and Methods of the research

Methods of research-theoretical analysis and generalization of scientific and methodical literature; pedagogical observations; special pedagogical testing; pedagogical experiment;

medical and biological research; methods of mathematical statistics.

To identify the dynamics indicators characterizing the special physical preparedness of rock'n'roll athletes during the annual macrocycle at the beginning of the pedagogical experiment and at the end of it we tested the level of speed, speed-strength and strength qualities, as well as the level of general and special endurance of those whose involved.

Athletes from the Juvenale category from the acrobatic rock'n'roll control and experimental groups were engaged in the traditional curriculum, where: 25% and 43,7% of total time were allocated to the general physical training and special physical training respectively, 31,3% were allocated to technical training.

In the course of the pedagogical experiment using the traditional method, the time allocated for physical training in the control group was distributed as follows: 17% of the total time was allocated for strength training, 33% for speed-strength training, 45% for the development of general and special endurance, and coordination abilities 5%.

The time allotted for physical training in the experimental group on the basis of the experimental methodology was distributed as follows: 27% of the total time was allocated for strength training, 46% for speed-strength training, 20% for general and special endurance development, to improve flexibility and coordination abilities 7%.

Athletes of the Juvenale category from the acrobatic rock'n'roll of the control and experimental groups were trained under the same conditions with the same program. The difference was only in the different distribution of physical training. The main difference between the experimental method and the traditional method was the use of functional training at the end of the main part of the class (Figure 1).

The training of the Juvenal athletes from the acrobatic rock'n'roll of the experimental group was aimed at improving the strength and speed-strength qualities with the use of the functional training of the experimental technique.

Physical training of the Juvenal category athletes from the acrobatic rock'n'roll of the control group was aimed at increas-

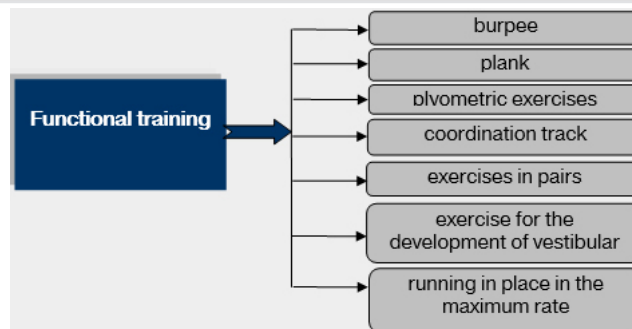


Figure 1. Means of functional training of the experimental methodology for improving the special physical preparedness of athletes of the category Juvenal from acrobatic rock'n'roll

ing the level of development of general and special endurance according to the traditional method of the training process.

Results of the research

At the beginning of the pedagogical experiment, athletes, both in the experimental and in the control groups, were relatively equal in terms of physical preparedness (Table 1, 2) [9].

By the coefficients of variation in the male partners of the sports pair of the experimental group, the uniformity of the indices in eight tests of physical preparedness is traced (bending and extension of the arms in the rest lying on the floor, raising the legs in the vise on the gymnastic wall, standing long jump, running speed on the place, lifting the trunk from the supine position, tilt forward from sitting position, VC) from $V - 5,5\%$ to $V - 15,9\%$. In two tests, the indicators were of an average degree of uniformity (dynamometry: right hand $V - 25,0\%$, left hand $V - 28,5\%$).

By the coefficients of variation in the female partners of the sports pair of the experimental group, the uniformity of the indices in seven tests of physical preparedness is traced bending and extension of the arms in the rest lying on the floor, raising the legs in the vise on the gymnastic wall, running speed on the place, lifting the trunk from the supine position, tilt forward from sitting position, VC) from $V - 3,9\%$ to $V - 15,4\%$. In three tests, the indicators were of an average degree of uniformity (standing long jump $V - 16,3\%$; dynamometry: right

Table 1
Indicators of fitness level of sports couples (male partner+female partner) of the category Juvenal from acrobatic rock'n'roll (EG, n=20)

No. i/o	Test	Male partner indicators				Female partner indicators			
		\bar{X}	σ	m	V, %	\bar{X}	σ	m	V, %
1.	Flexion and extension of hands in the rest lying on the floor (number of times)	23,8	3,79	1,26	15,9	15,5	1,72	0,6	3,9
2.	Lifting the legs in the vise on the gymnastic wall (number of times)	27,1	3,98	1,33	14,6	23,5	3,44	1,1	14,6
3.	Jump upwards (cm)	31,8	4,42	1,47	13,9	31,42	5,11	1,7	16,3
4.	Running speed on the place for 10 s. (Number of steps)	28,1	2,69	0,9	9,6	26,2	3,12	1,04	11,9
5.	Standing long jump (cm)	172,4	9,59	3,2	5,5	155,8	5,12	1,7	3,3
6.	Lifting the trunk from the supine position for 60 s (times)	41,4	4,5	1,5	10,8	37,8	2,53	0,84	6,7
7.	Tilt forward from sitting position (cm)	10,8	1,69	0,6	15,6	14,7	2,26	0,8	15,4
8.	Dynamometry: right hand (kg)	21,6	5,4	1,8	25,0	17,8	4,16	1,4	23,4
9.	Dynamometry: left hand (kg)	21,4	6,11	2,03	28,5	16,8	3,16	1,05	18,8
10.	VC	26,1	3,54	1,18	13,5	23,3	2,71	0,9	11,6

hand V – 23,4%; left hand V – 18,8%).

By the variation coefficients of the male partner sports pair of the control group, the uniformity of the indices is observed in the five physical preparedness tests (lifting the legs in the vise on the gymnastic wall, jump up, running speed in place, jumping in length, lifting the trunk from the lying position) from V – 5,5% to V – 15,3%. In two tests, the indices were of an average degree of homogeneity (flexion and extension of the arms in the rest lying on the floor, V – 17,6%, inclination forward from the sitting position V – 19,2%). In three tests (dynamometry: right hand V – 48,2%, left hand V – 43,9%, VC V – 31,1%), the group was not homogeneous.

By the coefficients of variation in the female partners of the sports couple of the control group, the uniformity of the indices in seven physical preparedness tests is observed (lifting the legs in the vise on the gym wall, leaping up, running speed in place, leaping in length, lifting the trunk from the prone position, tilting forward from the sitting position; VC) from V – 4,4% to V – 13,9% in three tests the indices were of medium degree of homogeneity (flexion and extension of the arms in the rest lying on the floor, V – 16,4%; dynamometry: right hand V – 21 8 %, left hand V – 25,0%).

The average group indicators of physical fitness testing of athletes EG and CG show a minimal difference in the results. The greatest difference in the result among partners is observed in the average indicators of the test "Dynamometry: right hand, kg" (4 kg, 15,6%). The slightest difference in their results is observed in the average test scores: "Flexion and extension of the arms in the rest lying on the floor, kil-in time" (0,1 times, 0,4%); "Lifting the legs in the vise on the gymnastic wall (keel-at times)" (0,1 times, 0,4%).

The greatest difference in the result among female partners is observed in the average indicators of the test "Dynamometry: left hand, kg" (4,4 kg, 26,2%). The slightest difference in their results is in the average test scores: "Jump up (cm)" (0,12 cm, 0,4%).

To monitor the dynamics of the level of special physical fitness of the Juvenaly category from acrobatic rock'n'roll in the process of the pedagogical experiment, testing of various components of special physical preparedness was used: speed, strength, strength and level of endurance development. To determine the nature of the impact of training aimed

at developing the special qualities of Juvenaly athletes from acrobatic rock'n'roll, were tested indicators. Tests: T1, T2, T5 – used to determine the level of development of speed-strength components; test T6 was used to determine the level of development of power components; To determine the level of development of special endurance, we used tests: T3, T4, T7 (Table 3). The degree of influence of the means of functional training of the experimental methodology aimed at developing the special qualities of the athletes of the Juvenal category from acrobatic rock'n'roll EG is shown in Table 3.

Testing Juvenal category athletes from the acrobatic rock'n'roll at the end of the experiment revealed that the special physical readiness indicators significantly increased in the experimental group under the influence of the functional training experimental procedure. Thus, in the EG, the indices of the special physical preparedness of the male partners of a sports couple from acrobatic rock'n'roll after the pedagogical experiment in the first test "2 somersaults forward, 1 somersault back, "tour" for 30 seconds" tour "for 30 s (number of times)" amounted to 5,47, which exaggerated the average result by 0,9 times (t=6,05, p<0,05). The average performance of the test "Performing the main move in 20 s (number of times)" improved by 0,67 times (t=6,9; p<0,05).

Indicators of special physical preparedness of female partners of a sports couple with acrobatic rock'n'roll after the pedagogical experiment in the performance of the first test "2 somersaults forward, 1 somersault back, "tour" for 30 seconds" tour "for 30 s (number of times)" was 5,72, which exaggerated the average result is 1,2 times (t=5,14, p<0,05). The average result of the test "Performing the main move in 20 s (number of times)" improved from 11,44 to 11,67 (t=3,02; p<0,05).

The indicators of the special physical preparedness of the sports couple (male partner+female partner) from acrobatic rock'n'roll after the pedagogical experience in the performance of the test "Lower change with the rotation of the partner at 540° (number of times)" on average increased by 1,1 times (t=3,45, p<0,05). The average performance of the test "Top change with the turn of the partner at 720° in American spin (number of times)" improved by 1,1 times (t=3,6, p<0,05). The average performance of the test "Lower, upper change, tour anler (in the air) for 360° (number of times)" improved by 0,6 times (t=3,04; p<0,05). The average performance of the test "Lower, upper change, the partner jump up

Table 2
Indicators of fitness level of sports couples (male partner+female partner) of the category Juvenal from acrobatic rock'n'roll (CG, n=20)

No. i/o	Test	Male partner indicators				Female partner indicators			
		\bar{X}	σ	m	V, %	\bar{X}	σ	m	V, %
1.	Flexion and extension of hands in the rest lying on the floor (number of times)	23,9	4,2	1,4	17,6	15,2	2,49	0,8	16,4
2.	Lifting the legs in the vise on the gymnastic wall (number of times)	27,0	2,83	0,94	10,5	24,4	3,17	1,47	13,9
3.	Jump upwards (cm)	32,2	4,92	1,64	15,3	31,3	4,2	1,4	13,4
4.	Running speed on the place for 10 s. (Number of steps)	28,5	2,84	0,94	0,9	26,8	3,18	1,06	11,8
5.	Standing long jump (cm)	168,9	9,3	3,1	5,5	156	6,9	2,9	4,4
6.	Lifting the trunk from the supine position for 60 s (times)	40,7	3,2	1,06	7,8	36,5	3,63	1,2	9,9
7.	Tilt forward from sitting position (cm)	11,1	2,13	0,8	19,2	15,7	2,16	0,9	13,7
8.	Dynamometry: right hand (kg)	25,6	12,5	4,2	48,2	14,2	3,05	1,01	21,8
9.	Dynamometry: left hand (kg)	24,0	10,54	3,5	43,9	12,4	3,1	1,03	25,0
10.	VC	30,5	9,5	3,16	31,1	20,5	2,6	0,9	12,6

Table 3

Dynamics of changes in the indices of special physical readiness of the Juvenale category athletes from acrobatic rock'n'rol (EG; n=20; p=0,05)

Test SPP		$\bar{X} \pm m$		t	p
		Before experiment	After experiment		
Male partner (n=10)					
T 1	2 somersaults forward, 1 somersault back, "tour" for 30 seconds (number of times)	4,57±0,14	5,47±0,05	6,05	<0,05
T 2	Performing the main move in 20 seconds (number of times)	10,74±0,04	11,41±0,09	6,9	<0,05
Female partner (n=10)					
T 1	2 somersaults forward, 1 somersault back, "tour" for 30 seconds (number of times)	4,52±0,17	5,72±0,16	5,14	<0,05
T 2	Performing the main move in 20 seconds (number of times)	11,44±0,07	11,67±0,03	3,02	<0,05
General (joint) execution in a pair (n=20)					
T 3	Lower change with the rotation of the partner at 540° (number of times)	5,3±0,27	6,4±0,17	3,45	<0,05
T 4	Top change with the turn of the partner at 720° in American spin (number of times)	4,2±0,26	5,3±0,16	3,6	<0,05
T 5	Lower, upper change, tour anler (in the air) for 360° (number of times)	4,5±0,17	5,1±0,1	3,04	<0,05
T 6	Lower, upper change, the partner jump up with the support of the partner's hands (number of times)	6,4±0,17	7,2±0,14	3,63	<0,05
T 7	Performing competitive program in nonstop (number of times)	1,38±0,04	1,79±0,05	6,4	<0,05

with the support of the partner's hands (number of times)" improved by 0,8 times ($t=3,63$, $p<0,05$). In the performance of the test "Performing competitive program in nonstop (number of times)" the average indicators after the pedagogical experiment exceeded the initial indicators of the pedagogical experiment by 0,41 times ($t=6,4$; $p<0,05$).

The degree of influence of the training aimed at developing the special qualities of the athletes of the Juvenale category from acrobatic rock'n'roll CG is shown in Table 4.

In the CG, the indicators of the special physical preparedness of the male partners of a sports couple from acrobatic rock'n'roll after the pedagogical experiment in the first test "2 somersaults forward, 1 somersault back, "tour" for 30 seconds" tour "for 30 s (number of times)" was 4,9, which exaggerated the average result by 0,05 times ($t=0,1$, $p<0,05$). The average performance of the test "Performing the main move in 20 s (number of times)" improved by 0,06 times ($t=1,34$; $p>0,05$).

The indicators of the special physical preparedness of the female partners of a sports couple from acrobatic rock'n'roll after the pedagogical experiment in the performance of the first test "2 somersaults forward, 1 somersault back, "tour" for 30 seconds" tour "for 30 s (number of times)" was 4,9, which exaggerated the average result is 0,08 times ($t=0,43$, $p>0,05$). The average result of the test "Performing the main move in 20 s (number of times)" improved from 11,4 to 11,46 ($t=0,56$; $p<0,05$).

The indicators of the special physical preparedness of the sports couple (male partner+female partner) from the acrobatic rock'n'roll CG after the pedagogical experiment in the performance of the test "Lower change with the rotation of the partner at 540° (number of times)" increased by an average of 0,2 times ($t=0,86$, $p>0,05$). The average performance of the test "Top change with the turn of the partner at 720° in American spin (number of times)" improved by 0,2 times ($t=0,9$; $p>0,05$). The average performance of the test "Lower, upper change, tour anler (in the air) for 360° (number of times)" improved by 0,3 times ($t=1,1$, $p<0,05$). The average perfor-

mance of the test Lower, upper change, the partner jump up with the support of the partner's hands (number of times)" improved by 0,2 times ($t=0,9$; $p<0,05$). In the performance of the test "Performing competitive program in nonstop (number of times)" the average figures after the pedagogical experiment were at least 0,33 times the initial parameters of the pedagogical experiment ($t=0,6$; $p>0,05$).

The total positive changes in the indices of the special physical readiness of the athletes of the EG were: the partners exceeded the initial indicators of the pedagogical experiment by 8,8%; partners exceeded the initial indicators of the pedagogical experiment by 8,3%; general (joint) performance of tests in a pair exceeded the initial parameters of the pedagogical experiment on 15,4%.

The total positive changes in the indices of the special physical preparedness of the CG athletes were: the male partners exceeded the initial indices of the pedagogical experiment by 0,6%; female partners exceeded the initial indicators of the pedagogical experiment by 0,8%; general (joint) performance of tests in a pair exceeded the initial parameters of the pedagogical experiment on 4,2%.

Conclusions / Discussion

This study complements the methodology for improving the special physical preparedness of athletes, as described in the authors' works [2; 3; 5]. At the same time, in our study for the first time the obtained indices of the level of special physical preparedness of rock'n'roll athletes due to the use of the means of functional training of the experimental methodology in the training process. The use of functional training tools in the training process during the one-year macrocycle fully confirms our vision of solving the problem of improving the special physical preparedness of the Juvenale category in acrobatic rock'n'roll.

The technique of improving the special physical preparedness is developed on the basis of the use of functional training tools.

Table 4

Dynamics of changes in the indices of special physical readiness of the Juvenal category athletes from acrobatic rock'n'rol (EG; n=20; p=0,05)

Test SPP		$\bar{X} \pm m$		t	p
		Before experiment	After experiment		
Male partner (n=10)					
T 1	2 somersaults forward, 1 somersault back, "tour" for 30 seconds (number of times)	4,85±0,1	4,9±0,8	0,1	>0,05
T 2	Performing the main move in 20 seconds (number of times)	10,75±0,04	10,81±0,02	1,34	>0,05
Female partner (n=10)					
T 1	2 somersaults forward, 1 somersault back, "tour" for 30 seconds (number of times)	4,82±0,15	4,9±0,11	0,43	>0,05
T 2	Performing the main move in 20 seconds (number of times)	11,4±0,08	11,46±0,07	0,56	>0,05
General (joint) execution in a pair (n=20)					
T 3	Lower change with the rotation of the partner at 540° (number of times)	5,3±0,16	5,5±0,17	0,86	>0,05
T 4	Top change with the turn of the partner at 720° in American spin (number of times)	4,2±0,14	4,4±0,17	0,9	>0,05
T 5	Lower, upper change, tour anler (in the air) for 360° (number of times)	4,5±0,17	4,8±0,21	1,1	>0,05
T 6	Lower, upper change, the partner jump up with the support of the partner's hands (number of times)	6,6±0,17	6,8±0,14	0,9	>0,05
T 7	Performing competitive program in nonstop (number of times)	1,4±0,04	1,43±0,03	0,6	>0,05

It is established that the determining factor in raising the level of special physical preparedness is the use of a set of exercises of functional training at the end of the main part of the training process and their impact on the development of speed, strength and speed-strength qualities of rock'n'roll athletes. The minimal increase in the test scores of the Juvenal athletes in acrobatic rock'n'roll was revealed after the load in the components of special endurance in the training process increased.

The application of the developed technique allows to optimize the training process of the Juvenal category athletes from acrobatic rock and roll, to increase the efficiency of their competitive programs.

Prospects for further research should be in the search for ways to solve the problem of correcting the training process of the athletes of the Juvenal category in acrobatic rock'n'roll.

Conflict of interests. The authors declare that no conflict of interest.

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

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Received: 15.07.2018.
Published: 31.08.2018.

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Influence of health swimming lessons on the physical development of women 18–25 years old

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Purpose: determine the degree of influence of health swimming lessons on changes in the physical development of women 18–25 years of age.

Material & Methods: the study involved 30 women 18–25 years. Data collection was carried out in the physical culture groups of the Author's School of Swimming Yu. V. Bliznyuk and the Pioneer pool (public educational institution sport school for water sports Yana Klochkova). Subjects had the same swimming readiness. Applied: interrogation, testing, instrumental methods of studying the cardiovascular system. The obtained quantitative data were processed by methods of mathematical statistics.

Results: the study suggests that in women 18–25 years of health swimming exercises cause positive changes in physical development. In both groups of studied events, significant changes in anthropometric indicators and indicators of the state of the cardiovascular system. Significant improvement in indicators The most characteristic is revealed after a year of regular studies.

Conclusion: swimming exercises positively influenced the anthropometric indicators of women aged 18–25. It has been established that there have been significant improvements in the indices of the functional state of the cardiovascular system of women swimming. It was revealed that the anthropometric indices and indices of the functional state of the cardiovascular system after a year of occupations in comparison with the initial data were significantly high ($P(t) < 0,01$; $P(t) < 0,001$).

Keywords: swimming, women, indicators, body systems, physical development.

Introduction

The negative impact of modern civilization on human health is a decrease in the biologically necessary level of motor activity and an increase in the psychoemotional burden; environmental pollution; bad habits (smoking, drinking alcohol, drugs, etc.). Currently, the search for new forms of motor activity of the population is urgent, since a sedentary lifestyle entails many diseases. Recently, there has been a significant increase in attention to the means and methods of health promotion, disease prevention. The leading role in the formation of a healthy lifestyle is attributed to the optimization of human motor activity in combination with hardening, rational nutrition, appropriate rest. According to experts, physical education and sports are a preventive means of maintaining and strengthening the health and prevention of various non-communicable diseases and bad habits, and the use of physical activity and sports in order to prevent morbidity requires little additional state expenditure [7].

The simplest way to improve the healing effect of motor activity is to combine its influence with the influence of the aquatic environment.

Swimming is very popular among various forms of recreational activities. Variety, constant updating of logically built programs, high emotional background of swimming practice allows this type of health-improving activity for many decades to maintain a high rating [1; 5–7; 10].

The sanative role of swimming, in comparison with other types of physical exercises, is the versatile effect of water on the

human body, which is associated with the physical, thermal, chemical and mechanical properties of water. Staying in an aquatic environment during swimming sessions positively affects physical development, circulation, breathing and thermoregulation functions; stimulates the activity of the central nervous system and the higher nervous functions of man [2; 3]. The brightest effect of the aquatic environment is manifested in the case of deterioration of the psychoemotional state due to fatigue and functional disorders of the central nervous system. The impact of water can accelerate the formation of moving skills and recovery after tiring loads. Swimming is an effective means of preventing and treating diseases of the cardiovascular and respiratory systems. It is also shown in disorders of metabolism, posture, consequences of injuries of the musculoskeletal system, etc. [4–6].

Taking into account the literature data on the effect of swimming on the body, as well as the great popularity of swimming among various strata of the population, it can be stated that swimming is one of the most accessible and effective forms of health effects on the body that positively affects the physiological functions of the body.

According to a number of domestic and foreign authors [1; 5; 6] with regular swimming lessons, the cardiovascular and respiratory systems are improved, metabolic processes are activated, the physiological capabilities of the organism are increased, posture is improved, cheerfulness, good mood and other favorable changes are made that increase the person's capacity for action. However, their work does not provide enough scientific data on the change in the level of health and anthropometric indicators when practicing recreational swim-

ming. Insufficiency of data on positive changes in the physical development of those engaged under the influence of recreational swimming and prompted us to conduct this study [8; 11].

The relevance of the chosen topic is that the dissemination of the experience of such work meets the requirements of practice, and the information offered will help teachers, instructors, physical education methodologists, doctors, as well as self-employed to make better use of recreational swimming for health and physical readiness.

Purpose of the study: determination of the change in the physical development of women aged 18–25 under the influence of health swimming exercises.

Objectives of the study:

1. Determine the physical development of women 18–25 years of age engaged in groups of health-improving swimming.
2. Conduct a comparative analysis of changes in the physical development of the study population.
3. Develop practical recommendations for teachers on the use of recreational swimming in health groups.

Material and Methods of the research

Data collection was carried out in the physical culture groups of the Author's School of Swimming Yu. V. Bliznyuk and the pool "Pioneer" (public educational institution sport school for water sports Yana Klochkova). In our study, 30 women aged 18–25 took part, who regularly, 2–3 times a week, visit physical culture and health groups of swimming. The duration of one lesson is 45–60 minutes. By age, subjects were divided into 2 groups. The first group included women from 18 to 21 years ($n=15$), the second group included women from 22 to 25 years ($n=15$).

Subjects had the same swimming readiness. In both groups, the same set of exercises was performed on land and in water. With an equal number of repetitions, the complexity of the exercises, the amplitude of the movements, the difference was in choosing the method of swimming for the test subjects.

As is known, when teaching the swimming of adult people, first of all, the applied task of the steady mastering of the technique of one, and not necessarily sports, mode of swimming is put. Some experts also emphasize that the basis for training the swimming of an adult contingent should be modern technology of swimming, because sports methods of swimming have significant advantages over original, primarily speed of movement. Many authors argue that the fastest adult can teach you to swim on your back, breaststroke or on your side, because when swimming these methods do not necessarily make an exhalation in the water. In determining the method of swimming, age, individual abilities for mastering one method are taken into account (since adults are more capable of mastering one method of swimming). In order to establish which way of swimming will be easier to master, give the task to try to sail in known ways. Observations and fixation of various movements of hands and feet in original ways of swimming are conducted, with special attention being paid to what movements the legs perform by the subjects. If these movements resemble foot movements when swimming crawl

way, breaststroke or on their side, then the practitioner offers one of these ways of swimming for training. However, the final choice of the method remains for the practitioner, since many

Table 1
Methods of swimming that the subjects used as their main during the health training sessions

Ways of swimming	Group I (n=15)		Group II (n=15)	
	n	%	n	%
Original ways	2	13,3	4	26,7
Crawl	3	20,0	2	13,3
Backstroke	5	33,4	3	20,0
Breaststroke	3	20,0	4	26,7
Owned in 2-3 ways	2	13,3	2	13,3

people have a coordination predisposition to certain movements – in particular, to more effective performance of the foot movements with the crawl or breaststroke [9].

Subjects who participated in our study used both original and sporting methods of swimming during health training (Table 1).

In the period from October 2017 to June 2018, the level of physical development of women aged 18–25 was determined, which are engaged in recreational swimming. During the study, the physical development status of the test subjects was tested at the beginning of the experiment and after 9 months (in October 2017 – the initial indicators were taken; in June 2018, the indicators were recorded after a year of swimming). A comparative analysis of changes in the physical development of the study contingent.

During the data collection, the following methods were used: interrogation, testing, instrumental methods for studying the cardiovascular system. The obtained quantitative data were processed by methods of mathematical statistics.

Results of the research

During the study, measurements of anthropometric parameters (body length, body weight, chest circumference, waist, hips, arm biceps, hip) in both age groups were performed. The data obtained as a result of the study are given in Tables 2 and 3.

As can be seen from Table 2, under the influence of health swimming exercises, significant changes occurred in most indicators. So, after a year of regular swimming in the younger age group, we have reliable differences in the lower side of the initial data for such parameters as body weight, chest circumference, thighs, hip volume ($P(t)<0,01$) and waist ($P(t)<0,001$). Exceptions were such parameters as body length and biceps volume ($P(t)>0,05$).

A similar picture can be observed in the second age group of those engaged (Table 3).

In this age group, the parameters of body weight, chest circumference, waist ($P(t)<0,001$), thighs and hip volume ($P(t)<0,01$) significantly changed. Such an indicator, as the volume of the arm bicep, increased, but insignificantly ($P(t)>0,05$), and the body length indices remained practically unchanged ($P(t)>0,05$).

Table 2
Anthropometric indicators of the I group engaged in recreational swimming, n=15

No. i/o	Indicators of measurement	Initial data	Data after 1 year	t	P(t)
1.	Body length, cm	164,54±1,23	164,39±2,37	0,62	>0,05
2.	Body weight, kg	59,07±1,45	54,72±1,43	2,14	<0,01
3.	Circumference of the chest, cm	88,90±0,86	84,36±1,95	2,16	<0,01
4.	Waist circumference, cm	68,05±1,30	62,57±1,27	3,07	<0,001
5.	Circumference of hips, cm	96,39±1,23	91,76±1,46	2,43	<0,01
6.	Arm biceps volume, cm	25,81±1,08	27,29±2,39	0,56	>0,05
7.	Thigh volume, cm	57,52±1,06	53,36±1,11	2,77	<0,01

Table 3
Anthropometric indicators of the II group engaged in recreational swimming, n=15

No. i/o	Indicators of measurement	Initial data	Data after 1 year	t	P(t)
1.	Body length, cm	169,74±1,83	169,89±2,57	0,48	>0,05
2.	Body weight, kg	73,97±1,15	67,92±1,25	3,78	<0,001
3.	Circumference of the chest, cm	97,92±1,06	92,36±0,95	3,97	<0,001
4.	Waist circumference, cm	80,05±1,12	74,57±1,27	3,42	<0,001
5.	Circumference of hips, cm	106,39±2,03	101,16±1,46	2,17	<0,01
6.	Arm biceps volume, cm	30,81±1,08	32,29±1,39	0,87	>0,05
7.	Thigh volume, cm	59,35±1,36	54,16±1,71	2,47	<0,01

In the course of our research, two widely used in practice works of highly informative and simple indicators-heart rate and blood pressure-were also measured as the most important indicators of the functional state of the cardiovascular system (Table 4) [12].

As can be seen from Table 4, under the influence of swimming lessons, there were significant changes in all indicators of the functional state of the cardiovascular system of the women studied.

The factor of the beneficial effect of swimming on the cardiovascular system is the normalization of blood pressure [11; 12]. Reliability of differences in the systolic blood pressure index after a year of occupations was revealed in both groups of subjects (P(t)<0,01). During the study period, systolic blood pressure in the 18-21 year old female group decreased from 119,29±2,97 to 110,21±1,97 mm Hg. and in the group of women 22-25 years old – from 131,43±2,25 to 123,57±1,80 mm Hg.

All the women who took part in the studies particularly notice differences in these indices of diastolic blood pressure (P(t)<0,001). During the year of systematic swimming sessions in young women of the I group, the diastolic pressure

decreased from 82,14±1,88 mm Hg to 71,71±1,97 mm Hg and in more mature women (group II) – from 86,43±1,11 mm Hg to 78,00±2,04 mm Hg.

Analyzing the results of the study of blood pressure indicators, we can state that as a result of swimming lessons, most of the women tested managed to reduce the amplitude of blood pressure (the difference between the maximum and minimum pressure) and bring the pressure values closer to the age norm [4-8].

Among the various recorded parameters, heart rate (pulse) is an extremely important indicator for assessing the functional state of the body and the effectiveness of training. It is known that an increase in exercise is accompanied by a decrease in the pulse [12]. In our study, as a result of the regular application of the proposed swimming programs after a year of HR sessions in the group where the age of the subjects was 18-21, decreased by 7,14 beats min⁻¹ (P(t)<0,001). In the II group (women 22-25 years), the decrease in heart rate occurred at 6,07 beats min⁻¹ and stabilized on the basis on indicators 79,07±1,27 beats min⁻¹ (P(t)<0,01).

In addition, independently counting the pulse, the subjects

Table 4
Dynamics of the cardiovascular system in women aged 18-25 under the influence of swimming during the year

No. i/o	Indicators of measurement	Initial data	Data after 1 year	t	P(t)
Group I, n=15					
1.	Blood pressure (systolic), mm Hg.	119,29±2,97	110,21±1,97	2,59	<0,01
2.	Blood pressure (diastolic), mm Hg.	82,14±1,88	71,71±1,97	3,97	<0,001
3.	Heart rate, beats min ⁻¹	78,14±2,75	71,00±1,70	2,23	<0,01
Group II, n=15					
4.	Blood pressure (systolic), mm Hg.	131,43±2,25	123,57±1,80	2,80	<0,01
5.	Blood pressure (diastolic), mm Hg.	86,43±1,11	78,00±2,04	3,68	<0,001
6.	Heart rate, beats min ⁻¹	85,14±2,27	79,07±1,27	2,43	<0,01

paid attention to its rhythm. According to the estimates of the majority of women (26 people out of 30–86,6%), as a result of regular health swimming exercises, the pulse strokes began to follow one after another at regular intervals, which also confirms the increased fitness and functionality of the cardiovascular system [4–8; 12].

The relationship between anthropometric indicators and the state of the cardiovascular system in both age groups is estimated as high. Between the indices of arterial pressure and pulse, the correlation relationship has an equidirectional pattern and ranges from $r=0,51$ to $r=0,83$. This trend is typical for both age groups.

Conclusions / Discussion

As a result of the study conducted over the course of the year, it can be stated that health swimming exercises positively influenced the anthropometric indicators of women aged 18–

25. It has been established that there have been significant improvements in the indices of the functional state of the cardiovascular system of women swimming. It was revealed that the anthropometric indices and the indices of the functional state of the cardiovascular system in comparison with the initial data were significantly high ($P(t)<0,01$; $P(t)<0,001$).

The dissemination of the experience of such work meets the requirements of practice, and the information offered will help teachers, instructors, physical education practitioners, doctors, and self-employed to make more effective use of recreational swimming to improve health and improve physical readiness.

Prospects for further research. Further research is planned to be carried out in the direction of studying the physiological mechanisms of adaptation processes to physical loads during recreational swimming.

Conflict of interests. The author declares that no conflict of interest.

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

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Received: 17.07.2018.

Published: 31.08.2018.

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Dynamics of indicators of empirical research and biogeometric profile in wrestlers – veterans of sports with osteochondrosis of the lumbosacral spine

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Purpose: to evaluate the effectiveness of the program of physical rehabilitation on the basis of studying the dynamics of indicators of empirical research, vertebro-neurological symptoms and biogeometric profile in wrestlers – veterans of sports with osteochondrosis of the lumbosacral spine.

Material & Methods: theoretical analysis and generalization of literature data; use of diagnostic scales (visual analogue pain scale (VAS), scale of five-point evaluation of vertebro-neurological symptoms), determination of mobility of the lumbosacral spine, Schober's test, Tommyer test – fingers-floor test; methods of mathematical statistics.

Results: based on the results of the study, a statistically significant dynamics of the parameters of the empirical study, the parameters of the biogeometric profile in the wrestlers – the veterans of the main group sport, was found in the course of physical rehabilitation according to the developed program with the application of therapeutic gymnastics, exercises in post-isometric relaxation.

Conclusion: the results of the study confirmed the effectiveness of the comprehensive physical rehabilitation program developed by us, showed that a positive effect on the index of pain, vertebro-neurological symptoms, an increase in the amplitude of the spinal motion in both the sagittal and frontal planes.

Keywords: veterans of sports, physical rehabilitation, VAS scale, biogeometric profile.

Introduction

Among all diseases of the spine, the most frequent (60–90%) is pain in the lumbar spine. Numerous statistics indicate a high incidence of spinal diseases, the absence of a tendency to decrease it, a variety of clinical forms of the disease, a variety of methods of recovery, as well as methods of treatment and prevention. Hitting people mainly of working age, spinal pathology leads to significant labor costs (F. Sh. Favvaz, 2012, O. B. Lazareva, 2012, Sohob Bahjat, 2014) [1; 2; 3].

According to statistics, among the diseases in athletes, osteochondrosis of the spine is one of the leading places. So, according to V. F. Bashkirov (1987), about one tenth of the entire pathology of the musculoskeletal system accounts for osteochondrosis of the thoracic and lumbar spine [4]. After the cessation of active sports, there is a progress of degenerative-dystrophic processes of the spine and joints, due to the motor stereotype, which acquired changes, a sharp decrease in physical activity, adverse social factors after the athletes left the sport. In sports, an improper exercise regime during training can lead to spastic states in the spinal muscular system, causing both a decrease in athlete mobility and additional energy loss, and a number of neurological syndromes in the future. In this regard, the problem of timely and effective rehabilitation treatment of veteran athletes with the aim of preserving their work and social activity, improving health, improving their quality of life is of particular relevance [5–7].

Many scientific data indicate the presence of various functional disorders of the musculoskeletal system in representatives of various sports. As a rule, these disorders occur due to excessively traumatic effects on a part of the body, which is subjected to the greatest load in a particular sport. When leav-

ing the sport, athletes have impaired adaptation processes, maladaptation syndrome develops, and as a result, the development of pathology and exacerbation of the disease [8].

Over the course of 20 years, various methods of physical rehabilitation have been developed and tested for osteochondrosis of the spine, but all of them are aimed either at restoring the functions of only a certain part of the spine, or for use during an exacerbation, or for patients of a limited age category. Analysis of the patent search showed that the majority of the proposed methods belong to medicine, and a variety of different means and methods of physical rehabilitation are presented for persons with osteochondrosis of the spine. Many authors (A. M. Aksyonova, 2009; S. Byuon, H. Son, 2012; O. B. Lazareva, 2012, I. V. Vasilyeva, 2013, V. V. Kormiltsev, 2014) support the view of the positive effect physical exercises, massage, post-isometric relaxation in the treatment of patients with this pathology [10–14].

The use of physical rehabilitation is an integral part of the recovery of athletes who have stopped active sports training, and its further application in practice will help reduce pain and alleviate the symptoms of this disease, improve the quality of life of wrestlers – veterans of sports [7].

Relationship of research with scientific programs, plans, themes. The work was carried out in accordance with the priority thematic direction No. 76.35 "Medical and biological substantiation of carrying out of restoration measures and appointment of means of physical rehabilitation for persons of a young age of different degrees of training". State registration number – 0116U004081.

Purpose of the study: to evaluate the effectiveness of the

program of physical rehabilitation on the basis of studying the dynamics of indicators of empirical research, vertebro-neurological symptoms and biogeometric profile in wrestlers – veterans of sports with osteochondrosis of the lumbosacral spine.

Material and Methods of the research

The selection and examination of the subjects was carried out in the conditions of the problem laboratory of the Kharkov State Academy of Physical Culture and Physical Rehabilitation in the sports complex KSAPC and the CSCYSSOR water sports pool of Yana Klochkova. We observed 34 veteran wrestlers aged 36–45 years, the type of wrestling – judo and sambo. Sports qualification of athletes: MS – 10 people, CMS – 24 people. After the primary examination, they were divided into two groups – the main group (MG) was 19 people, in the control group (CG) was assigned 15 people. Both groups were homogeneous in terms of sex, age, and clinical manifestations of the disease. The formation of the groups was carried out by careful examination and examination of patients, the study of their clinical and anamnestic data, the general condition of the patient's tissues, the biomechanical profile of the lumbar spine, with their inclusion criteria and design. All participants in the study received complete information on the plan for physical examination and physical rehabilitation, and agreed to participate in the study.

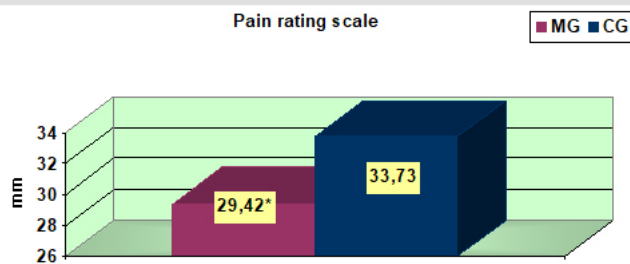
Observation of this cohort of patients was carried out for 1 month. In the morning, patients of the MG and CG performed a set of therapeutic exercises (15–20 minutes), which ended with exercises in post-isometric relaxation (10 minutes). The first week of classes were held by a rehabilitation therapist in the hall, then independently at home. In the second half of the day, every other day, with the MG wrestlers, classes were held in the pool (15–20 minutes), then the contingent of subjects independently conducted traction effects in the water (10–15 minutes) or performed a massage according to the method of P. B. Efimenko (20–30 minutes). Hydrokinase therapy was carried out in the pool of the CSCYSSOR water sports pool of Yana Klochkova at the KSAPC sports base. Athletes-veterans of the CG in the second half of the day went through a course of treatment in a polyclinic at the place of residence, which included classes in therapeutic gymnastics according to the classical scheme, therapeutic massage, ultraphonophoresis with hydrocortisone.

Research methods: theoretical analysis and synthesis of literature data; use of diagnostic scales; visual analogue pain scale; VAS; five-point scale for assessing vertebro-neurological symptoms; determination of the mobility of the lumbosacral spine, Schober's sample, Tomayer's test – fingers-to-floor test; methods of mathematical statistics.

Results of the research

When comparing the dynamics of the magnitude of pain on a visual analogue scale of VAS, the wrestling veterans of the MG observed a statistically significant decrease in complaints compared to the subjects of the CG ($t=-3,26$; $p<0,05$) (Figure 1).

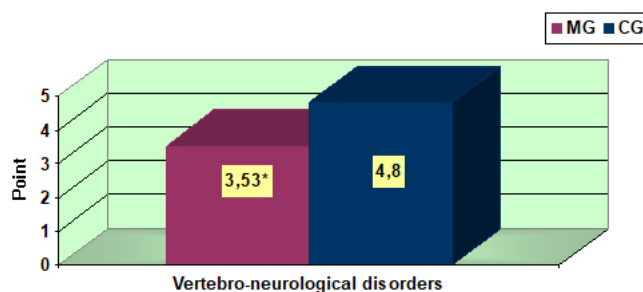
The comparative dynamics of the test results on the scale of the five-point evaluation of vertebro-neurological symptoms



Remark: * statistical significant difference between MG and CG.

Figure 1. Comparative dynamics of the results of the determination of pain on a visual analogue scale VAS in wrestling veterans of the MG and CG

in the wrestlers veterans of sports MG revealed statistically significant differences. In wrestlers veterans of sports of MG 1,36 times statistically significant below there were violations of vertebro-neurological symptoms, than in fighters of CG ($t=-3,33$; $p<0,05$) (Figure 2).

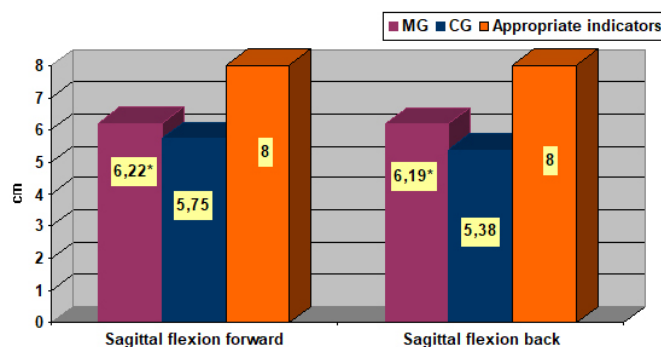


Remark: * statistical significant difference between MG and CG.

Figure 2. Comparative dynamics of the results of the evaluation of vertebro-neurological symptoms on a five-point scale for wrestling veterans of the MG and CG

Comparison of dynamics of biogeometric profile showed that the parameters of the amplitude of motion of the spine forward ($t=2,07$, $p<0,05$) and back ($t=4,91$, $p<0,05$) in the sagittal plane in the test subjects were statistically significant in Compared with the same parameters of veterans wrestlers of CG (Figure 3).

The comparative dynamics of the parameters of the amplitude of the spinal motion to the right ($t=4,70$, $p<0,05$) and left

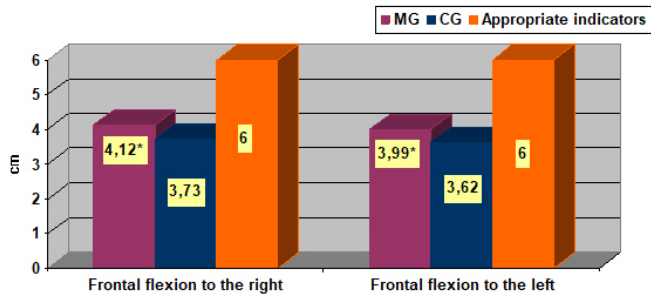


Remark: * statistical significant difference between MG and CG.

Figure 3. Comparative dynamics of the amplitude of the movement of the spine forward and back in the sagittal plane in wrestling veterans of the MG and CG

($t=2,74$, $p<0,05$) in the front plane showed similar changes, that is, statistically significant improvements in the test subjects were observed results than the veterans wrestlers CG.

Figure 4 shows the comparative dynamics of the amplitude of the spine movement forward and backward in the front plane of the veterans of the main and control groups.

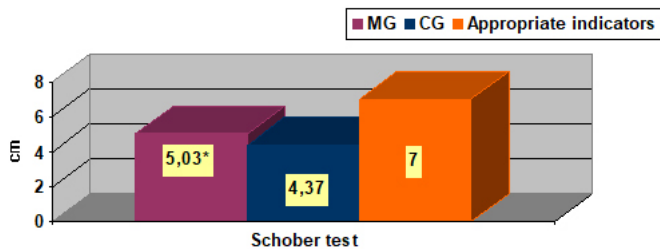


Remark: * statistical significant difference between MG and CG.

Figure 4. Comparative dynamics of the amplitude of the movement of the spine back and forth in the frontal plane in wrestling veterans of the MG and CG

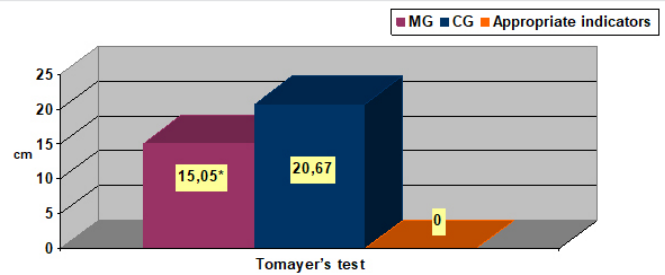
Comparison of the indicator of the Schober test showed a statistically significant change in the studied MG ($t=2,96$, $p<0,05$) compared with that of CG veterans (Figure 5).

More pronounced changes were noticed in the analysis of



Remark: * statistical significant difference between MG and CG.

Figure 5. Comparative dynamics of the sample of Schober in wrestling veterans of the MG and CG



Remark: * statistical significant difference between MG and CG.

Figure 6. Comparative dynamics of Tomayer test at wrestling veterans of MG and CG

the parameters of the Tomier's sample. In the veterans wrestlers of the MG, the parameter of the Tomayer test ($t=-7,65$, $p<0,05$) was statistically significant in comparison with the test subjects CG ($p<0,05$) (Figure 6).

Conclusions / Discussion

The positive effect of the developed program of physical rehabilitation using therapeutic gymnastics, post-isometric relaxation exercises, Traction influence in water has been proved by statistically significant positive dynamics of an empirical study on the VAS scale, by the degree of infestation of vertebro-neurological disorders, by diagnostic indicators of the biogeometric profile in the main group of subjects compared to with changes in the veterans wrestlers of CG.

The results of the study confirmed the effectiveness of the comprehensive physical rehabilitation program developed by us, and showed that a positive effect on the pain indicator, vertebro-neurological symptoms, and an increase in the amplitude of spinal movement both in the sagittal and in the frontal plane.

Prospects for further research are related to the assessment of the dynamics of physical performance in wrestlers – sports veterans with osteochondrosis of the lumbosacral spine after the application of a comprehensive physical rehabilitation program on the training motor mode.

Conflict of interests. The author declares that no conflict of interest.

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

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Received: 18.07.2018.

Published: 31.08.2018.

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Dynamics of cardiovascular system and adaptive potential in students with chronic bronchitis

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Purpose: to determine the impact of the physical rehabilitation program on the state of the cardiovascular system and changes in the adaptive capacity of students with chronic bronchitis.

Material & Methods: theoretical analysis of literature and generalization of scientific, methodological and specialized literature; pulseometry, arterial tonometry, a technique for determining the adaptive potential by R. M. Baevsky; methods of mathematical statistics.

Results: a comprehensive program of physical rehabilitation was made taking into account the two stages of the period of convalescence, clinical and biological recovery, for students of the same group, additional application of varieties of walking and running on various health-normalizing regimes. After applying the program of physical rehabilitation of students of both groups, a slowdown in the recovery of all cardiovascular parameters and changes in the adaptive potential of the circulatory system was noted, however, the best results were obtained in a group of students, additionally, the versions of walking were used in various health-normalizing regimes with a combination of permutations of hand movements.

Conclusion: confirmation of the effectiveness of the developed program of physical rehabilitation was a statistically significant improvement in the cardiovascular system, a slowdown in recovery processes after exercise, an increase in the number of students with a state of satisfactory adaptation.

Keywords: students, chronic bronchitis, cardiovascular system, adaptive potential.

Introduction

Among all the population, respiratory diseases are most commonly encountered, the prevalence of which reaches the level of diseases of the circulatory system (from 15% to 20% in different age groups). At the same time, diseases of the respiratory system are characterized by high rates of temporary disability and disability. Today, the state of health of students indicates that this problem is relevant both for the health care system and for the society as a whole. In connection with this, there is a need to develop health programs to support health and healthy lifestyles, including the development of physical rehabilitation programs for various diseases [1]. Chronic bronchitis is a disease with a primary lesion of the airways, which is associated with inflammation or prolonged irritation of the bronchial mucosa by various agents and is characterized by a progressive recurrent course [2]. The development of chronic bronchitis is associated with the action of exogenous and endogenous risk factors. (A. H. Кокосов, 2005; P. M. A. Calverley, N. G. Koulouris, 2005). Among the exogenous factors are smoking, pollutants of inorganic and organic nature, ecological and climatic factors, low socioeconomic level, some forms of respiratory infection; among endogenous – congenital deficiency of alpha-1-antitrypsin, hyperreactivity of bronchi, prematurity of a fetus at birth [3; 4].

Chronic bronchitis is among the most frequent diseases due to the prevalence among people of working age. The issues of treating and rehabilitating patients are of important medical and social importance [5]. Priority areas in the rehabilitation of patients with chronic bronchitis are methods using non-drug, natural and climatic factors, physical training. For patients with chronic bronchitis at all stages of the course of the disease high efficiency have physical training programs that in-

crease exercise tolerance and reduce shortness of breath and fatigue [6]. According to the experience of medical practice and observations S. N. Zinatulin systematic special breathing exercises allow to significantly increase the efficiency and economy of the function of external respiration, and at the same time increase, make more stable physiological reserves and adaptive capabilities of the organism [7].

According to many authors, in the complex treatment of patients with chronic bronchitis, physical rehabilitation is an integral part and occupies a decisive place among rehabilitation and rehabilitation measures. Under the influence of purposeful and systematic use of therapeutic physical culture, both special and general developmental exercises, the activation of extracardiac factors, coronary circulation by increasing the volume and speed of the circulating blood is greatly improved [8–12].

Thus, despite the available work devoted to the study of methods of diagnosis, prevention and rehabilitation of patients with bronchitis, this problem has not yet been fully studied. Not enough attention is paid to rehabilitation programs, taking into account recovery periods, while this stage is fundamental in the correction of the condition of patients with chronic bronchitis.

Relationship of research with scientific programs, plans, themes. The work is carried out according to the consolidated plan of research work in the sphere of physical culture and sports for 2011–2015. On the theme: "Traditional and non-traditional methods of physical rehabilitation in diseases of various systems of the body and damage to the locomotory system in people of different degrees of training" (code for topic 4.1, state registration number – 0111U000194) and ac-

ording to the priority thematic direction No. 76.35 "Medical and biological substantiation carrying out of restoration measures and appointment of means of physical rehabilitation for persons of a young age of an exhaustive degree of training". State registration number – 0116U004081.

Purpose of the study: to determine the impact of the physical rehabilitation program on the state of the cardiovascular system and changes in the adaptive capacity of students with chronic bronchitis.

Material and Methods of the research

Research methods: theoretical analysis of literature and generalization of scientific, methodological and special literature; pulsometry, arterial tonometry, the method of determining the adaptive potential of R. M. Baevsky; methods of mathematical statistics.

A comprehensive program of physical rehabilitation was drawn up taking into account two stages of the recovery period, clinical and biological recovery. Examination and physical rehabilitation of students with chronic bronchitis, were held at the University Hospital of the Kharkov National Medical University. Under our supervision, there were 73 students aged 17–20 years, which were divided into three groups. MG1

consisted of 25 students who underwent a course of physical rehabilitation in accordance with the developed program with the additional use of walking and walking variants in various health-normalizing regimes, 21 students were assigned to MG2, they were engaged in a program of physical rehabilitation, and 27 students of CG were students who did not have bronchopulmonary pathologies and were engaged in physical education according to the program of the university. The course of treatment was 21 days [2; 8; 9]. All ethical principles for medical research were met, according to the WMA Declaration (Helsinki, 2013).

In the first stage, the students of MG1 and MG2 prescribed therapeutic physical training, massage of the muscles of the body, shoulder girdle, upper limbs; Physiotherapeutic agents: UHF to alternate with solutex on the nasal passage and chest; Internally recommended taking vitamins of group B, C, E; Eleutherococcus (to stimulate the body's resistance). Students of both groups were engaged in therapeutic gymnastics 3 times a week, performing general strengthening and general exercises in relation to respiratory exercises 4:1. The students of OG1 additionally used varieties of walking on various health-normalizing regimes with a combination of permutations of the movements of hands.

At the second stage, MG1 students performed morning hy-

Table 1

Dynamics of indicators of the cardiovascular system in students with chronic bronchitis (MG1 and MG2) when compared with the indicators of healthy students (CG), $\bar{X} \pm m$

No. i/o	Indicators at the stages of rehabilitation	MG1 (n=25)	MG2 (n=21)	CG (n=27)
1.	Heart rate at rest, for 10 s I II	12,92±1,42* 12,03±1,02 t=2,27	12,30±1,14* 11,36±0,45 t=3,37	11,84±0,23
2.	HR after load, 10 s I II	17,76±2,05 17,32±0,97 t=1,06	17,10±1,11 17,03±0,48 t=0,24	17,36±0,34
3.	SBP before load, mmHg I II	126,16±11,59 121,08±6,72 t=1,99	123,90±7,69 121,19±4,37 t=1,33	120,93±1,38
4.	SBP after loading, mmHg I II	146,60±6,41* 138,80±6,00 t=2,27	142,86±8,60 139,67±5,09 t=1,33	140,56±1,32
5.	DBP before load, mmHg I II	73,00±6,92 76,92±8,40 t=-1,98	73,33±7,30 73,10±7,66 t=0,10	74,07±1,56
6.	DBP after load, mmHg I II	96,00±5,95* 90,60±7,40 t=2,65	93,33±7,30 93,10±5,80 t=0,13	94,81±1,45
7.	PBP before load, mmHg I II	53,16±8,41* 44,16±7,25 t=4,20	50,57±5,13 48,10±7,65 t=1,06	46,85±1,21
8.	PBP after load, mmHg I II	50,60±9,28 48,20±8,65 t=1,08	49,52±8,20 46,57±8,72 t=1,28	45,74±1,35
9.	Heart rate recovery time, min I II	7,40±1,44* 5,46±0,69 t=5,36	6,21±1,46* 5,07±0,73 t=3,57	6,22±0,31
10.	BP recovery time, min I II	12,00±3,12* 10,10±1,27 t=2,88	10,47±2,13 10,10±0,93 t=0,71	10,61±0,37

Remark. * – statistically significant difference between indicators ($p < 0,05$).

Table 2

Dynamics of changes in the adaptive potential of the circulatory system by the method of R. M. Baevsky students of both groups with chronic bronchitis, %

No. i/o	Condition of adaptive potential	Stage	MG1 (n=25)	MG2 (n=21)	CG (n=27)
1.	satisfactory adaptation (not more than 2.1)	I	59	61	91
		II	78	69	
2.	stress adaptation mechanisms (2.11-3.2)	I	36	32	9
		II	22	30	
3.	unsatisfactory adaptation (3,21-4,3)	I	5	7	-
		II	-	1	

gientic exercises in the morning, accelerated walking in the evening for 20 minutes; slow running – 30 min; accelerated walking – 10 min. MG2 students continued to perform the motor tasks of the first stage, gradually completely replacing them with motor programs that included special, basic and simulation exercises with increasing load [13].

Results of the research

After the application of the comprehensive program of physical rehabilitation of students of MG1, proposed by us, the cardiovascular system parameters decreased statistically significant, such as the value of heart rate at rest by 1,07 times, SBP after exercise by 1,04 times, DBP after exercise by 1,06 times, time HR recovery 1,35 times, BP recovery time 1,19 times ($p < 0,05$ for all indicators). Indicators of the value of SBP before the load, DBP to the load tended to increase, but still received statistical significance. All this suggests a certain development of the economization of the activity of the heart at rest and during exercise.

MG2 students had a statistically significant decrease in heart rate at rest by 1,08 times ($p < 0,05$), recovery time of heart rate by 1,22 times ($p < 0,05$), changes in other indicators of statistical significance were not obtained (Table 1).

After the application of the physical rehabilitation program, there was a slowdown in the recovery of all indicators of both MG1 students and MG2 students, however, the best results were obtained in a group of students, and additional types of walking were used.

Health assessment is closely related to the study of the state of adaptation. In order to identify cases of a decrease in the protective-adaptive capabilities of the organism, tension or insufficiency of adaptation mechanisms, the adaptation potential of the circulatory system was calculated using the formula of G. M. Baevsky.

According to the results of the pre-natal examination of MG1 students, 12 students had a satisfactory adaptation, 7 were the tension of the adaptation mechanisms, and 6 students had an unsatisfactory state of adaptation potential. After the proposed program of physical rehabilitation, satisfactory adaptation was observed in 19 students, only 6 people remained in the tension of the adaptation mechanisms, there was no

satisfactory state of adaptive potential.

For students of MG2, satisfactory adaptation was observed in 11 people, 6 students identified the stress of adaptation mechanisms, the unsatisfactory state of adaptive potential was in 4 students. The dynamics of the adaptive potential of MG2 students showed that 1 student remained inadequate adaptation status, 6 students were in a state of stress adaptation mechanisms, 14 people acquired the value of the indicator, which corresponds to the value of satisfactory adaptation (Table 2).

The dynamics of changes in the adaptive potential of the circulatory system by the method of R. M. Baevsky students of both groups with chronic bronchitis after the application of the proposed comprehensive program of physical rehabilitation indicates that the best results were obtained in the group of students (MG1), which additionally used varieties of walking.

Conclusions / Discussion

A comprehensive physical rehabilitation program has been developed for students with chronic bronchitis, taking into account recovery periods, especially with the use of therapeutic exercises and walking on various health-normalizing modes with a combination of hand movements' permutations positively influences the state of the cardiovascular system and the adaptive potential of the circulatory system. Statistically significant changes were observed in MG1 students who were engaged in this program. The MG2 students also showed positive changes in cardiovascular parameters, but statistically significant changes received only the value of heart rate at rest ($p < 0,05$) and the recovery time of heart rate ($p < 0,05$).

The confirmation of the effectiveness of the developed program of physical rehabilitation was a statistically significant improvement in the cardiovascular system, slow down the processes of restoring the cardiovascular system after loading, increasing the number of students with a state of satisfactory adaptation, especially in the case of MG1 students, reducing the stress state of adaptation mechanisms.

Prospects for further research related to the study of the dynamics of the level of physical condition and physical performance in students with chronic bronchitis after the application of the author's program of physical rehabilitation.

Conflict of interests. The author declares that no conflict of interest.

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

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Received: 20.07.2018.

Published: 31.08.2018.

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Physical fitness as one of the directions of the historical development of physical culture

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Purpose: to reveal the cultural and historical origins of the concept of "physical fitness".

Material & Methods: an analysis of specialized literature covering various aspects of the development of the field of human activity associated with the use of physical exercises.

Results: at the turn of the 20th century, the term "physical culture" was used as a generalising name for the three areas of people's activities related to the use of physical exercises: activities aimed at bringing the body in line (physical fitness) activities aimed at developing physical strength and body build (bodybuilding) activities aimed at improving through the use of physical exercises (therapeutic physical culture).

Conclusion: in terms of the theory of physical culture of physical fitness is seen as a particular socio-cultural phenomenon, which is a historically conditioned human activity involving the use of physical exercise at their leisure, and individual and socially significant results of such activities.

Keywords: physical culture, physical fitness, theory, law of "interrelation of needs and activities".

Introduction

A necessary condition for the successful development of the theory of physical culture [2; 5] as a theory revealing the driving forces, social mechanisms and objective laws of the historical development of people's activities related to the use of physical exercises is the establishment of the sociocultural nature of the process of changing terms and concepts that were formed as a result of cognitive process. In previous reports, generalizing (consensus) definitions of the concepts "physical culture" [3] and "sport" are presented [4]. Continuing the analysis begun, let us pay attention to the cultural and historical origins of the concept of "physical fitness". The need for such an analysis stems from the fact that in a broad social and scientific practice there is no correct substantiation of this concept. For example, G. Glassman [7] notes that a significant part of fitness programs do not give a clear definition of the concept of "fitness". According to the expert, the Encyclopedic Dictionary, in which the concept of "fitness" is interpreted as the ability to transfer genes and be healthy, does not help either. He also draws attention to the fact that NSCA, a respected publisher in the field of exercise physiology, in his authoritative publication *Essentials of Strength Training and Conditioning* did not even attempt to define this concept. E. Corre [8] notes in his research that E. Desbonnet and B. Macfadden are pioneers in the health industry, after which society enters the age of confusion, in the age of the fitness business. The examples given indicate that the problem of the correct definition of the concept of "physical fitness" now requires a more detailed analysis.

Purpose of the study: to reveal the cultural and historical sources of the concept of "physical fitness".

Material and Methods of the research

Research methods consist in the analysis of the special literature, which highlights the historical aspects of the development of various forms of social manifestation of physical culture, as well as the use of a systematic and historiographical approach to the analysis of this problem.

Results of the research

The correct understanding of the concept of "physical fitness" is possible only within the framework of the theory of physical culture, namely, through the prism of the general definition of the concept of "physical culture". In the previous message it was shown that physical culture is a historically conditioned activity of people associated with the use of physical exercises, and its individual and socially significant results [3]. That is, in this definition, attention is drawn to the two components of the concept of "physical culture" – an activity and resultant. Analyzing the problem of using the terms "physical culture" and "physical fitness" in the English language, one should pay attention to the fact that the activity of people using physical exercises has not only the effect of forming their corporeality (this direction was called bodybuilding [6]), such activity also significantly affects the general level of physical well-being of a person, on his suitability for fulfilling life's important tasks. J. Sifferman [9] draws attention to this feature, noting that physical culture is more than just bodybuilding. According to a specialist, it represents a certain philosophy, mode or lifestyle, and is aimed at maximizing the physical, mental, spiritual and social development of a person. So, this activity of people with the use of physical exercises is aimed at improving their ability to respond adequately to the various challenges that arise

in the process of life activity. Using the generalized definition of the concept of "physical culture" [3], we can conclude that, based on the resultant effect of people's activities using physical exercises, which formed their physical fitness, physical conformity, this is the direction of development of physical culture at the turn of the 20th century in the English-speaking practice called "physical fitness". He began to develop intensively, starting at about the beginning of the 20th century. The frequency of the use of the term "physical fitness" in the 1930s equated with the frequency of the use of the term "physical culture", and in the future it significantly outstripped it, which is an objective consequence of the intense development of that period of the fitness industry (Figure).



Figure. Dynamics of use of the terms "physical culture", "physical fitness" from 1800 to 2008 (English) (obtained using the search engine "Google Books Ngram Viewer") (access mode: <https://books.google.com/ngrams>)

According to historical materials, B. McFadden, the pioneer of the health industry [8], as a successful businessman, was aware of the importance of this trend in the use of physical exercise and sought to consolidate his rights to it. This hypothesis is confirmed by the information contained in the "Annotated Bibliography of English Literature Series in the Field of Physical Culture" (for the period from 1829 to 1990 inclusive), prepared by the Center for Physical Culture and Sports (USA) [1]. It shows that immediately after the magazine was released in January 1924, called "Physical Fitness" (this is the first use of the term "fitness" in the title of the official publication), its publishers were forced to change the name to "Mental, Physical and Moral Fitness" in order to avoid, as stated in the report, prosecution by B. McFadden. In January 1925, this magazine ceased to exist. Note that at that time the use of the terms "physical fitness" and "fitness" to characterize the results of physical activity was not accidental. So, Catharine Beecher (Catharine Beecher) in 1832 used the term "fitness" to substantiate the need for the introduction of exercise in US schools. This term was actively used at the beginning of the 20th century and in England in the process of improving physical education in public schools, to assess the compliance of physical fitness of schoolchildren [10]. To this, it should also be added that during the indicated period the word "fitness" was widely used in natural sciences. For example, it is found in the work by L. Joseph Henderson "Fitness of the Environment" (1913) to characterize that the environment corresponds to the conditions of life development [11], as well as in biology to characterize the quantitative measure of natural selection (Darwinian fitness) [12].

Conclusions / Discussion

The analysis performed allows us to make the following generalization. Based on the selected mechanism of self-development of social phenomena, which is based on the law "the interrelation of needs and activities" [5], it is necessary to recognize that the driving forces that determine the self-development of physical fitness as a socially significant phenomenon, manifested in the dialectical unity, on the one hand, business-interests of the organizers of such activities, and on the other hand, the need in a similar type of activity existing in society. The situation is formulated is confirmed by the following historical facts, indicating that already in the 19th century in a large number of countries in Europe, in the UK and in the USA, a significant number of various venues, halls, studios, salons in which people exercised were functioning. For example, in Germany, the first gymnastics grounds (Turnplatz) were opened by F. Jan in Berlin in 1811. In Paris, the famous Hippolyte Triat athlete founded in 1847 several gymnasts for bourgeois, aristocrats and energetic young people, and Professor E. Desbonnet at the turn of the 20th century had around 300 similar institutions throughout France and Europe. In the US, the first such room in 1824 was discovered by C. Beck. The same work was carried out by D. A. Sargent, who at the end of the 19th century organized several rooms at Harvard University, as well as B. McFadden, who founded his first studio in 1875, calling it "Bernard McFadden – a teacher of Higher Physical Culture". In the United Kingdom in 1858, S. A. MacLaren opened a similar hall at Oxford University, and E. Sandov created in London at the end of the 19th century a whole network of similar "institutions", which at that time were called the institutes of physical culture. All these "halls", "studios", "institutions", "salons" were designed for different layers of population, from modest establishments for representatives of the middle class to many arranged salons for aristocrats. Historical materials indicate that such organizations, for example, B. McFadden (USA), E. Desbonnet (France) and especially E. Sandov (Great Britain), earned large profits on the organization. A significant factor that influenced the development of such activity was its informational support. Historical materials indicate that in the UK E. Sandov issued from 1898 to 1907 Sandov Journal of Physical Education magazine (the first name of the journal Physical Education). In the US, the same work on advertising the activities of people related to the use of physical exercises was carried out by B. McFadden, who created an entire publishing empire, which was based on the journal Physical Education. created together with the writer A. Surier magazine "Physical Education".

Thus, based on the results of the above analysis, and also taking into account the results of D. McFadden's (USA), D. Lewis (USA), E. Sandova (UK) and E. Dasbonneet (France) as outstanding historians, a significant contribution to the development of physical culture, we can conclude that at the turn of the 20th century the term "physical culture" was used as a generalization of the three directions of human activity associated with the use of physical exercises: first, activities aimed at bringing (physical fitness), secondly, activities aimed at the development of physical strength and body composition (bodybuilding); thirdly, activities aimed at improving with the use of physical exercises (therapeutic physical culture).

Secondly, within the framework of the theory of physical culture, physical fitness is considered as a special socio-cultural phenomenon, which is a historically conditioned activity of people associated with the use of physical exercise at leisure, as well as individual and socially significant results of such activity.

Conflict of interests. The authors declare that no conflict of interest.
Financing sources. This article didn't get the financial support from the state, public or commercial organization.

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Received: 19.07.2018.

Published: 31.08.2018.

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SLOBOZHANSKIY HERALD OF SCIENCE AND SPORT

The reliability of the presented results correspond to authors

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