ISSN 2311-6374

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

Vollum 7 No. 3(71)

Kharkiv
Kharkiv State Academy of Physical Culture
2019

P 48
UDC 796.011(055)”540.3”

Slobozhanskyi herald of science and sport : [scientific and theoretical journal]. – Kharkiv : KhSAPC. 2019, Vol. 7 No. 3(71), 62 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.
2. Improving the training of athletes of different qualification.
3. Biomedical Aspects of Physical Education and Sports.
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.

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

SLOBOZHANSKYI HERALD OF SCIENCE AND SPORT

Scientific and Theoretical Journal *Vollum 7 No. 3(71), 2019*

CONTENT

SLOBOZHANSKYI HERALD OF SCIENCE AND SPORT

UDK 796.815:796.062(477.54)

ISSN (English ed. Online) 2311-6374
2019, Vol. 7 No. 3(71), pp. 4-8
DOI: 10.5281/zenodo.3371196

Organizational and managerial bases of activity of the Kharkiv Regional Sumo Federation

Ruslan Bairamov
Anastasia Bondar

Kharkiv State Academy of Physical Culture, Kharkiv, Ukraine

Purpose: *to characterize the organizational and managerial bases for the activity of the Kharkiv Regional Sumo Federation.*

Material & Methods: *the study analyzed the Charter of the Kharkiv Regional Sumo Federation, training programs on sumo, to assess the activities of the Federation a survey was conducted among residents of the Kharkiv region, 230 people took part in it from 17 to 55 years, the sample type is random, the sample calculation was carried out according to the standard methodology, the SWOT analysis was used to assess the environment of the federation, 15 specialists from the sphere of physical culture and sports took part in it.*

Results: *revealed that the public organization "Kharkiv Regional Sumo Federation" was registered in 2009 with the aim of promoting the development of sumo, acting on the basis of the Charter. In the Kharkiv region, 94 athletes are engaged in sumo, while 48.7% of the surveyed residents of the Kharkiv region consider sumo as an unpopular sport in our country, 76% of respondents are not interested in this sport at all, and only 4.3% are interested, while a low level of awareness has been revealed population of sumo in the region. 80% of respondents consider it necessary to develop sumo in the Kharkiv region.*

Conclusions: *the results obtained complement and expand modern scientific data on the development of non-Olympic sports, sumo development, methods of teaching sumo. The study determined the state of development of sumo in the Kharkiv region, the structure, activities of the public organization of physical culture and sports direction "Kharkiv Regional Sumo Federation" in accordance with the Charter. Surveys of ordinary citizens showed that, in the opinion of most of them, the Federation should intensify marketing activities, increase the number of broadcasts of competitions on television, create official websites of federations and clubs on the Internet. Estimates of experts confirm the opinion of citizens, the greatest opportunities for the further development of the federation are opened by the popularization of sumo among the population and the expansion of the range of the federation itself, the improvement of quality and advertising of its services, as well as legislative changes. According to ordinary citizens and according to experts, the state should have the least impact on the development of sumo in our country and on the activities of the Federation.*

Keywords: *sumo, federation, Charter, activities, marketing activities.*

Introduction

In recent years, in our country, along with other non-Olympic sports, sumo has been actively developing. This is facilitated by the activities of the Sports Committee of Ukraine and the creation of an extensive system of physical education and sports organizations in this sport led by the national federation. In their scientific works of A. Borisov (2013; 2016), E. Imas (2016), S. Matveev (2016), E. Savarets (2012) reviewed the history of non-Olympic sports and its modern structure, in the works of N. Dolbishevoy (2014; 2015; 2016) described the organizational structure, functions, activities of the governing bodies of domestic non-Olympic sports, N. Sereda (2015) studied the marketing activities of physical education and sports organizations with non-Olympic sports. However, among the works of modern authors there are no issues related to improving the management system of sumo in our country. It should be noted that only a few studies of domestic scientists are devoted to sumo, in particular, G. Arzyutova (2000) studied the rules of sumo wrestling, S. Bezkorovainy (2018), S. Korobko (2004), V. Yaremenko, I. Malinsky, M. Kolos V. Shandrigos (2011) proved the effectiveness of the use of sumo elements in the physical education of students to improve the health of students and meet their desire to engage in exotic sports. To popularize sumo among school-age children, the authors of N. Smag, S. Korobko, A. Rebrin (2017) developed a variant module "Sumo", which is included in the "Physical Education Curriculum for General Education Institutions, Grades 5-9" [5], in addition, the Ministry of Education and Science of Ukraine approved the Sumo program for youth sports schools (2014) [3], which presents the methodology of sports training of sumo players at different stages of sports training. Today, unfortunately, there are no normative documents of the state level, which determined the mechanism of interaction of all subjects of the sphere of physical culture, contributing to the development of sumo.

Purpose of the study: to characterize the organizational and managerial bases for the activity of the Kharkiv Regional Sumo Federation.

Material and Methods of the research

At the first stage of the study, the scientific and methodological literature on the history and development of sumo in Ukraine, the problems of international and domestic non-Olympic sports, and sports management was analyzed with the aim of posing the problem of research and the formation of a scientific apparatus. At the second stage, statistical reports were analyzed in the form of 2-FC and the Charter of the public organization "Kharkiv Regional Sumo Federation" to determine the state of development of sumo in the Kharkiv region and features of the federation's activities. To identify the weaknesses and strengths of the federation's marketing activities, a SWOT analysis was used; 15 specialists in the field of physical culture and sports took part in assessing the external environment, including members of the Kharkiv Regional Sumo Federation, coaches, athletes, directors of youth sports schools, and teachers of the Kharkov State Academy of Physical Culture. To assess the activities of the Kharkiv regional sumo federation in the region, a sociological survey was carried out among residents of the Kharkiv region, in which 230 respondents aged 17–55 years old took part, the sample type was random, the calculation of the sample was carried out according to the standard method of sociological research. At the third stage, the results are systematized and analyzed, the main conclusions of the research are formulated.

Results of the research

In modern sumo there are two directions: professional and amateur. Professional sumo (Ozu) exists only in Japan, where the main governing body is the Japanese Sumo Association (JSA). In all other countries of the world, amateur sumo is developing; for this, the International Sumo Federation (ISF) has been created with headquarters in Tokyo [10; 12].

The international sumo federation has more than 80 countries, the European sumo federation has about 30 countries. In Ukraine, sumo began its existence in 1999. The official status of the All-Ukrainian Sumo Federation was received in 2001, and in 2013 the Federation received the status of a national one and today it has the full name Public Organization All-Ukrainian Public Organization Sumo Federation of Ukraine [8]. In addition, in our country, separate divisions of the national sports federation, including 22 regional and 3 city federations, are engaged in the development and popularization of sumo [7].

To obtain the status of a national, in the manner prescribed by law, the federation must fulfill certain qualification requirements, namely:

– develop sumo throughout the country;
– have membership in the International Federation, included in the list of the State Committee of Youth Policy of Sport and Tourism of Ukraine (now the Ministry of Youth and Sports of Ukraine);
– organize and conduct official international and all-Ukrainian competitions;
– availability of qualification personnel (athletes, coaches, judges and specialists with appropriate qualifications and work experience);
– availability of the necessary logistical and information base, organizational and methodological support [11].

The Sumo Public Organization "Kharkiv Regional Sumo Federation", which according to the register of public associations was registered in 2009, is engaged in the development of sumo in the Kharkiv region. In the Kharkiv region, 94 people are engaged in sumo, 50 of whom are members of a separate division of the national sports federation; 9 physical education and sports workers conduct training sessions: 4 full-time coaches for sports, coaches, teachers, sports teachers and 5 coaches of a separate division of the national sports federation, 1 of whom has the title of Honored Coach of Ukraine [2]. Among Kharkiv athletes are 11 members of the national sumo national team of Ukraine, champions and prize-winners of international competitions.

Public organization "Kharkiv Regional Sumo Federation" (hereinafter referred to as the Federation) is a public organization founded on the basis of the commonality of citizens' interests for the purpose and purpose of the Charter [6]. The main purpose of the Federation's activity is to protect the legitimate interests of its members and to promote the development of sumo in the city of Kharkiv and the Kharkiv region. The Federation is a non-profit organization that is created and operates in accordance with the Constitution of Ukraine, the Law of Ukraine "On Public Associations", the Law of Ukraine "On Physical Culture and Sports", other laws of Ukraine and its own Charter. Members of the Federation may be citizens of Ukraine, foreigners and stateless persons who are legally in Ukraine who recognize the principles, objectives, directions and the Statute of the Federation, promote their implementation, pay membership fees.

The governing and supervising bodies of the Federation are the Conference, the Presidium, the Supervisory Board. The Federation officials are: the President of the Federation, the Vice-Presidents of the Federation, the Chairman and members of the Supervisory Board. The supreme governing body of the Federation is the Conference, which is convened by the Presidium of the Federation at least once a year. An extraordinary Conference is convened by the President of the Federation, the Supervisory Board or at the request of the majority of the Federation members.

The competence of the Conference of the Federation includes the solution of such issues as: adoption of the program of the Federation's activities; amendments to the Federation Charter; election and recall of the Presidium and the Supervisory Board; hearing and approval of reports on the activities of the Presidium and the Supervisory Board of the Federation; the decision to terminate the Federation, the appointment of a liquidation commission, the approval of the liquidation balance sheet; realization in accordance with the procedure established by law the right of ownership to the property of the Federation

Bairamov, R. & Bondar, A. (2019), "Organizational and managerial bases of activity of the Kharkiv Regional Sumo Federation", *Slobozhanskyi Herald of Science and Sport*, Vol. 7 No. 3(71), pp. 4-8, doi: 10.5281/zenodo.3371196.

The governing body of the Federation, acting between conferences, is the Federation Presidium. The Presidium of the Federation is elected from the membership of the Federation for a term of 5 years and is headed by the President of the Federation. The Presidium of the Federation consists of three people, ex officio the President of the Federation, two vice-presidents of the Federation. The President of the Federation is elected from among the members of the Federation for a term of 5 years and heads the Federation Presidium.

President of the Federation during the rule, manages current activities and performs other functions, for example:

– concludes any transactions and contracts on behalf of the Federation;
– has the right to first sign financial documents;
– opens and closes accounts in banks;
– by decision of the Conference, carries out the operational management of the property of the Federation, subject to restrictions that may be established by the Conference of the Federation;
– approves the staffing of the Federation;
– recruits and dismisses full-time employees of the Federation, and also concludes contracts with specialists to resolve issues related to the activities of the Federation [6].

In accordance with its charter, the regional federation, like many other public organizations, is an independent organization. However, she coordinates all her decisions regarding the global development of sumo in the region with the regional Youth and Sports Administration and the Sumo Federation of Ukraine, namely: the regional federation annually signs a cooperation agreement with the Youth and Sports Administration of the regional state administration, According to which the federation has the right to promote the development of sumo, promote this sport, approve the regional team for official competitions and training camps, as well as organizing and conducting official international, all-Ukrainian and regional competitions in the Kharkiv region. The Department in turn exercises control over the activities of the Federation in the established manner and within its competence [1].

All competitions that take place on the territory of the region included in the regional calendar plan of sports and recreation and sporting events, approved by the Kharkiv Regional State Administration on the proposal of the federation. International and All-Ukrainian competitions, which take place in the region, are held under the general guidance of the Ministry of Youth and Sports of Ukraine and the Sumo Federation of Ukraine. The direct management and preparation of competitions is conducted by the Office of Youth Affairs and Sports of the Regional State Administration, and for the conduct of all-Ukrainian practice-training session, which take place in the territory of the region, the All-Ukrainian Federation and the regional federation are in compliance. Thus, in the Kharkiv region, all practice-training session of domestic sumo athlets from the special preparedness are held annually, in particular, in 2017 seven practice-training sessions were held, in 2018 – 10, in 2019 there are also scheduled 10 practice-training session [1].

A survey among residents of the Kharkiv region showed that only 8,3% of respondents consider sumo a popular sport in Ukraine, 40,4% said that sumo is, in their opinion, an unpopular sport in our country, but is developing rapidly, and 48,7 % believe that sumo is a completely unpopular sport.

It is interesting that 69% of respondents consider sumo a spectacular sport, and 31% – no. To the question "Are you interested in news about sumo?" The overwhelming majority of the respondents – 76% answered that they were not interested, 19,7% chose the option "sometimes look" and only 4,3% of respondents are interested in sumo news regularly. The study showed that, despite the fact that most respondents consider sumo a spectacular sport, it does not cause them interest.

Only 40% of respondents know that international sumo competitions are held in Kharkiv, and only 30% know where sumo can be practiced in Kharkiv and Kharkiv region. This indicates a low level of awareness of sumo in the region.

It turned out that 80% of respondents consider it necessary to develop sumo in the Kharkiv region, for this, according to respondents, there are several ways presented in Figure 1.

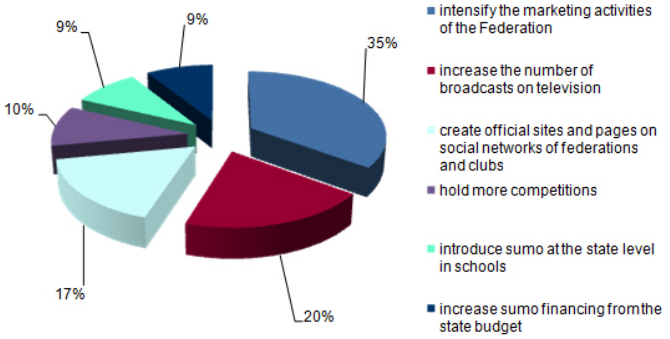

Fig. 1. Ways of development of sumo, according to respondents

The figure shows that the majority of respondents are convinced that for the development of sumo in the Kharkiv region it is necessary to intensify marketing activities of the regional Federation, increase the number of broadcasts of competitions and educational and entertainment programs about sumo on television and create official websites of federations and clubs on the Internet and social networks, while the least effective, according to respondents, is the way of implementing sumo with the help of government leverage, like sumo introduction in educational institutions and financial ensuring a sport from the state budget.

Research on marketing activity in sport [4; 9; 13] show that the effective functioning and strategic directions of development of non-Olympic sports depend on the variability of political and legal factors. Dependence on the power and political stability of the state is defined as the first factor in the further effective operation; competition and competitiveness should

also be taken into account, the services market should be explored, the range of services increased and their quality, effective advertising and strategy of promotion of their services in the market. It can be stated that the Kharkiv Regional Sumo Federation, on the recommendations of interviewed residents of the region, should develop a marketing strategy for the development of sumo, through which to promote services in the market of physical culture and sports services.

In our study, in addition to studying public opinion on the development of sumo in the Kharkiv region, the opportunities and threats of the external environment of the Kharkiv regional sumo federation in the current market conditions (Table 1) were identified. It should be noted that the indicators that scored less than 60 points are threats to the development and implementation of the marketing concept, and the indicators that scored 60 points or more – the possibilities of the marketing environment of the federation.

Table 1

Assessment of opportunities and threats to the activities of the Kharkiv Regional Sumo Federation, according to a survey of specialists in the field of physical culture and sports (n=15)

No.	Evaluation indicators	Sum (Σ)	$\bar{X}$±m	%
1.	Expansion of the range	65	4,26±0,23	60,0
2.	Improving the quality and advertising of its services	60	4,00±0,84	80,0
3.	Legislative changes	62	4,13±0,34	70,6
4.	Popularization of the sport (sumo)	70	4,66±0,34	62,6
5.	Political changes in the country	35	2,33±0,05	80,0
6.	Level of inflation in the country	26	1,73±0,28	88,6
7.	Increased mortality	16	1,07±0,06	72,3
8.	Changing preferences of the population by sport	54	3,60±0,30	72,0
9.	Changing the level of income	44	2,93±0,34	79,6

$$\sum_{i=1}^{n} x_{i\max} = 75 \sum_{i=1}^{n} x_{i\min} = 15$$

From table 1 it is clear that according to experts, the greatest opportunities for further development of the Federation are opened by popularization of sumo among the population and expansion of the range of the Federation itself, quality improvement and advertising of its services, as well as legislative changes. On the other hand, the greatest threat to the development of the Federation is an increase in the mortality rate among the population, inflation and political changes in the country, a somewhat smaller negative impact on the development of the Federation has a change in income levels and preferences of the population by sport. So, taking into account the risks and using all your available resources of the Federation, you should look for ways of further development and competitiveness in the modern services market.

Important, in our opinion, was the fact that the results of a sociological study are confirmed by expert estimates about the possibilities for the further development of sumo in the Kharkiv region thanks to the effective marketing activities of the Federation.

Conclusions / Discussion

The study characterized the structure of the government of sumo in the world and Ukraine, analyzed the main constituent goals and activities of the Kharkiv Regional Sumo Federation, as a public organization of sports and sports orientation, which complemented the study of N. Dolbisheva on the non-Olympic sport management system. The scientific search of S. Bezkorovaynyi, S. Korobko, V. Yaremenko, I. Milansky, M. Kolos, V. Shandrigos on the application of sumo elements in educational institutions and out-of-school educational institutions was extended. Expanded data from previous studies on the development of non-Olympic sports in the Kharkiv region [1; 7], in particular, found that today in the region, 94 athletes are engaged in sumo, 11 of whom are members of the national team of Ukraine; ordinary citizens showed that 48,7% of respondents consider sumo as an unpopular sport in our country, 76% of respondents are not interested in this kind of sport at all, and only 4,3% are interested, while there is a low level of public awareness about sumo in this region. 80% of the respondents consider it necessary to develop sumo in the Kharkiv region, in their view, should increase the marketing activities of the regional Federation, increase the number of broadcasting competitions and informative and entertainment programs on the sumo on television and create official websites of federations and clubs on the Internet and pages in social networks. Experts estimate that the greatest opportunities for the further development of the federation are the popularization of the sumo among the population and the expansion of the range of the federation itself, improving the quality and advertising of its services, as well as legislative changes. It should be noted that according to ordinary citizens and according to experts, the state should have the least impact on the development of sumo in our country and on the activities of the Federation.

Prospects for further research in this direction are to study the international experience of marketing activities of the governing bodies in non-Olympic 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.

References

1. Bairamov, R.Kh., Bondar, A.S., Kotliar, S.M. & Kandrashchenko S.M. (2018), "Menedzhment neolimpiiskoho sportu (na prykladi sumo)",

Bairamov, R. & Bondar, A. (2019), "Organizational and managerial bases of activity of the Kharkiv Regional Sumo Federation", *Slobozhanskyi Herald of Science and Sport*, Vol. 7 No. 3(71), pp. 4-8, doi: 10.5281/zenodo.3371196.

Stratehichne upravlinnia rozvytkom fizychnoi kultury i sportu. Kharkiv, pp. 123-126. (in Ukr.)
2. The Ministry of Youth and Sports of Ukraine (2019), the Report on Physical Culture and Sport of the Office of Youth and Sports of the Kharkiv Regional State Administration as of January 1, 2019. Form No. 2-FC (annual), Kiev. (in Ukr.)
3. Ministry of Education and Science of Ukraine (2014), Sumy. Educational program for children's and youth sports schools, Kiev. (in Ukr.)
4. Sereda, N.V. (2015). "Analysis of the influence of marketing environment factors on the development of non-Olympic sports in sports schools (on the example of sports tourism)", *Slobozans`kij naukovo-sportivnij visnik*, No. 3(47), pp. 111-114. (in Ukr.)
5. Ministry of Education and Sciences of Ukraine (2017), *Optional module. Sumo. Primary Program in the Physical Culture for the Primary Fundamentals of the 5–9th Class*, Smaga, N., Korobko, S. & Rebrina, A. (red.), Kiev. (in Ukr.)
6. Public organization "Kharkiv regional sumo federation" (2016), Statute of the public organization "Kharkiv regional sumo federation", Kharkiv. (in Ukr.)
7. Bondar, A.S. (ed.) (2017), *Organizatsiyno-upravlinski umovi rozvitku neolimpiyskogo sportu na Slobozhanshchini: monografiya*, [Organizational-administrative conditions for the development of non-Olympic sport in Slobozhanshchyna: monograph], Kharkiv. (in Ukr.)
8. Federation of Sumo Ukraine (2019), Official Website of the Sport Committee of Ukraine, available at: http://scu.org.ua/federacii-neolimpijskogo-sporty-ukrainu-28/1052-2013-01-15-16-19- 23.html
9. Abeza, G., O'Reilly, N. & Reid, I. (2013), "Relationship Marketing and Social Media in Sport", *International Journal of Sport Communication*, No. 6 (2), pp. 120-142, doi:10.1123/ijsc.6.2.120.
10. International sumo federation (2019), "International Sumo Federation Regulations On Refereeing", available at: http://www.ifs-sumo.org/ (accessed 10 Juan 2019)
11. Nenad Zec (2011), "Management in sport", *I International Symposium Engineering Management And Competitiveness 2011. June 24-25, 2011*, Zrenjanin, Serbia, pp. 329-332
12. All about sumo (2019), Nihon Sumo Kyokai Official Grand Sumo, available at : www.sumo.or.jp/EnSumoDataRikishi/search/ (accessed 10 Juan 2019)
13. Williams, J. & Chinn, S.J. (2010), "Meeting relationship-marketing goals through social media: A conceptual model for sport marketers", *International Journal of Sport Communication*., No. 3 (4), pp. 422-437, doi:10.1123/ijsc.3.4.422.

Received: 02.05.2019.
Published: 30.06.2019.

Information about the Authors

Bairamov Ruslan Khalik ogly: *Kharkiv State Academy of Physical Culture: 99 Klochkivska Str., Kharkiv, 61058, Ukraine.*
ORCID.ORG/0000-0001-8204-5533
E-mail: bayramov16031990@ukr.net

Anastasia Bondar: *PhD (Physical Education and sport); Kharkiv State Academy of Physical Culture: Klochkivska str., 99, Kharkiv, 61058, Ukraine.*
ORCID.ORG/0000-0002-2816-4985
E-mail: anastasiabond1@ukr.net

SLOBOZHANSKYI HERALD OF SCIENCE AND SPORT

UDK 616.833-001.35/615.825

ISSN (English ed. Online) 2311-6374
2019, Vol. 7 No. 3(71), pp. 9-12
DOI: 10.5281/zenodo.3371188

Rehabilitation examination of patients with compression-ischemic neuropathy of the upper limb

Olena Bismak

National University of Ukraine on Physical Education and Sport, Kyiv, Ukraine

Compression-ischemic neuropathy of the upper limb is a common disease of the peripheral nervous system, accompanied by impaired motor, sensory spheres and a decrease in the quality of life in people of working age.

Purpose: *to reveal the structure of rehabilitation examination in people with compression-ischemic neuropathy of the upper limb.*

Material & Methods: *analysis and synthesis of data from scientific and methodological literature and the Internet information network; interrogation, history taking, palpation, tests, mathematical methods. The study was conducted on the basis of the neurological departments No. 1 and No. 2 of the Kiev City Clinical Hospital No. 4, Kiev, from 2017 to 2019. The examination involved 48 patients with compression-ischemic neuropathy of the upper limb.*

Results: *a scheme (algorithm) of rehabilitation examination was proposed, which included: a survey, history taking, determining the level of damage, the degree of neurological deficit, motor and sensory disturbances, muscle hypotrophy and atrophy, joint and muscle contracture. During the initial examination of patients with compression-ischemic neuropathy of the upper limb, the predominance of male patients was revealed, namely 89.6%. Damage to the peripheral nerves of the upper limb was more often observed in patients of able-bodied young and middle age – 77,1%. The vast majority were patients with radiation injuries – 52,1% and ulnar nerves – 35,4%. In 60,4% of individuals, pains of moderate intensity were observed (4–6 points on a 10-point visual-analogue scale for assessing pain intensity (VAS)).*

Conclusions: *an initial examination was carried out indicating the presence of disorders of the motor and sensory function of the affected limb in individuals with this pathology. To restore the functional state and preserve the function of the affected limb, it is necessary to comply with the developed scheme (algorithm) of the rehabilitation examination, and will contribute to the development of an effective physical therapy program.*

Keywords: *rehabilitation examination, compression-ischemic neuropathy, patients, physical therapy, motor, sensory disturbances.*

Introduction

Today in Ukraine, as in other countries of the world, there is a tendency to increase neurological diseases. Diseases of the peripheral nervous system is currently a socially significant problem [2]. Compression ischemic (tunnel) neuropathies are quite common in clinical practice [12]. Tunnel neuropathies account for 1/3 of diseases of the peripheral nervous system. The literature describes more than 30 forms of tunnel neuropathies [5].

The reason for the development of compression-ischemic neuropathy is a short, moderate or prolonged slight compression (compression) of the nerve, which is accompanied by a violation of the internal neural circulation, leads to the development of ischemia of nerve fibers. It was found that even short-term, but strong compression of the nerve leads to blockage of neural conduction mainly in motor fibers due to local demyelination at the site of compression and degeneration of part of the nerve fibers, followed by progressive distal atrophy of the nerve. Ischemic damage to nerve fibers leads to their Waller degeneration [4; 17].

Acute (develop within a few days to 4 weeks), subacute (develop within a few weeks) and chronic, including recurrent (develop within a few months or years), tunnel neuropathies are distinguished by the timing of development. [6].

The full clinical picture of tunnel syndrome includes sensory (pain, paresthesia, numbness), motor (decreased function, weakness, atrophy) and trophic disorders. There are various options for the clinical course. More often – a debut from pain or other sensitive disorders. Less commonly, the onset is with motor impairment. Trophic changes, as a rule, are expressed slightly and only in advanced cases. The characteristic syndrome of tunnel syndrome is pain. Usually the pain appears during movement (load), then it occurs at rest. Sometimes the pain wakes up the patient at night, which drains the patient and makes him see a doctor [16].

Motor disturbances occur as a result of damage to the motor branches of the nerve and manifest as a decrease in strength, rapid fatigue. In some cases, the progression of the disease leads to atrophy, the development of contractures ("clawed paw", "monkey paw") [1; 15].

Bismak, O. (2019), "Rehabilitation examination of patients with compression-ischemic neuropathy of the upper limb", *Slobozhanskyi Herald of Science and Sport*, Vol. 7 No. 3(71), pp. 9-12, doi: 10.5281/zenodo.3371188

The treatment of tunnel syndromes is based on conservative therapy aimed at decompression of the nerve trunk and restoration of its functions. Medications and non-medications are used, among which an important role is given to physical therapy, since with this pathology, disorders of the motor function of the upper limb are observed [11].

The components of the clinical activity of a physical therapist are examination; assessment; diagnosis of violations; forecasting; interventions [3]. However, the analysis of literature and Internet sources indicates that little attention is paid to the problem of conducting a rehabilitation examination in compression-ischemic neuropathy. Therefore, the study of the structure and content of rehabilitation examination in compression-ischemic neuropathy is an urgent problem.

Purpose of the study: to reveal the structure of rehabilitation examination in people with compression-ischemic neuropathy of the upper limb.

Material and Methods of the research

Research methods: analysis and synthesis of data from scientific and methodological literature and the Internet information network; interrogation, history taking, palpation, mathematical methods.

The study was conducted on the basis of the neurological departments No. 1 and No. 2 of the Kiev City Clinical Hospital No. 4, Kiev, from 2017 to 2018. The examination involved 48 patients with compression-ischemic neuropathy of the upper limb.

Results of the research

It is known that one of the areas of work of a physical therapist is a comprehensive examination of patients with the aim of establishing a rehabilitation diagnosis and planning an intervention program.

To determine motor disorders, we developed a *rehabilitation examination* scheme (algorithm), which included: a survey, medical history, determination of the level of damage, the degree of neurological deficit, motor and sensory disturbances, muscle hypotrophy and atrophy, joint and muscle contractures. The survey results were recorded in a specially designed rehabilitation examination card.

Surveys included patient complaints, both basic and additional, information about the features of professional activity, since one of the reasons for the development of neuropathy of the upper limb, in particular carpal tunnel syndrome, is compression of the median nerve during the performance of work functions [11]. It is important to pay attention to the age of the person, the date of diagnosis and the period of manifestation of the disease, which will analyze the rate of progression of neuropathy.

The survey made it possible to find out the priority tasks of rehabilitation interventions and the needs of the patient.

When collecting an anamnesis, it was found out the presence of trauma in the past (traffic accidents, falls, fractures, stab wounds, gunshot wounds, etc.), provoking factors (profession, occupation), the time of manifestation of symptoms was specified, a history of concomitant diseases and previous ones was collected surgical interventions. Palpation was determined by the presence of soreness, hypertrophic altered tissues, joint deformities.

When conducting a rehabilitation examination, it is necessary to know what motor and sensory disturbances occur when a particular nerve of the upper limb is affected. In addition, the symptoms of neuropathy are largely determined by the location of the compression of the nerve.

So, with neuropathy of the radial nerve, the motor function is primarily disturbed: the patient cannot squeeze his hand tightly, not only delicate work (writing, knitting) is difficult, but also rough. In addition, the clinical picture includes specific manifestations, namely: a symptom of a "mounted brush", limitation or absence of amplitude of movements (extension of the forearm, hand, fingers in the metacarpophalangeal joints, extension of the I finger) difficulty supination of the forearm, hand; retraction of I, IV, V fingers from the III finger, and finger from II, retraction and adduction of the hand. There is a decrease or complete lack of sensitivity in the area from the shoulder to the back surface of the III-V fingers. As a rule, sensitivity is disturbed in the area of the "anatomical snuffbox" on the hand [8; 10].

With incomplete damage to the ulnar nerve, weakness of the muscles of the hand, hypotrophy of the muscles in the region of the first interdigital spaces, decreased sensitivity in the region of the fifth finger, pain, tingling along the ulnar nerve are noted. For complete damage to the ulnar nerve, anesthesia of the skin of the fifth finger, half of the fourth finger, the ulnar edge of the palm, paralysis of the muscles that move the finger, and the flexor muscles of this finger are characteristic. A person is disturbed by a constant feeling of tightness, soreness, burning in the region of IV-V fingers. The formation of the so-called "clawed paw" of paresis and atrophy of the own muscles of the hand [8].

When the median nerve is damaged, the muscles of the hand are affected (most often it is carpal tunnel syndrome), which are responsible for flexion, atrophy of the muscles of the palm occurs and it becomes impossible to bend I-II fingers, it is difficult for the patient to hold small objects. Patients have a typical "monkey" brush; it is impossible to bend the terminal phalanges of I-II fingers with the palm firmly lying on the table ("scratches"), it is impossible to hold a sheet of paper between the I and II fingers (and the finger is straightened). The defeat of the median nerve is accompanied by sensitivity disorders, trophic and vasomotor disorders (increased sweating of the skin of the palmar surface) [7; 9; 13].

During the initial examination, we found a predominance of

male patients, namely 89,6% (women – 10,4%), which is obviously connected with the lifestyle and habits (driving a motorcycle, scooter) and the features of work in the so-called "male" professions. Among the males, working professions predominated, women worked as accountants, cashiers and conveyor workers.

According to the new WHO classification of 2015, patients are divided into age groups according to young age (25–44 years), middle (45–59 years), elderly (60–74 years) and senile (>75 years). The age of patients ranged from 19 to 78 years. As can be seen from the Table 1, injuries of the peripheral nerves of the upper limb were more often observed in patients of precisely working age – 77,1%. The greatest number of peripheral neuropathies among the examined patients was found in young people (25–44 years old) – 43,8%.

Table 1

Distribution of patients by age (n=48)

Age of patients	Number of patients	
	abs.	%
under 25 years old	2	4,1
25–44 years old	21	43,8
44–60 years old	16	33,3
60–75 years old	8	16,7
>75 years old	1	2,1

The distribution of patients according to the clinical syndromes of nerve damage is presented in Table 2: the vast majority of observations were made by patients with injuries of the radial nerve – 52,1% and the ulnar nerve – 35,4%.
Pain is assessed using a ten-point visual-analogue scale for assessing pain intensity (VAS) (Table 3).

The muscle strength of the affected upper limb, we plan to evaluate by manual muscle test (MMT) [14]. The test results showed that in all patients there was a decrease in muscle strength of the affected limb.

Table 2

Distribution of patients according to clinical syndromes (n=48)

Clinical Syndromes	Number of patients	
	abs.	%
Injuries of the ulnar nerve	17	35,4
Injuries to the radial nerve	25	52,1
Injuries to the median nerve (carpal tunnel syndrome)	4	8,3
Combined injuries to the median and ulnar nerves	2	4,2

Table 3

Severity of pain in the examined patients (n=48)

Manifestations of pain	Number of patients	
	abs.	%
Moderate pain (4-6 points)	29	60,4%
Intense, unbearable pain (7-9 points)	19	39,6%

Conclusions / Discussion

The initial examination showed the presence of disorders of the motor and sensory function of the affected limb in individuals with this pathology. To restore the functional state and preserve the function of the affected limb, it is necessary to comply with the developed scheme (algorithm) of the rehabilitation examination, and will contribute to the development of an effective physical therapy program.

Our results of the initial examination of persons with compression-ischemic neuropathy of the upper limb confirm the results of studies by scientists E. V. Bakhterev, Yu. V. Tsimbalyuk and others.

Prospects for further research are to justify the means of physical therapy for this pathology.

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.

References

1. Bakhtereva, E.V. (2017*), Kompressionnye perifericheskie nevropatii verkhnikh konechnostey: rol' proizvodstvennykh faktorov, rannyaya diagnostika i lechenie: avtoref. dis. d-ra med. nauk* [Compression peripheral neuropathies of the upper extremities: the role of production factors, early diagnosis and treatment: abstract of the dissertation of the medical sciences doctor], Ekaterinburg, 44 p. (in Russ.)
2. Bismak, O.V. (2019), "Peripheral neuropathy of the upper limb as a medical and social problem", *Scientific journal of the National Pedagogical University named after MP Drahomanov Series No. 15. Scientific and pedagogical problems of physical culture (physical culture and sports),* No. 7 (115), pp. 12-16. (in Ukr.)
3. Bismak, O.V. (2019), "The role of physical therapist in rehabilitation of carpal tunnel syndrome patients", *Materials of the international scientific and practical conference "Traditions and innovations in the training of specialists in physical education and physical rehabilitation",* pp. 53-58. (in Ukr.)
4. Golubev, V.L., Merkulova, D.M. & Orlova, O.R. (2017), "Tunnel hand syndromes", *Russian Medical Journal*, No.2. (in Russ.)
5. Levin, O.S. (2005), *Polyneuropathies*, Moscow. (in Russ.)
6. Merkulova, D.M., Merkulov, Yu.A. & Nikitin, C.C. (2012), "Tunnel neuropathies. Diagnosis and principles of pathogenetic therapy", *Consilium Med.*, No. 2, pp. 1-2. (in Russ.)
7. Nikitin, S.S., Maslak, A.A., Kurenkov, A.L., Savitskaya, N.G. & Pripisnova, S.G. (2013), "Features of the diagnosis of carpal tunnel syndrome using electromyography and ultrasound", *Annals of Clinical and Experimental Neurology*, Volume 7, No. 4, pp. 20-26. (in Russ.)
8. Pizova, N.V. (2017), "Clinic, Diagnosis and Therapy of Some Tunnel Syndromes of the Upper Limbs", *Russian Medical Journal*, No. 21, pp. 1548-1552. (in Russ.)

Bismak, O. (2019), "Rehabilitation examination of patients with compression-ischemic neuropathy of the upper limb", *Slobozhanskyi Herald of Science and Sport*, Vol. 7 No. 3(71), pp. 9-12, doi: 10.5281/zenodo.3371188

9. Suponeva, N.A., Piradov, M.A., Gnedovskaya, E.V., Belova, N.V., Yusupova, D.G., Vuytsik, N.B. & Lagoda, D.Yu. (2016), "Carpal tunnel syndrome: the main issues of diagnosis, treatment and rehabilitation (review)] ", *Ulyanovsk Medical and Biological Journal*, No. 2, pp. 91-97. (in Russ.)
10. Khalimova, A.A. (2013), "Wrist Tunnel Syndrome (Literature Review)", *Vestnik AGIUV*, pp. 94-101. (in Russ.)
11. Tsymbaliuk, Yu.V. (2014). *Vidnovne neirokhirurhichne likuvannia ushkodzhen peryferychnykh nerviv iz zastosuvanniam dovhotryvaloi elektrostymuliatsii: avtoreferat dysertatsii doktora medychnykh nauk: 14.01.05* [Restorative neurosurgical treatment of peripheral nerves injuries with the use of long-term electrostimulation: the dissertation author's abstract of the doctor of medical sciences]. NAMN Ukrainy, In-t neirokhirurhii im. A.P. Romodanova, Kyiv, 40. (in Ukr.)
12. Assmus, H., Antoniadis, G. & Bischoff, C. (2015), "Carpal and cubital tunnel and other, rarer nerve compression syndromes", *Dtsch Arztebl Int.*, Vol. 112(1-2), pp. 14-25.
13. Dong-Wook, R., Sang Hee, I., Seong-Kyun, K. et al. (2011), "Median nerve conduction study through the carpal tunnel using segmental nerve length measured by ultrasonographic and conventional tape methods", *Phys. Med. Rehabilitation*, No. 92, pp. 1-2.
14. Hagert, E. & Hagert, C-G. (2008), "Manual Muscle Testing – A Clinical Examination Technique for Diagnosing Focal Neuropathies in the Upper Extremity" In book: Upper Extremity Nerve Repair: Tips and Techniques, Chapter: 36, *American Society for Surgery of the Hand, Editors: David Slutsky*, pp.451-466.
15. Jepsen, J.R., Laursen, L.H., Kreiner, S. & Larsen, A.I. (2009), "Neurological Examination of the Upper Limb: A Study of Construct Validity", *Open Neurol J.*, No. 3, pp. 54-63, doi: 10.2174/1874205X00903010054.
16. Jepsen, J.R. (2018), "Studies of upper limb pain in occupational medicine, in general practice, and among computer operators", *Dan Med J.*, No. 65(4).
17. Linda, D.D., Harish, S., Stewart, B.G., Finlay, K., Parasu, N., Rebello, R.P. (2010), "Multimodality imaging of peripheral neuropathies of the upper limb and brachial plexus", *Radiographics*, No. 30(5), pp. 1373-400, doi: 10.1148/rg.305095169.

Received: 20.05.2019.
Published: 30.06.2019.

Information about the Authors

Olena Bismak: *PhD (Physical Education and Sport), Associate Professor: National University of Ukraine on Physical Education and Sport: Fizkul'tury str. 1, Kyiv, 03150, Ukraine.*
ORCID.ORG/0000-0002-6495-6170
E-mail: ebismak@gmail.com

SLOBOZHANSKYI HERALD OF SCIENCE AND SPORT

UDK 796.012.13:797.12

ISSN (English ed. Online) 2311-6374
2019, Vol. 7 No. 3(71), pp. 13-19
DOI: 10.5281/zenodo.3371083

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

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

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

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

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

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

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

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

Introduction

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

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

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

Balanced autonomic regulation of muscle activity allows an athlete to maximize the use of their functionality with the prop-

Bogush, V., Getmantsev, S., Bogatyirev, K., Tarasova, G., Kulakov, Yu. & Yatsunskiy, Ye. (2019), "Functional state of the rowers on kayaks at the stage of special basic training", *Slobozhanskyi Herald of Science and Sport*, Vol. 7 No. 3(71), pp. 13-19, doi: 10.5281/zenodo.3371083

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

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

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

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

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

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

Material and Methods of the research

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

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

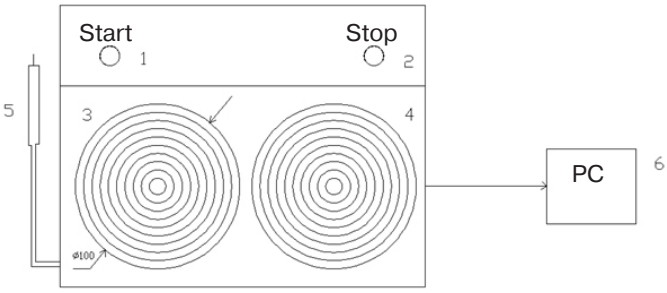

Fig. 1. Scheme of the device for measuring the effect of the training action (META):
1, 2 – alarm device; 3 – left target; 4 – right target; 5 – dipstick; 6 – personal computer.

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

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

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

the mean and the mean square deviation were calculated.

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

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

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

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

Results of the research

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

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

Table 1

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

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

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

Bogush, V., Getmantsev, S., Bogatyirev, K., Tarasova, G., Kulakov, Yu. & Yatsunskiy, Ye. (2019), "Functional state of the rowers on kayaks at the stage of special basic training", *Slobozhanskyi Herald of Science and Sport*, Vol. 7 No. 3(71), pp. 13-19, doi: 10.5281/zenodo.3371083

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Table 2

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

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

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

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

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

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

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

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

Bogush, V., Getmantsev, S., Bogatyirev, K., Tarasova, G., Kulakov, Yu. & Yatsunskiy, Ye. (2019), "Functional state of the rowers on kayaks at the stage of special basic training", *Slobozhanskyi Herald of Science and Sport*, Vol. 7 No. 3(71), pp. 13-19, doi: 10.5281/zenodo.3371083

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

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

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

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

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

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

Conclusions / Discussion

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

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

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

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

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

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

The data obtained can be applied in the training process in the preparation of athletes with regard to the age dynamics of

the development of physical qualities, somatic, sensory and autonomic systems of the body in the selection, construction and correction of the training process, the study of compensatory reactions and recovery processes in sports.

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

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

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.

References

1. Platonov, V.N. (2013), *Periodizatsiya sportivnoy trenirovki. Obshaya teoriya i ee prakticheskoe primenenie* [Periodization of sports training. General theory and its practical application], Olymp. lit., Kiev. (in Russ.)
2. Gunina, L., & Cheredny`chenko, O (2012), "Assessment of the combined effect of nontraining facilities on the indicators of special working capacity and homeostasis parameters of qualified rowers", *Teoriia i metodyka fizychnoho vykhovannia i sportu*, No. 2, pp. 103-107. (in Ukr.)
3. Turevskiy, I.M. (2009), "Extreme conditions as a factor in the adaptation of young athletes to the motor", *Materials of the First International Scientific and Practical Conference: Gifted in Sporting and Extreme Activities*, Moscow. (in Russ.)
4. Matveev, L.P. & Meerson, F.Z. (1984), "Some laws of sports training in the light of the modern theory of adaptation to physical loads", *Adaptatsiya sportsmenov k trenirovochnyim i sorevnovatelnyim nagruzkam*, pp. 29-40. (in Russ.)
5. Vinohradov, V. (2006), "Effectiveness of extra-curricular means, aimed at increasing the implementation of anaerobic potential in a series of unidirectional training sessions of qualified rowers", *Teoriia i metodyka fizychnoho vykhovannia i sportu*, No. 4, pp. 57-62. (in Ukr.)
6. Malikov, N.V., Bogdanovskaya, N.V. & Kuznetsov, A.A. (2005), "The use of new computer technologies in assessing the functional readiness and functional state of the body", *Slobozans`kij naukovo-sportivnij visnik*, No. 8, pp. 237-240. (in Russ.)
7. Rovnyi, A.S., & Rovnyi, V.A. (2012), "Psychosensory correlates as a mechanism for controlling precise human movements", *Symposium "Features of formation and formation of psychophysiological functions of a person in ontogenesis"*, pp. 73-74. (in Ukr.)
8. Rovnyi, A.S. (2015), "Features of the functional activity of kinesthetic and visual sensory systems in athletes of various specializations", *Slobozans'kiy naucovo-sportivniy visnik*, No. 1(45), pp. 104-108, doi: 10.15391/snsv. 2015-1.020. (in Russ.)
9. Malikov, M.V., Bohdanovska, N.V. & Svatiev, A.V. (2006), *Funktsionalna diahnostyka v fizychnomu vykhovanni ta sporti* [Functional diagnostics in physical education and sports], Zaporizhzhia. (in Ukr.)
10. Semkin, A.A. (1992), *Fiziologicheskaya harakteristika razlichnyih po strukture dvizheniya vidov sporta: Mehanizm adaptatsii* [Physiological characteristics of various kinds of movement sports: The mechanism of adaptation], Polyimya, Minsk (in Russ.)
11. Kamaiev, O.I. (2017), "Structural features and characteristics of the process of training an athlete as a system object", *Slobozans`kij naukovo-sportivnij visnik*, No. 1(57), pp. 41-48, doi: 10.15391/snsv.2017-1.007. (in Russ.)
12. Platonov, V.N. & Bulatova, M.M. (1995), *Fizychna pidgotovka sportsmena* [Physical training of an athlete System], Olimpiiska literatura, Kiev (in Ukr.)
13. Laputyn, A.M., Hamalii, V.V. & Arkhypov, O.A. (2005), *Biomekhanika sportu* [Biomechanics of sport], Olimpiiska literatura, Kiev. (in Ukr.)
14. Shinkoruk, O.A. (2013), *Teoriya i metodika pidgotovky sportsmeniv: upravlinnya, kontrol`, vidbir, modeluvannya ta prognoz v olimpijs`komu sporti* [The theory and methods of training athletes: management, control, selection, modeling and forecasting in the Olympic sport], Poligraf ekspres, Kiev. (in Ukr.)

Received: 25.04.2019.
Published: 30.06.2019.

Information about the Authors

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

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

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

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

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

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

E-mail: lily0210837@gmail.com

Bogush, V., Getmantsev, S., Bogatyirev, K., Tarasova, G., Kulakov, Yu. & Yatsunskiy, Ye. (2019), "Functional state of the rowers on kayaks at the stage of special basic training", *Slobozhanskyi Herald of Science and Sport*, Vol. 7 No. 3(71), pp. 13-19, doi: 10.5281/zenodo.3371083

UDK 796.412[796.012.63:796.015.132]

ISSN (English ed. Online) 2311-6374
2019, Vol. 7 No. 3(71), pp. 20-24
DOI: 10.5281/zenodo.3371198

Characteristics of the leading factors of special physical preparedness of athletes from acrobatic rock and roll at the stage of preliminary basic training

Petro Kyzim
Serhii Humeniuk

Kharkiv State Academy of Physical Culture, Kharkiv, Ukraine

Purpose: *analysis of the leading factors of special physical fitness of athletes from acrobatic rock and roll at the stage of preliminary basic training.*

Material & Methods: *10 sports couples took part in the study (10 male partners, 10 female partners). The research methods are: theoretical analysis and synthesis of data from special scientific and methodological literature; pedagogical testing methods; methods of mathematical statistics (factor analysis).*

Results: *the analysis of the identified factors of special physical fitness of athletes-Juvenal at the beginning of the pedagogical experiment was conducted and their redistribution in the factor structure of preparedness at the end of the pedagogical experiment was established.*

Conclusions: *it was found that for male partners and female partners the determining factors are: speed-strength, coordination; anthropometric; functional preparedness. The results of the analysis of the factor structure of preparedness of athletes from acrobatic rock-and-roll testifies to the significant impact of the use of the developed speed-strength patterns, motor coordination and functional training on the special and competitive preparedness of juvenile athletes at the stage of preliminary basic training.*

Keywords: *acrobatic rock and roll, factors, analysis, preparedness, juvenile athletes.*

Introduction

It is known that improving the athletic performance of athletes at the stage of preliminary basic training is possible only if objective data are available, taking into account the characteristics of training and the structure of athletes' preparedness [2]. Features of modern sports training, which is characterized by high intensity of muscle activity, determines the search for factors and conditions that determine the training of athletes [3; 4]. The regularity of the formation of adaptation to the factors of training impact and the formation of differences in the components of sportsmanship provide at each new stage of improvement the presentation to the body of athletes of requirements close to the limit of their functional capabilities is crucial for the effective flow of adaptive processes [9; 11]. An important aspect of the management processes of such a complex dynamic system, like acrobatic rock and roll, is the principle of feedback, according to which successful management can be carried out only if the trainer receives information about the effect achieved under his influence on the athlete [1; 4; 10]

Purpose of the study: analysis of the leading factors of special physical preparedness of athletes from acrobatic rock and roll at the stage of preliminary basic training.

Objectives of the study:

1. To study the problem of special physical preparedness of juvenile athletes from acrobatic rock and roll at the stage of preliminary basic training.

2. To determine the leading factors of special physical preparedness of juvenile athlfrom acrobatic rock and roll at the stage of preliminary basic training

Material and Methods of the research

The study involved 10 sports couples (10 male partners, 10 female partners) from an acrobatic rock and roll category "Juvenile", whose training and training process at the preliminary basic training stage included exercises of speed-strength orientation and functional training (integral set of exercises) [3]. With the help of factor analysis, the influence of the developed technique on the special and competitive readiness of the juvenile athletes (male partners) was investigated.

Research methods: theoretical analysis and synthesis of data from special scientific and methodological literature; pedagogical testing methods; methods of mathematical statistics (factor analysis) using the universal statistical package "STATISTICA".

To determine the factor structure of special physical fitness of athletes of the Juvenal category in acrobatic rock-and-roll and the dynamics of its change under the influence of an

experimental technique, a factor analysis was conducted of 7 indicators of special physical fitness (T1 – "2 somersaults forward, 1 somersault back, "tour" for 30 seconds (number of times) "; T2 – "Performing the main move in 20 seconds (number of times)"; T3 – "Lower change with the rotation of the female partner at 540° (number of times) "; T4 – "Top change with the turn of the partner at 720° in American spin (number of times)"; T5 – "Lower, upper change, tour anler (in the air) for 360° (number of times)"; T6 – "Lower, upper change, the female partner jump up with the support of the male partner's hands (number of times)"; T7 – "Performing competitive program in nonstop (number of times)"), 3 indicators of functional preparedness (the girth of the chest in a rest condition (cm), the index Rufie (c. u.), VC, ml) and anthropometric indices (18 indicators in total) at the beginning and at the end of the pedagogical experiment. Given the fact that acrobatic rock'n'roll is a pair of sports, then factor analysis was conducted separately for each of the partners of the sports pair. But despite this, each of them is a component of a single process of competition aimed at achieving a high sporting result [5–7]. The initial data of the factor analysis did not include the parameters of psychological, tactical and other types of athletes' preparedness, which are concomitant with special physical preparedness and also affect the athletic performance in acrobatic rock and roll. Based on the purpose of our work, in this aspect, indicators of special physical fitness, anthropometric indicators and indicators of the Ruffier index were taken into account, which play a major role in the technique of performing elements (movements) in a pair [8; 10].

Results of the research

According to the data obtained [3], in the group of juvenile athletes (male partners) 4 factors were revealed (Table 1).

In Fig. 1 shows the factor structure of indicators of special physical preparedness of athletes Juvenal (male partners) of the experimental group at the beginning of the pedagogical experiment. This structure explains 82,1% of the total variance, which indicates its adequacy. 17,9% of the total variance accounted for by other parameters that were not included in the output of the factor analysis.

The factor structure obtained from the analysis of data from

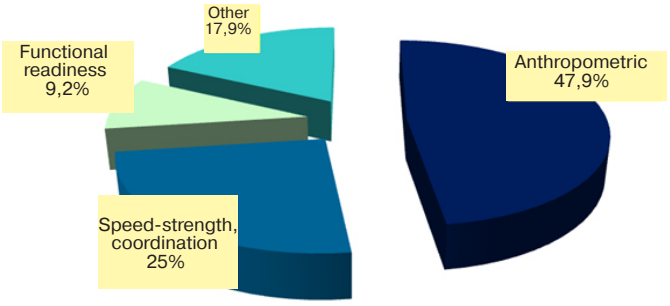

Fig. 1. Factor structure of special physical preparedness of athletes (male partners) of the "Juvenal" category of the experimental group at the beginning of the pedagogical experiment

Table 1

Factor structure of fitness of athletes of the category "Juveniles" from acrobatic rock and roll (male partners) at the beginning of the pedagogical experiment

Name of the factor, the total contribution to the variance	Indicators	Factors			
		1	2	3	4
1. Anthropometric, 47,9%	Length of the right hand, cm	0,97	–	–	-
	Length of the left leg, cm	0,97	–	–	-
	Length of the left lower leg, cm	0,93	–	–	-
		0,95	–	–	-
	Length of the right thigh, cm	0,80	–	–	–
	Girth of the left hip, cm	0,98	–	–	–
	Girth of the left shin, cm	0,88	–	–	–
	Body weight, kg	0,98	–	–	–
	Body length, cm	0,99	–	–	–
2. Speed-strength, coordination, 25,0%	T1. 2 somersaults forward, 1 somersault back, "tour" for 30 seconds (number of times)	–	0,82	–	–
	T2. Performing the main move in 20 seconds (number of times)	–	0,88	–	–
	T4. Top change with the turn of the partner at 720° in American spin (number of times)	–	0,71	–	–
	T5. Lower, upper change, tour anler (in the air) for 360° (number of times)	–	0,83	–	–
	T6. Lower, upper change, the partner jump up with the support of the partner's hands (number of times)	–	0,94	–	–
3. Functional readiness, 9,2%	Chest girth at rest, cm	–	–	0,98	–
	VC, ml	–	–	0,78	–
	Rufie Index (c. u.)	–	–	–0,67	–
4. Other – 17,9%					

Kyzim, P. & Humeniuk, S. (2019), "Characteristics of the leading factors of special physical preparedness of athletes from acrobatic rock and roll at the stage of preliminary basic training", *Slobozhanskyi Herald of Science and Sport*, Vol. 7 No. 3(71), pp. 20-24 , doi: 10.5281/zenodo.3371198

partners of the experimental group of juvenile athletes explains 77,4% of the total variance (Table 2, Figure 2).

The factor structure obtained from the results of the analysis of the experimental data of the group of athletes Juvenal

Table 2

Factor structure of fitness of athletes of the category "Juveniles" from acrobatic rock and roll (female partners) at the beginning of the pedagogical experiment

Name of the factor, the total contribution to the variance	Indicators	Factors			
		1	2	3	4
1. Anthropometric, 45,4%	Length of the left hand, cm	0,71	–	–	–
	Length of the right leg, cm	0,98	–	–	–
	Length of the right lower leg, cm	0,90	–	–	–
	Length of the right foot, cm	0,89	–	–	–
	Girth of the right shin, cm	0,79	–	–	–
	Body weight, kg	0,70	–	–	–
	Body length, cm	0,93	–	–	–
2. Speed-strength, coordination, 20,7%	T1. 2 somersaults forward, 1 somersault back, "tour" for 30 seconds (number of times)	–	0,90	–	–
	T2. Performing the main move in 20 seconds (number of times)	–	0,78	–	–
	T3. Lower change with the rotation of the partner at 540° (number of times)	–	0,75	–	–
	T5. Lower, upper change, tour anler (in the air) for 360° (number of times)	–	0,72	–	–
	T6. Lower, upper change, the partner jump up with the support of the partner's hands (number of times)	–	0,70	–	–
	T.7. Performing competitive program in nonstop (number of times)	–	0,85	–	–
3. Functional readiness, 11,3 %	Chest girth at rest, cm	–	–	0,81	–
	VC, ml	–	–	0,79	–
	Rufie Index (c. u.)	–	–	–0,90	–
4. Other – 22,6 %					

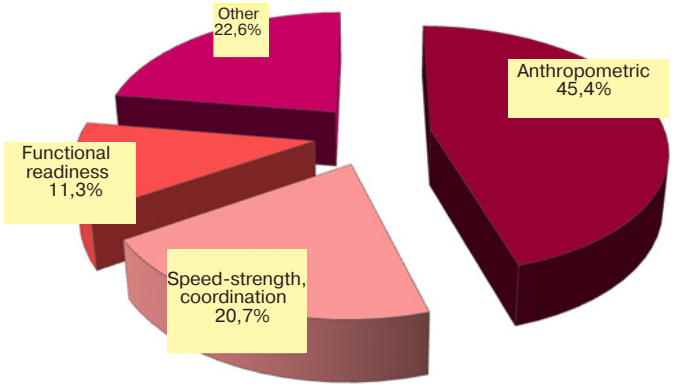

Fig. 2. Factor structure of special physical fitness of athletes (female partners) of the "Juvenal" category of the experimental group at the beginning of the pedagogical experiment

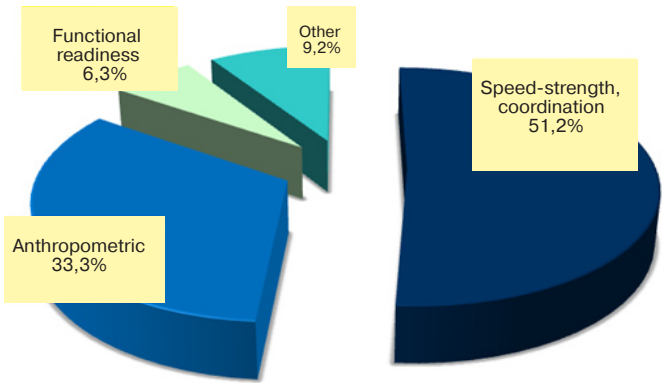

Fig. 3. Factor structure of special physical preparedness of athletes (male partners) of the "Juvenal" category of the experimental group at the end of the pedagogical experiment

(male partners) after the pedagogical experiment explains 90.8% of the total variance (Table 3, Figure 3).

Thus it was established that during the period of the training process, the redistribution of the significance of factors into partners took place. The speed-strengh factor, coordination factor (51,2%) came out on top, the anthropometric factor came in second place, which has a percentage ratio to the total variance of 33,3%, the third place was left to the factor of functional readiness with a percentage ratio to the total variance 9,2%, the fourth factor has incorporated other indicators of preparedness and has a percentage of the total variance – 6,3%. The redistribution of the importance of factors among the male partners testifies to the significant influence of the use of developed speed-strengh orientation complexes and functional training (integral complex of exercises) developed in the training process on the special and competitive preparation of athletes-juvenals (male partners) in the stage of preliminary basic training.

Table 3

Factor structure of fitness of athletes of the category "Juveniles" from acrobatic rock and roll (male partners) at the end of the pedagogical experiment

Name of the factor, the total contribution to the variance	Indicators	Factors			
		1	2	3	4
Speed-strength, coordination, 51,2%	T1. 2 somersaults forward, 1 somersault back, "tour" for 30 seconds (number of times)	0,81	–	–	–
	T2. Performing the main move in 20 seconds (number of times)	0,97	–	–	–
	T3. Lower change with the rotation of the partner at 540° (number of times)	0,89	–	–	–
	T4. Top change with the turn of the partner at 720° in American spin (number of times)	0,92	–	–	–
	T5. Lower, upper change, tour anler (in the air) for 360° (number of times)	0,71	–	–	–
	T6. Lower, upper change, the partner jump up with the support of the partner's hands (number of times)	0,85	–	–	–
	T.7. Performing competitive program in nonstop (number of times)	0,94	–	–	–
Anthropometric, 33,3%	Length of the right hand, cm	–	0,87	–	–
	Length of the left leg, cm	–	0,88	–	–
	Length of the left lower leg, cm	–	0,84	–	–
	Girth of the left hip, cm	–	0,88	–	–
	Girth of the left shin, cm	–	0,88	–	–
	Body weight, kg		0,77		–
	Body length, cm		0,77		–
Functional readiness, 6,3%	Chest girth at rest, cm	–	–	0,71	–
	VC, ml	–	–	0,73	–
	Rufie Index (c. u)	–	–	–0,65	–
Other – 9,2%					

In the factor structure of the preparedness of the female partners of the experimental group after the pedagogical experiment, four factors were identified that explain 83,7% of the total variance (Table 4, Figure 4).

Table 4

Factor structure of fitness of athletes of the category "Juveniles" from acrobatic rock and roll (female partners) at the end of the pedagogical experiment

Name of the factor, the total contribution to the variance	Indicators	Factors			
		1	2	3	4
Speed-strength, coordination, 42,7%	T1. 2 somersaults forward, 1 somersault back, "tour" for 30 seconds (number of times)	0,95	–	–	–
	T2. Performing the main move in 20 seconds (number of times)	0,95	–	–	–
	T3. Lower change with the rotation of the partner at 540° (number of times)	0,90	–	–	–
	T6. Lower, upper change, the partner jump up with the support of the partner's hands (number of times)	0,84	–	–	–
	T.7. Performing competitive program in nonstop (number of times)	0,90	–	–	–
Anthropometric, 30,5%	Length of the right hand, cm	–	0,82	–	–
	Length of the left leg, cm	–	0,85	–	–
	Length of left foot, cm	–	0,87	–	–
	Girth of the left shin, cm	–	0,88	–	–
	Body weight, kg	–	0,91		–
	Body length, cm	–	0,85		–
Functional readiness 10,5%	Chest girth at rest, cm	–	–	0,74	–
	VC, ml	–	–	0,83	–
	Rufie Index (c. u.)	–	–	–0,75	–
Other – 16,3%					

Kyzim, P. & Humeniuk, S. (2019), "Characteristics of the leading factors of special physical preparedness of athletes from acrobatic rock and roll at the stage of preliminary basic training", *Slobozhanskyi Herald of Science and Sport*, Vol. 7 No. 3(71), pp. 20-24 , doi: 10.5281/zenodo.3371198

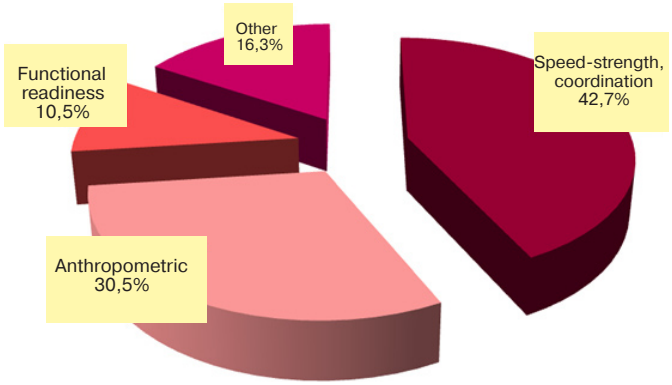

Fig. 4. Factor structure of special physical preparedness of athletes (female partners) of the "Juvenal" category of the experimental group at the end of the pedagogical experiment

An analysis of the factor preparedness of female partners before and after the pedagogical experiment also showed a redistribution of the significance of factors. In the first place should be the factor of speed-strength, coordination (42,7%), in the second place is the anthropometric factor, which is 30,5% as a percentage of the total variance explained. The third factor of *functional readiness* decreased by 0,8% and is 10,5%. The total contribution of the factor structure to the variance after the pedagogical experiment increased by 6,5%.

Conclusions / Discussion

It was established that during the study a redistribution of factors of special physical readiness among male partners and female partners of the studied group of acrobatic rock and roll athletes of the Juvenals category occurred, characterizing the variability of the load in the training process of the weekly microcycles of the pre-competitive mesocycle in the annual training macrocycles. The factor analysis allowed to establish the determining factors: speed-strength, coordination; anthropometric; functional preparedness. The results of the analysis of the factor structure of preparedness of athletes from acrobatic rock and roll testifies to the significant impact of the use of the developed speed-strength patterns, motor coordination and functional training (integral exercise complex) on the special and competitive readiness of athletes juvenals (male partners and female partners) at the stage preliminary basic training.

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.

References

1. Bateeva, N.P. (2012), "The Factor Structure of Special Physical Fitness of Qualified Athletes in Acrobatic Rock and Roll", *Slobozans`kij naukovo-sportivnij visnik*, No. 3, pp. 69-74. (in Russ.)
2. Bateeva, N.P. & Kyzim, P.N. (2017), *Sovershenstvovanie fizicheskoy i tekhnicheskoy podgotovki kvalifitsirovannykh sportsmenov v akrobaticheskom rok-n-rolle v godichnom makrotsikle* [Improving the physical and technical training of qualified athletes in acrobatic rock and roll in the annual macrocycle], KhSAPC, Kharkiv. (in Russ.)
3. Humeniuk, S.V. (2018), "Features of functional training and its influence on the interconnection of indicators of special physical fitness of athletes of the category" juveniles "from acrobatic rock and roll", *Naukovyi chasopys Natsionalnoho pedahohichnoho universytetu imeni M.P.Drahomanova. Seriia № 15. "Naukovo-pedahohichni problemy fizychnoi kultury. Fizychna kultura i sport. Zb. naukovykh prats*, Issue 10 (104) 18, pp. 20-28. (in Ukr.)
4. Kyzim, P.M., Humeniuk, S.V. & Batieieva, N.P. (2018), "Improvement of special physical fitness of athletes of the category" Juveniles "on acrobatic rock-and-roll using functional training tools", *Slobozans`kij naukovo-sportivnij visnik*, No. 4(66), pp. 47-52, doi:10.15391/snsv.2018-4.007. (in Ukr.)
5. Kokhanovych, K.K. (2004), "Features of the factor structure of special preparedness of young gymnasts", *Aktualni problemy fizychnoi kultury i sportu: zbirn. nauk. prats*, Issue 5, pp. 63-67. (in Ukr.)
6. Litovko, T.V. (1998), "The Factor Structure of Competitive Activity in Rhythmic Gymnastics", *Pedagogika, psikhologiya ta mediko-biologichni problemi fizichnogo vikhovannya i sportu*, No. 4, pp. 20-22. (in Russ.)
7. Lutsenko, L.S. (1999), "Standards for special physical fitness in acrobatic rock and roll", *Fizicheskoe vospitanie studentov*, No. 7, pp. 7-9. (in Russ.)
8. Lutsenko, Yu.M. (2018), "The quality of the implementation of the structural components of the competitive programs of qualified athletes as a factor determining the sporting result in acrobatic rock and roll", *Slobozans`kij naukovo-sportivnij visnik*, No. 2(64), pp. 41-44, doi. org/10.15391/snsv.2018-2.008. (in Ukr.)
9. Mulyk, V.V. (2002), "Features of the construction of four-year Olympic training", *Slobozans`kij naukovo-sportivnij visnik*, No. 5, pp. 104-106. (in Ukr.)
10. Nachinskaya, S.V. (2005), *Sportivnaya metrologiya: Ucheb. posobie dlya stud. vyssh. ucheb. Zavedeniy* [Sports Metrology: Proc. allowance for stud. higher studies. institutions], Akademiya, Moscow. (in Russ.)
11. Platonov, V.N. (2004), *Sistema podgotovki sportsmenov v olimpiyskom sporte. Obshchaya teoriya i ee prakticheskie prilozheniya* [The system of training athletes in the Olympic sport. General theory and its practical applications], Olimpiyskaya literatura, Kiev. (in Russ.)

Received: 11.05.2019.
Published: 30.06.2019.

Information about the Authors

Petro Kyzim: *Associat Professor; Kharkov State Academy of Physical Culture: Klochkovskaya 99, Kharkov, 61058, Ukraine.*
ORCID.ORG/0000-0001-5094-3988
E-mail: petrkyzim@i.ua

Serhii Humeniuk: *senior teacher; Kharkov State Academy of Physical Culture: Klochkovskaya 99, Kharkov, 61058, Ukraine.*
ORCID.ORG/0000-0003-3414-0629
E-mail: raoidstk@gmail.com

SLOBOZHANSKYI HERALD OF SCIENCE AND SPORT

UDK 796.035:796.012-057.87"15/.16"

ISSN (English ed. Online) 2311-6374
2019, Vol. 7 No. 3(71), pp. 25-28
DOI: 10.5281/zenodo.3371218

Use of fitness trackers to determine the volume of physical activity of students in secondary schools aged 15–16 years

Andriy Mandyuk

Lviv State University of Physical Culture, Lviv, Ukraine

Purpose: *determine the weekly volume of motor activity of pupils of general education schools aged 15–16 in Lviv.*

Material & Methods: *analysis of scientific and methodological literature, analysis and synthesis, determination of the volume of physical activity using technology FitnessTracker, methods of mathematical statistics. The study was attended by students of secondary schools No.45 and No. 54 (Lviv). For further processing, the results of the 26th boys and 25 girls were recorded. The total number of students was 51 people.*

Results: *presents results of fixation of indicators of motor activity of children 15–16 years. The average number of steps that are carried out by students of this age on weekdays and weekends.*

Conclusions: *it is established that on average, pupils of the specified age perform 7185,1 steps per day. This indicator is below the recommended standards for children of this age. Indicators of daily physical activity among children were higher than among women. It is established that the volume of physical activity of children 15–16 years old is 8,2% more on weekends compared with the same indicator on weekdays.*

Keywords: *physical activity, fitness tracker, free time, students*.

Introduction

One of the main negative factors affecting the child's body during school is the low level of physical activity. The sedentary, or so-called "sedentary" lifestyle, is a generally recognized negative factor and is consistently associated with an increased risk of developing chronic diseases and mortality [10; 15]. The decrease in the volume of motor activity is often due to the fact that children of different ages choose sedentary methods of spending free time [12].

Over the past 10 years of the 21st century, the pace of decline in the quality of health of school-age children and adolescents has accelerated. One of the reasons for this is a decrease in the level of daily physical activity among school-age children [5]. According to the results of analytical studies, it was established that for a positive effect on the body, children and young people aged 5 to 17 years should be involved in moderate physical activity from an average of less than 60 minutes to several hours per day. Moderate physical activity on average 30 minutes per day can also have a certain positive effect on health in some cases [14].

Among the modern approaches to improve the motor activity of students, experts highlight the use of the latest information technology tools [3]. These tools include compact fitness trackers.

Modern fitness tracker is able to perform a number of functions. With among other functions, it allows you to count the number of steps, calculate distance and calories burned, calculate heart rate, monitor sleep [6]. The potential benefits of mobile fitness trackers include the ability to motivate a person to lead a healthy lifestyle, develop a community of like-minded people who seek to improve their health and also help create a lasting environment for long-term advancement of health-saving technologies [9]. In addition, data collected using fitness trackers, smartphones or smart hours is already used as ancillary to treat certain disorders [11].

Problems of motor activity of school-age children constantly become the object of study in domestic and foreign scientific research. In addition, the value of motor activity is considered in different contexts. Among them we recall the study of factors of a healthy lifestyle as components of the individual physical culture of contemporary schoolboys author Oksana Marchenko, in which motor activity is considered one of the components of a value relation to their own health [2].

Studies by authors A. Tomenko and S. Matrosov, aimed at studying differences in indicators of somatic health, physical activity, theoretical readiness and motivational and value sphere of high school students, showed a difference in the level of physical activity among pupils of senior school age with regard to gender differences. According to the index of motor activity, the results of boys were dominated by girls [8].

Irina Novikova, in her research, proves that fitness gadgets are a promising direction in the field of physical education and create optimal conditions for the implementation of comprehensive monitoring of physiological indicators of human life activity and its physical improvement and development [4].

Mandyuk, A. (2019), "Use of fitness trackers to determine the volume of physical activity of students in secondary schools aged 15-16 years", *Slobozhanskyi Herald of Science and Sport*, Vol. 7 No. 3(71), pp. 25-28, doi: 10.5281/zenodo.3371218

Today, mobile fitness tracker technologies are widely used to monitor the level of physical activity of various social and age groups. In modern scientific research, this technology is used both in studies of the motor activity of schoolchildren and adults, and in determining the motor activity of special groups, in particular, children with cancer. Related research by Mary Hooks [13].

Stephen Wright et al. analyzed the features of today's most popular devices and programs that allow monitoring of human performance, and found that such devices are an effective tool for studying the physiological characteristics of the body [15].

At the same time, in modern scientific research problems of motor activity in Ukraine, fitness trackers and other mobile devices are used very rarely. This may be due primarily to the cost of these devices and their insufficient prevalence among certain populations.

Purpose of the study: determine the weekly volume of motor activity of pupils of general education schools aged 15–16 in Lviv.

Objectives of the study:

1. Set the average number of steps performed by pupils of older school age during the day.
2. To identify differences in indicators of the volume of physical activity on weekdays and weekends.

Material and Methods of the research

The study was attended by students of secondary schools number 45 and number 54 (Lviv). For further processing recorded the results of 26 boys and 25 girls. The total number of students was 51 people.

The fixation of the results was carried out in a period that did not cover the time of the holidays and which did not have a state weekend. Another feature of the study was that the parameters of physical activity were recorded during periods of the year when the air temperature exceeded 15°C, namely at such a time: the second half of April – May and September – the first half of October.

The indicated periods of the year are chosen because they are most favorable for the exercise of motor activity in their spare time outside the educational institution. Such an approach, in our opinion, allowed us to avoid the potential negative impact of the factor of adverse weather conditions.

The results recorded by the fitness tracker were analyzed using a special Mi Fit application that can be installed on any modern smartphones. Using the application, the bracelet was synchronized with the corresponding smartphone and transmitted via Bluetooth all the necessary data. The children simply wore a bracelet for a week, without fulfilling any additional conditions, after which the necessary information was received on their own smartphones.

Research methods: analysis of scientific and methodological literature, analysis and synthesis, determination of the volume of physical activity using the Fitness Tracker, methods of mathematical statistics.

Results of the research

Using the fitness tracker Xiaomi Mi Band, it was established that the volume of motor activity of students aged 15–16 years during the school week was 50295,5 steps. Among young men, this figure was 50,580,7 steps, among girls – 49998,8 steps (Figure 1).

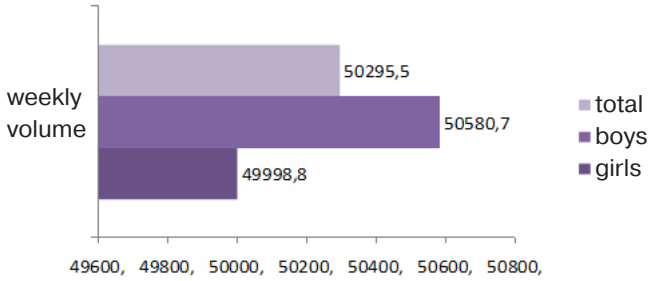

Fig. 1. Weekly volume of motor activity of pupils aged 15–16 years old, X±s=50295,5±413,7 (steps, n=51)

The average daily volume of motor activity in boys was 7225,8 steps and was 83 steps more than that of girls, which was 7142,7 steps (Figure 2).

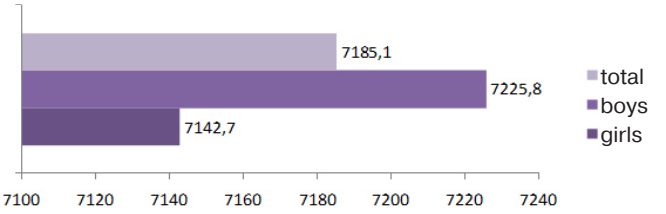

Fig. 2. Average number of steps that pupils carry out during the day is 15–16 years old, X±s=7006,6±59,7 (steps, n=51)

Analysis of motor activity, taking into account the factor of training and weekends, showed that the volume of motor activity among girls and boys was large at the weekend. Among young men, the average daily number of steps at the weekend was 328.3 steps higher than on weekdays and amounted to 7460,3 steps. Among girls, the same indicator was 7522,1 steps. The total daily number of steps among pupils aged 15–16 on weekdays was 7006,6 steps, and 7613,3 steps on weekends (Table 1). Interestingly, in this age group of students, the indicators of motor activity on weekends were higher among girls than among boys.

Figure 3 shows the change in the daily volume of motor activity of students in a specified age group during the week.

As can be seen from the figure, among young men, the indi-

Table 1

Indicators of motor activity of pupils in general education schools aged 15–16 on weekdays and weekends

Volume MA	Boys (n=26)		Girls (n=25)		Total (n=51)	
	Weekdays	Weekends	Weekdays	Weekends	Weekdays	Weekends
In general steps	927164	387935	859519	390450	1786683	778385
Steps per day	7132	7460,3	6876,2	7522,1	7006,6	7631,2
X±s	7132±83,5	7460,3±154,4	6876,2±78,9	7809±186,3	7006,6±59,7	7631,2±121,9

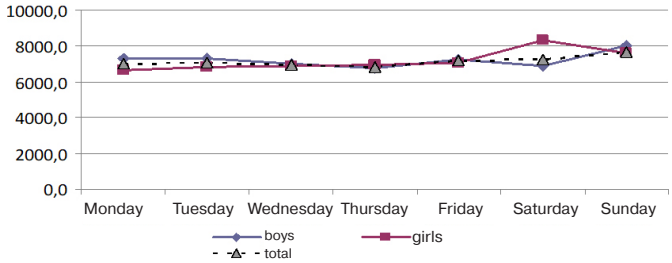

Fig. 3. Dynamics of motor activity during the week among pupils of secondary schools aged 15–16 years

Table 2

Indicators of the coefficient of variation of motor activity of pupils of comprehensive schools aged 15–16 years

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Boys	10,2%	12,1%	10,9%	9,2%	14,7%	13,2%	20,1%
Girls	12,7%	10,4%	12,9%	14,2%	13,8%	15,5%	23,9%
Total	12,4%	11,8%	11,8%	12%	14,2%	17,4%	22,2%

cators of physical activity on weekdays were higher on Monday and Tuesday, making 7327,9 and 7332,1 steps, respectively. During the school week, physical activity among young men declined, reaching the lowest level on Thursday (6749,8 steps). The increase in motor activity indicators among boys at the weekend was primarily due to the growth of this activity on Sunday. This day recorded the highest level of motor activity, which amounted to 8025,4 steps.

Among girls, the dynamics of changes in motor activity indicators during the school week was somewhat different. Indicators gradually grew, starting from Monday, reaching the highest value on Saturday (8342,8 steps).

Analysis of the obtained indicators using the methods of mathematical statistics showed mainly the average variability of the data. If on weekdays, the coefficient of variation values were close to 10%, which indicated weak variability, then at the output the coefficient of variation of the data grew to more than 20% (Table 2).

In our opinion, these indicators of the coefficient of variation indicate significant differences, both in general in the structure of the daily routine, and, in particular, in the structure of the motor activity of students on weekends. The increase in the amount of free time and non-binding forms of activity allows students of this age to be attracted to various forms of leisure, while increasing the difference in the time spent on physical activity.

Conclusions / Discussion

It was established that under optimal weather conditions among students aged 15–16 years, the indicators of physical activity during the school week were 50295,5 steps. Among boys this indicator was higher, reaching 50580,7 steps, among girls – 49998,8 steps.

The average daily volume of motor activity in boys was 7225,8 steps and was 83 steps more than that of girls, which was 7142,7 steps. The average number of steps in this group of students was 7185,1 steps per day.

Daily motor activity on weekends was higher compared to weekdays at 624.6 steps. On weekdays, pupils of high school age performed an average of 7006,6 steps per day, on weekends – 7631,2 steps per day.

The obtained data showed the urgency for Ukraine of the global tendency to decrease the volume of motor activity among pupils of the senior school. Low indicators of the volume of motor activity on weekdays show the negative impact of compulsory activities, primarily on the educational, on the general motor condition of schoolchildren of this age.

The results obtained also confirm the research data of domestic authors, show a change in priorities in the choice of activities at leisure among pupils of different ages towards sedentary activities [1; 7].

Prospects for further research is to determine the current norms of the volume of motor activity, which was measured in steps. In addition, an important task is the creation of objective models of motor activity of pupils of different ages, allowing to determine effective ways of organizing the daily and weekly modes of activity.

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.

Mandyuk, A. (2019), "Use of fitness trackers to determine the volume of physical activity of students in secondary schools aged 15-16 years", *Slobozhanskyi Herald of Science and Sport*, Vol. 7 No. 3(71), pp. 25-28, doi: 10.5281/zenodo.3371218

References

1. Marchenko, Oksana (2018), "Characteristic differences in the choice of factors of a healthy lifestyle as part of the individual physical culture of modern schoolchildren", *Slobozans`kij naukovo-sportivnij visnik*, No. 6(68), pp. 10-15, doi:10.15391/snsv.2018-6.002. (in Ukr.)
2. Moskalenko, N., Reshetilova, V. & Mihaylenko, Yu. (2018), "Modern approaches to increase motor activity of school-age children", *Sportivniy vlsnik Pridnlprov'ya: naukovo-praktichniy zhurnal*, No. 1, pp. 203-208. (in Ukr.)
3. Novikova, I.V. (2018), "Application of Information Technologies in the Field of Physical Education", *Aktualnyie nauchnyie issledovaniya v sovremennom mire*, No. 1(33), P. 3, pp. 90-94. (in Ukr.)
4. Nosko, M.O., Garkusha, S., Voedilova, O., Nosko, Yu. & Grishko, L. (2017), "Out-of-school healthcare-saving activity in physical education as a way to improve motor activity and improve the condition Health of participants in the educational process", *Visnik Chernigivskogo Natsionalnogo Pedagogichnogo Universitetu*, No. 147, P. 2, pp. 86-90. (in Ukr.)
5. Overview: Xiaomi Mi Band 1S – Update the Most Popular Fitness Trainer (2016), available at: http://lifehacker.ru/2016/01/21/obzor-xiaomi-mi-band-1s/ (accessed 14.01.16). (in Russ.)
6. Tomenko, O. & Matrosov, S. (2018), "Differences in indicators of somatic health, motor activity, theoretical preparedness and motivational-value sphere of senior pupils and students depending on sex", Pedagogichni nauki: teoriya, istoriya, innovatsiyni tehnologiyi : naukoviy zhurnal, No. 9(83), pp. 113-123. (in Ukr.)
7. Ahuja Neera, Ozdalga Errol, Aaronson Alistair (2017), "Integrating mobile fitness trackers into the practice of medicine" , *American Journal of Lifestyle Medicine*, No. 11.1, pp. 77-79.
8. Ekelund, U., Steene-Johannessen, J., Brown, W.J., Fagerland, M.W., Owen, N. & Powell, K.E. (2016), "Does physical activity attenuate, or even eliminate, the detrimental association of sitting time with mortality? A harmonised meta-analysis of data from more than 1 million men and women", *The Lancet*, No. 10051, pp. 1302-1310.
9. Henriksen, Andrйl (2018), "Using fitness trackers and smartwatches to measure physical activity in research: analysis of consumer wrist-worn wearables", *Journal of medical Internet research*, No. 20.3, pp. e110.
10. Hills, Andrew P, Dengel, Donald R. & Lubans, David (2015), "Supporting public health priorities: recommendations for physical education and physical activity promotion in schools", *Progress in cardiovascular diseases*, No. 57.4, pp. 368-374.
11. Hooke, Mary C. (2016), "Use of a fitness tracker to promote physical activity in children with acute lymphoblastic leukemia", *Pediatric blood & cancer*, No. 63.4, pp. 684-689.
12. Janssen, Ian & Leblanc, Allana G. (2010), "Systematic review of the health benefits of physical activity and fitness in school-aged children and youth", *International journal of behavioral nutrition and physical activity*, No. 7.1, pp. 40.
13. Wright, Stephen P. et al. (2017), "How consumer physical activity monitors could transform human physiology research", *American Journal of Physiology-Regulatory, Integrative and Comparative Physiology*, No. 312.3, pp. R358-R367.

Received: 10.05.2019.
Published: 30.06.2019.

Information about the Authors

Andriy Mandyuk: *PhD (Physical Education and Sport); Lviv State University of Physical Culture, 11, Kostushko str., 79000, Lviv, Ukraine.*
ORCID.ORG/0000-0002-9322-8201
E-mail: a.b.mandyuk@gmail.com

UDK 615.825:616.233-002-057.875

ISSN (English ed. Online) 2311-6374
2019, Vol. 7 No. 3(71), pp. 29-32
DOI: 10.5281/zenodo.3371794

Effect of kinesitherapy on quality of life of students with chronic bronchitis

***Oleksandr Petruhnov*[1]**
***Larysa Ruban*[2]**

[1]*Kharkiv National Medical University, Kharkiv, Ukraine*
[2]*Kharkiv State Academy of Physical Culture, Kharkiv, Ukraine*

Purpose: *to determine the effectiveness of kinesiotherapy on the quality of life of students with chronic bronchitis in the period of convalescence.*

Material & Methods: *under our supervision there were 73 students aged 17–20 years old, who were divided into three groups. According to the demographic indicators, the groups studied were homogeneous by sex, age, height and weight. To determine the index of the quality of life of students, we used a theoretical analysis of the literature and the synthesis of scientific, methodological and special literature information; computer test program "Evaluation of the quality of your life".*

Results: *when analyzing the results, we noticed that the students of gr. 1 and gr. 2 although they have an average QLI, however, the counting of answers indicates that the state of health of these young men is in a state of limitation. A comprehensive program of physical rehabilitation was drawn up taking into account two stages of the recovery period. Students gr. 1, from the first day, walking was prescribed on various health-normalizing modes with a combination of hand movements permutations. Students gr. 2 were engaged 3 times a week under the program of kinesiotherapy for special medical groups, gr. 3 were engaged in physical culture in accordance with the generally accepted program of the Ministry of Education and Science of Ukraine. After the application of the developed program, an increase in the quality of life of students of both groups was observed, respondents gr. 1 noted a decrease in fatigue, increased mobility, increased physical activity, thinking, and improved personal relationships. Students gr. 2 marked a trend of positive changes in the quality of life and health.*

Conclusion*: confirmation of the effectiveness of the developed program was statistically significant changes in students gr. 1 who were engaged in this program. Students gr. 2 also showed a positive dynamic of QLI, but there were no statistically significant changes.*

Keywords: *students, chronic bronchitis, quality of life index.*

Introduction

The future of each country in terms of its social, economic, cultural development is determined by the state of public health, especially young people. Scientific studies over the past five years indicate a steady increase in students who, due to health reasons, are completely exempted from physical education classes, the number in groups of physiotherapy exercises has increased 4–5 times, and in special medical groups – 2 times [3–8].

In this regard, special attention is required to analyze the health status of students of higher educational institutions, the percentage of incidence of which is growing steadily [1; 2]. Nonspecific respiratory diseases in adolescents and youth have recently caused great concern, which is associated with an increase in morbidity, the prevalence of disability and mortality from them in the adult population. The incidence of respiratory system in recent decades is from 10% to 40% in different regions of the world. Among the diseases of the respiratory system, the leading place is occupied by chronic bronchitis (about 65%) [3–7].

Respiratory organs, as the body's most open system, experience a significant influence of a set of adverse environmental factors, which can lead to their structural and functional damage and determine the climatic and geographical and regional differences in the prevalence of major respiratory diseases. According to academician A. G. Chuchalin (2004), among children and adolescents there is an increase in the prevalence of respiratory diseases, which can lead to an increase in the number of adult patients suffering from chronic pulmonary pathology [8–11].

Modern medicine has all kinds of pharmacological drugs for the treatment of respiratory diseases. However, drug therapy causes a significant number of side effects and is a passive treatment, does not take into account and does not include the reserve capabilities of the body. According to many authors, in the complex treatment of patients with chronic bronchitis, physical therapy is an integral part and occupies a decisive place among rehabilitation and rehabilitation measures. Under the influence of the targeted and systematic use of kinesiotherapy, both special and general developmental exercises, the function of external respiration is greatly enhanced, and exercises to increase the strength of the muscles of the body have a positive effect on the function of the diaphragm, which largely determines good drainage even of the basal bronchi and deep located bronchioles. The possibilities of kinesiotherapy for patients with chronic bronchitis, especially

Petruhnov, O. & Ruban, L. (2019), "Effect of kinesitherapy on quality of life of students with chronic bronchitis", *Slobozhanskyi Herald of Science and Sport*, Vol. 7 No. 3(71), pp. 29-32, doi: 10.5281/zenodo.3371794

students, should be considered precisely depending on the form of the disease and the degree of impaired pulmonary ventilation [12]. One of the forms of kinesiotherapy after exacerbation of chronic bronchitis is the use of walking and running in various health-normalizing modes with a combination of permutations of hand movements that promote breathing, have a positive effect on the respiratory system, increase the effectiveness of treatment, improve well-being and psychoemotional state [11; 14].

In recent decades, there has been a significant increase in research in the field of quality of life. The study of quality of life is very relevant both in medicine and in physical therapy. Assessing the quality of life makes it possible to assess the complex effect of the disease on the patient's life, compare the effectiveness of intervention programs, and predict the course of the disease. Studying the direction of changes in the quality of life indicators associated with the illness of students will help to determine the most significant limitations in the quality of life and influence them in order to optimize this indicator.

Purpose of the study: to determine the effectiveness of kinesiotherapy on the quality of life of students with chronic bronchitis in the period of convalescence.

Material and Methods of the research

Examination and physical therapy of students with chronic bronchitis were carried out at the University Hospital of Kharkov National Medical University. Under our supervision, there were 73 students aged 17–20 years who were divided into three groups. According to demographic indicators, the groups of subjects were homogeneous by gender, age, height-weight indicators. The first group (gr. 1) included 25 students who took a course of physical therapy according to the developed program using varieties of walking and running in various health-normalizing modes, the second group (gr. 2) included 21 students involved in the program kinesiotherapy for special medical groups, the third group (gr. 3) – 27 healthy students, engaged in physical education according to the generally accepted program of the Ministry of Education and Science of Ukraine.

To determine the index of quality of life for students, we used a computer test program "Assessing the quality of your life", developed by L. A. Ruban, S. V. Stavitsky (author. Certificate No. 70372 of 02.10.2017) (Fig. 1).

The test program consists of 36 questions, which help to assess the areas of quality of life: physical, psychological functions, level of independence, social relations, as well as the respondent's perception of his health and quality of life in general. Assessment of the level of satisfaction was carried out according to the general index of quality of life (IQL): very low (depressive) – 4–10 points; low – 11–20 points; average – 21–29 points; high – 30–40 points.

For people with high IQL, characterized by optimistic optimism

Fig. 1. Interface of the computer test program "Assessing the quality of your life"

and activity in life position. Low IQL is often found in individuals with burnout syndrome. A low level of IQL is characteristic for depressed patients.

Results of the research

At the beginning of the study, students with chronic bronchitis observed most cases with an average level of quality of life index. Table 1 presents the results of the IQL for students with chronic bronchitis (gr. 1 and gr. 2) and students of the comparison group (gr. 3).

Table 1

Comparative characteristics of the quality of life index of students with chronic bronchitis (gr. 1 and c gr. 2) and students of the comparison group (gr. 3), %

Quality of Life Index (IQL) persons / percentage			
	Gr. 1 (n=25)	Gr. 2 (n=21)	Gr. 3 (n=27)
Very low	0	0	0
Low	3/12	5/24	0
Average	22/88	16/76	17/63
High	0	0	10/37

Analysis of the results showed that students of gr. 1 and gr. 2, although they have an average IQL, however, the counting of answers indicates that the health status of these young men is in an extreme state. The respondents of these groups had an average response value of 22±1,04 points, indicating a decrease in the average level.

When analyzing the answers to questions in blocks, it was determined: what block I of the questions (physical criteria) students gr. 1 is estimated at an average of 6,32±0,18 points, students gr. 2 – by 6,54±0,16 points, students of gr. 3 – by 8,57±0,74 points. Regarding questions of the Psychological Criteria block, students with chronic bronchitis noted low self-esteem, which may indicate low self-esteem. An analysis of the issues of the "Level of Independence" block found that the young men of the three groups cannot quickly adapt to life circumstances. Counting the answers to the questions of the blocks "Environment" and "Spirituality" showed that all respondents have experienced life crises over the past 2 years.

Thus, a decrease in the quality of life in students with chronic bronchitis of both groups occurred due to the influence of the

Table 2

Dynamics of the quality of life index of students with chronic bronchitis (gr. 1 and gr. 2) and students of the comparison group (gr. 3), %

Stages	Quality of Life Index (IQL) persons / percentage				
	Gr. 1 (n=25)		Gr. 2 (n=21)		Gr. 3 (n=27)
	before	after	before	after	before
Low	3/12	0	5/24	0	0
Average, 21–23 points	22/88	10/40	16/76	0	17/63
Average,24-29 points	0	15/60	16/76	5/24	
High	0	0	0	0	10/37

disease on all spheres of life.

To restore the functional state of the respiratory system and improve the quality of life of the examined patient population, we developed a physical rehabilitation program [14], which was made taking into account two stages of the convalescence period, clinical and biological recovery, since even after normalizing human health, objective indicators of the respiratory system function still do not reach the values of healthy individuals. According to the International Classification of Functioning (ICF, 2017), the course of treatment was 21 days [15].

At the stage of clinical recovery, students gr. 1 and gr. 2 prescribed kinesiotherapy, massage of the muscles of the body, shoulder girdle, upper limbs; physiotherapeutic agents: UHF alternate with solux on the nose and chest; internally vitamins of group B, C, E; Eleutherococcus (to stimulate the body's resistance). Students gr. 2 were engaged in therapeutic gymnastics 3 times a week, performed general strengthening and general developmental exercises in relation to breathing exercises 4:1. Students gr. 1 from the first day, walking was prescribed in various health-normalizing modes with a combination of permutations of arm movements. Dosed slow run, started from three minutes, every two days its duration was increased by one minute, each exercise in the complex was repeated 6–8 times in the first two or three days of the first stage.

At the stage of biological recovery, students of gr. 1 morning morning hygienic gymnastics was performed, in the evening accelerated walking 20 minutes; slow run – 30 minutes; accelerated walking – 10 min. Students gr. 2 continued to perform motor tasks of the first stage, gradually completely replacing them with motor programs, which included special, basic and simulation exercises with an increase in load to the level of a regular training.

The dynamics of the index of IQL students gr. 2 tended to improve. After taking a course of physical therapy, a low level of IQL was observed, all respondents had an average level, but the average value of the responses was from 21 to 23 points. The IQL indicator in gr. 1 also acquired significance to the average level, but in 10 students it ranged from 21 to 23 points, and in 15 students it ranged from 24 to 29 points, that is, it almost approached a high level.

The overall quality of life of students with chronic bronchitis in both groups during physical therapy is presented in Table 2.

From the Table 2 shows that at the beginning of the study, the level of overall quality of life in the groups of sick students was relatively the same. After applying the developed program of physical therapy, an increase in the quality of life was observed among students of both groups, respondents Gr. 1 noted a decrease in fatigue, increased mobility, an increase in physical activity, thinking, and an improvement in personal relationships. Students gr. 2, there is a trend of positive changes in the quality of life and health status.

Conclusions / Discussion

A comprehensive program of physical rehabilitation has been developed for students with chronic bronchitis, taking into account recovery periods, especially with the use of walking varieties in various health-normalizing modes with a combination of permutations of arm movements, positively affects the quality of life of students with chronic bronchitis.

Walking is the easiest form of physical activity for people with a sedentary lifestyle. Health walking classes have a complex effect on the human body in different directions. First of all, it is the consumption of energy substances, fats and carbohydrates, in proportion to the duration and speed of walking. Walking provides a relatively high functional load, training and strengthening all body systems, which leads to an improvement in the quality of life in general.

Confirmation of the effectiveness of the developed physical therapy program was a statistically significant change in students gr. 1 who were involved in this program. Students gr. 2, a positive dynamic of the IQL was also observed, but no statistically significant changes were observed.

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

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.

Petruhnov, O. & Ruban, L. (2019), "Effect of kinesitherapy on quality of life of students with chronic bronchitis", *Slobozhanskyi Herald of Science and Sport*, Vol. 7 No. 3(71), pp. 29-32, doi: 10.5281/zenodo.3371794

References

1. Ruban, L. & Stavitsky, S. (2016), "Assessment of the quality of life index of students", *Slobozans`kij naukovo-sportivnij visnik*, No. 4(54), pp. 89-93, doi: 10.15391/snsv.2016-4.016. (in Russ.)
2. Zhitnitsky, A.A. (2017), "Modern problems of formation of a healthy lifestyle of youth", *Visnyk Kharkivskoho natsionalnoho universytetu imeni V.N. Karazina. Seriia "Valeolohiia: suchasnist i maibutnie"*, Vol. 21, pp. 86-92. (in Ukr.)
3. Yermakov, S.S., Cheslitska, M., Pilevska, V., SharkEtskardt, M., Podrigalo, L.V. & Kriventsova, I.V. (2013), "The health level of students of special medical groups in the context of improving the quality of life", *Visnyk Chernihivskoho derzhavnoho pedahohichnoho universytetu imeni T.H.Shevchenka*, No. 3, pp. 184-189. (in Russ.)
4. Tsys, D.I. (2013), "Sport orientation classes on physical education – one of the factors of increasing the physical fitness of student youth", *Slobozans`kij naukovo-sportivnij visnik*, No. 3, pp. 5-7. (in Ukr.)
5. Bashavets, N.A. (2011), "The state of morbidity of modern student youth and ways of its improvement", *Pedahohika, psykholohiia ta medyko-biolohichni problemy fizychnoho vykhovannia i sportu*, No. 7, pp. 6-10. (in Ukr.)
6. Romanchuk, S.V., Petruk, A.P. & Bykov, R.H. (2015), "Aktyvizatsii navchalnoho protsesu z fizychnoho vykhovannia studentiv shchodo vprovadzhennia zdorov'ia zberezhuvalnykh metodyk", *Naukovyi chasopys NPU imeni MP Drahomanova. Seriia 15: Naukovo-pedahohichni problemy fizychnoi kultury (fizychna kultura i sport)*, No. 5 (1), pp. 215-218. (in Ukr.)
7. Cherednichenko, I., Sokolova, O. & Malikov, N. (2016), "Changes in physical fitness indices of a young man of 18–19 years old in the process of sectional sessions with the integrated use of sports games", *Sportyvnyi visnyk Prydniprov'ia*, No. 3, pp. 239-243. (in Russ.)
8. Lynnyk, M.I., Nedospasova, O.P., Tarasenko, O.R., Kapustiak, V.I., Bushura, I.V. & Nikiforova, L.H. (2017), *Porivnialni dani pro rozpovsiudzhenist khvorob orhaniv dykhannia i medychnu dopomohu khvorym na khvoroby pulmonolohichnoho ta alerholohichnoho profiliu v Ukraini za 2010-2016 rr.* [Comparative data on the prevalence of respiratory diseases and medical care for patients with pulmonologic and allergic diseases in Ukraine for 2010-2016], Kyiv. (in Ukr.)
9. Belevskiy, A.S. & Novikov, Yu.K. (2008), "Chronic bronchitis in clinical practice", *Lechebnoe delo*, No. 1, pp. 32-38. (in Russ.)
10. Duka, K.D., Ilchenko, S.I. & Ivanus, S.H. (2013), *Khronichnyi bronkhit u ditei ta pidlitkiv – mynule, suchasne ta maibutnie* [Chronic bronchitis in children and adolescents – past, present and future], Dnipropetrovsk. (in Ukr.)
11. Petrukhnov, O.D. & Ruban, L.A. (2017), "Duration of elimination of disturbed functions of the respiratory system in students of different levels of trenirovannost, patients with chronic bronchitis after the application of a comprehensive program of physical rehabilitation", *Scientific Journal "ScienceRise"*, № 1/1(30), C. 32-36. (in Ukr.)
12. Malyavin, A.G., Yepifanov, V.A. & Glazkova, I.I. (2010), *Reabilitatsiya pri zabolevaniyakh organov dykhaniya* [Rehabilitation for respiratory diseases], Moscow. (in Russ.)
13. Mingazova, L.R., Selezneva, N.I. & Kildibekova, R.N. (2012), "Efficiency of rehabilitation complexes in chronic bronchitis", *Meditsina: vyzovy segodnyashnego dnya: materialy Mezhdunar. nauch. konf. (Chelyabinsk, June 2012). Chelyabinsk: Dva komsomoltsa*, pp. 61-62, available at: https://moluch.ru/conf/med/archive/52/2452/ (accessed by: 8.06.2019). (in Russ.)
14. Petrukhnov, O.D. & Ruban, L.A. (2017), Integrated program of physical rehabilitation for students of different levels of trenirovannost, patients with chronic bronchitis of moderate severity during reconvalescence. with. No. 72515 Ukraine, Statement. April 10, 2017. No. 73231; post June 27, 2017. (in Ukr.)
15. Melnikova, Ye.V., Buylova, T.V., Bodrova, R.A., Shmonin, A.A., Maltseva, M.N. & Ivanova, G.Ye. (2017), "The Use of the International Classification of Functioning (ICF) in Outpatient and Inpatient Medical Rehabilitation: A Guide for Professionals", *Vestnik vosstanovitelnoy meditsiny*, No. 6 (82), pp. 7-20. (in Russ.)

Received: 20.04.2019.
Published: 30.06.2019.

Information about the Authors

Oleksandr Petruhnov: *Kharkiv National Medical University: Nauky Avenue 4, Kharkiv, 61022, Ukraine.*
ORCID.ORG/0000-0003-1004-2290
E-mail: Petrukhnov-alex@rambler.ru

Larysa Ruban: *PhD (Physical Rehabilitation); Kharkiv State Academy of Physical Culture: Klochkivska Street 99, Kharkiv, 61058, Ukraine.*
ORCID.ORG/0000-0002-7192-0694
E-mail: slarisaruban@gmail.com

SLOBOZHANSKYI HERALD OF SCIENCE AND SPORT

UDK 797.212:796.015.82

ISSN (English ed. Online) 2311-6374
2019, Vol. 7 No. 3(71), pp. 33-37
DOI: 10.5281/zenodo.3371798

Determination of the most significant indicators of the preparedness of young men, representatives of various methods of swimming, which limit their sporting achievements

Elena Politko
Viacheslav Shutieiev

Kharkiv State Academy of Physical Culture, Kharkiv, Ukraine

Purpose: *the establishment of the most significant selection criteria for swimmers aged 14–16 years specializing in various swimming methods, which limit their sporting achievements.*

Material & Methods: *analysis and synthesis of scientific and methodical literature, pedagogical observation, testing, anthropometric measurements, methods of mathematical statistics.*

Results: *the scientific knowledge about modern model characteristics of a constitution and physical preparedness of the young swimmers specializing in various ways of swimming is added. Established significant selection criteria, allowing to identify the most gifted athletes, to orient their training for a specific competitive distance.*

Conclusion: *obtained results can be recommended for use in the work of swimming coaches to improve the quality of selection and sports orientation of young athletes on the choice of swimming and assess their prospects.*

Keywords: *swimmers, swimming methods, body build, fitness, sports orientation.*

Introduction

The urgency of the problem of selecting promising athletes and the orientation of their preparation for performances at various distances is determined by the high level of sporting achievements and requirements placed on the leaders of modern world swimming.

Success in one way or another of swimming is determined by the specific features of body build and physical preparedness, which together limit the level of athletic performance. Moreover, most of these indicators are genetically determined and therefore are of particular value as criteria for selecting and determining the athletic orientation of athletes [1–13]. Therefore, the determination of the specialization of swimmers in accordance with the characteristics of body build and physical preparedness is one of the urgent problems of sports selection.

The search for talented athletes requires an organized, evidence-based approach. This direction received a sufficiently detailed justification as in the general theoretical works [8; 9; 10; 11, etc.], So in the studies conducted on the material of various sports, in particular, sports swimming [1–7; 12; 13]. However, in the special literature there is presented disparate data, and the software and normative materials regulating work in the age groups of Children and Youth Sports School and Specialized Children and Youth Sports School of the Olympic Reserve in swimming, developed more than 20–30 years ago [1; 8; 10]. As a result, it is especially important to improve these provisions on the development of quantitative criteria for the selection of young swimmers, depending on the swimming specialization. The question of selection and orientation is particularly acute at the stage of specialized basic training in the formation of a potential closest reserve for national teams and the determination of promising opportunities for athletes to achieve high sports results.

Based on the above, the relevance of this work is determined by the need to complement modern scientific knowledge on the development of model characteristics that include a certain set of indicators of body constitution and physical fitness of young swimmers aged 14–16 years specializing in various swimming methods.

Purpose of the study: the establishment of the most significant selection criteria for swimmers aged 14–16 years specializing in various swimming methods, which limit their sporting achievements.

Objectives of the study:

1. To reveal the features of the morphological and functional parameters of young swimmers aged 14–16 years, representatives of various swimming methods.
2. To determine the differences in the level of physical preparedness of young swimmers, representatives of different specializations.
3. To establish the most significant criteria for the selection of young athletes who specialize in various methods of swimming, limiting their athletic achievements.

Politko, E. & Shutieiev, V. (2019), "Determination of the most significant indicators of the preparedness of young men, representatives of various methods of swimming, which limit their sporting achievements", *Slobozhanskyi Herald of Science and Sport*, Vol. 7 No. 3(71), pp. 33-37, doi: 10.5281/zenodo.3371798

Material and Methods of the research

The work investigated the morpho-functional parameters, their ratio, as well as the testing of physical preparedness of athletes. The data collection was carried out during training and training fees, in the framework of the Interdisciplinary Research Team, the Swimming Federation of Ukraine. The study involved 50 qualified young swimmers aged 14–16 years who were at the stage of specialized basic training (qualification at the level of I grade, CMS, MS). Sports experience swimmers was 6–9 years. Athletes were divided into 4 groups on swimming specialization.

Research methods: analysis and generalization of scientific and methodological literature, pedagogical observation, testing, anthropometric measurements, methods of mathematical statistics.

Results of the research

On the basis of the conducted studies, the features of the morphological and functional parameters of young swimmers aged 14–16 years specializing in various swimming methods (Table 1) were established.

So, when comparing the total and out-going body sizes, it was found that the highest average values were recorded for athletes who specialize in swimming with the front crawl. Slightly inferior to the young men who specialize in swimming in the way of the butterfly and the back crawl. The smallest values are fixed for young men who specialize in swimming in the way of breaststroke.

The analysis of indicators of the respiratory function of athletes showed that the highest indicators of chest capacity

Table 1

Model characteristics of the physical development of young swimmers 14–16 years old, specializing in different ways of swimming

No. i/o	Parameters	F/c (n=20)		Butt. (n=9)		B/c (n=5)		Breas (n=16)		$\bar{X}$
		$\bar{X}$	±σ	$\bar{X}$	±σ	$\bar{X}$	±σ	$\bar{X}$	±σ	
1.	Body length, cm	184,45	8,00	180,72	5,42	180,63	8,54	177,81	4,35	180,90
2.	Body weight, kg	72,54	7,15	66,27	8,73	68,73	10,70	65,42	7,08	68,24
3.	Arm span, cm	189,40	3,35	185,11	9,55	184,38	8,26	182,97	4,65	185,47
4.	Arm length, cm	83,10	7,37	81,17	3,17	80,38	2,69	79,78	2,18	81,11
5.	Brush length, cm	21,13	0,96	21,11	1,43	19,63	0,75	20,97	0,81	20,71
6.	Forearm length, cm	26,45	1,95	25,22	2,09	26,25	1,55	25,19	1,11	25,78
7.	Shoulder length, cm	33,23	3,05	32,61	1,58	33,13	2,43	32,50	1,37	32,87
8.	Limb length, cm	96,38	6,57	93,83	5,71	91,13	6,64	93,34	5,34	93,67
9.	Shin length, cm	43,44	2,97	42,22	1,39	41,63	3,30	41,97	2,06	42,32
10.	Foot length, cm	27,93	1,15	27,89	1,47	27,50	1,91	27,59	1,14	27,73
11.	Torso length, cm	60,80	3,72	60,00	5,27	57,63	3,50	57,88	3,28	59,08
12.	Shoulder width, cm	40,73	2,09	40,06	2,83	41,00	2,16	39,91	1,75	40,43
13.	Width of the pelvis, cm	27,30	1,46	26,56	1,76	26,00	2,45	26,47	1,63	26,58
14.	Brush width, cm	9,33	0,34	9,06	0,53	9,25	0,65	9,09	0,33	9,18
15.	CC in rest, cm	96,43	4,42	93,06	4,45	96,50	4,49	93,34	4,80	94,83
16.	CC on inhale, cm	102,43	4,64	99,67	4,38	101,13	3,79	99,59	4,97	100,71
17.	CC on expiration, cm	92,03	4,60	89,50	5,44	92,50	3,70	89,06	5,06	90,77
18.	Shoulder girth (tension)	32,33	2,01	30,61	2,64	31,25	1,71	30,81	2,80	31,25
19.	Shoulder girth (relaxed)	29,35	1,86	27,89	2,00	27,50	1,47	27,94	2,95	28,17
20.	Girth forearms, cm	25,85	1,61	24,72	1,79	24,50	2,08	25,03	1,77	25,03
21.	Wrist girth, cm	16,93	0,71	16,39	0,74	16,00	1,35	16,38	0,92	16,43
22.	Waist girth, cm	73,90	3,35	73,67	3,81	72,50	3,87	71,97	4,56	73,01
23.	Girth of the buttocks, cm	93,35	3,82	89,56	6,02	90,25	5,50	90,44	4,97	90,90
24.	Hip girth, cm	51,30	2,76	50,17	5,31	49,25	2,72	48,72	3,79	49,86
25.	Knee girth, cm	36,53	1,64	35,56	1,59	36,00	1,68	35,88	1,58	35,99
26.	Girth of a shin, cm	35,88	2,00	35,39	2,63	35,50	2,48	34,75	2,04	35,38
27.	Ankle girth, cm	22,93	1,29	22,00	1,41	22,25	1,50	22,84	1,11	22,51
28.	Excursion of the chest, cm	10,41	1,87	10,17	1,44	8,63	1,25	10,53	1,89	9,94
29.	VC, l	5,94	0,79	5,68	0,65	5,72	0,58	5,15	0,77	5,62
30.	VC, ml□kg^{-1}	81,85	6,78	86,04	5,76	84,09	9,87	79,32	12,49	82,83
31.	Arm / body length, c. u.	0,45	0,01	0,45	0,01	0,45	0,01	0,45	0,01	0,45
32.	Legs / body length, c. u.	0,52	0,02	0,52	0,02	0,50	0,02	0,52	0,02	0,52
33.	Width of the shoulders / pelvis, c. u.	1,50	0,11	1,51	0,11	1,58	0,07	1,51	0,10	1,53
34.	CC / body length. c. u.	0,52	0,03	0,51	0,02	0,53	0,02	0,53	0,03	0,52
35.	Quetelet index, kg ml	21,32	1,61	20,21	1,82	20,96	1,60	20,68	1,97	20,79
36.	Broca's index, c. u.	11,91	6,30	14,46	4,99	11,90	4,34	12,39	6,32	12,67
37.	Absol. body surface area, ml	1,97	0,14	1,87	0,14	1,89	0,19	1,83	0,10	1,89

(CC) at rest (96,43 – 96,50 cm), during inspiration (102,43 – 101,13 cm) and expiration (92,03 – 92,50 cm, respectively) belong to representatives of the swimming crawl on chest and back. Almost the same figures recorded in representatives of the swimming way of the butterfly and breaststroke. For athletes – representatives of the way of swimming the butterfly, the crawl on the chest and on the back, are characterized by large indicators of VC, which range from 5,68 to 5,94 liters.

The study of physical preparedness was carried out with the help of testing the level of development of individual motor abilities. To study the structure of power readiness, the maximum thrust force on land and thrust force in water on a harness were measured, on the basis of which the relative thrust force to body mass (RTF) was calculated, as well as the utilization rate of thrust force capabilities (URTF). To assess the speed capabilities, we analyzed the results of swimming the distances of 25, 75 and 100 meters with a maximum speed using various swimming methods.

The study of various aspects of special physical preparedness shows that the level of development of the athletic qualities of athletes, representatives of various methods of swimming, is somewhat different (Table 2).

The boys who specialize in backstroke and butterfly stroke have the best results of mobility in the shoulder joints, which is due to the structure of the technique for performing movements in the water. Representatives of the breaststroke occupy the last place, which reflects the specifics of swimming in this way.

The structure of strength training in swimmers, depending on the method of swimming is also different. The best results of the thrust force on land were found in the representatives of the crawl swimming on the chest and on the back. However, the greatest indicators of thrust in the water when swimming in various ways are found in young men who specialize in swimming as a crawl on chest and breaststroke.

With the help of the correlation analysis, the most significant criteria for the selection of athletes specializing in various methods of swimming, limiting their sporting achievements, were established.

For representatives of various swimming methods, the connection level of swimming speed at a distance of 100 meters with some anthropometric features and physical preparedness indicators has been revealed (Figure 1–4).

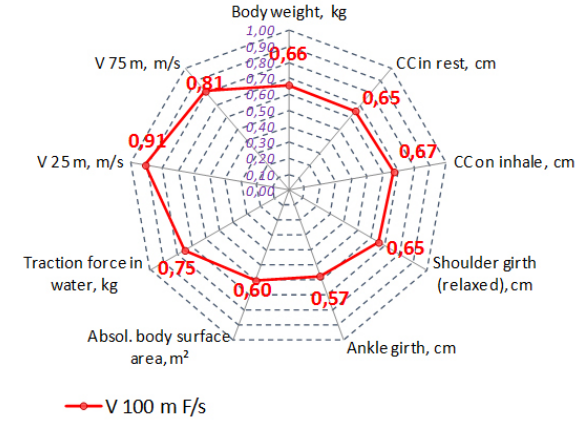

Fig. 1. Most significant indicators of athletes, representatives of swimming by way of front crawl, limiting sporting achievements

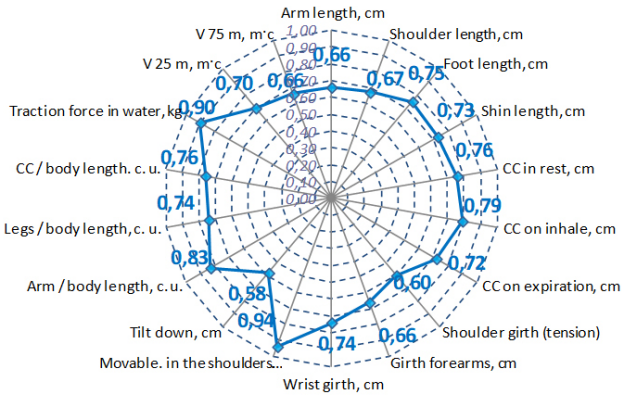

Fig. 2. Most significant indicators of athletes, representatives of swimming by way of butterfly, limiting sporting achievements

Table 2

Evaluation of the special physical preparedness of athletes 14–16 years old, specializing in different ways of swimming

Parameters	F/c (n=20)		Butt. (n=9)		B/c (n=5)		Breas (n=16)		$\bar{X}$
	$\bar{X}$	±σ	$\bar{X}$	±σ	$\bar{X}$	±σ	$\bar{X}$	±σ	
Movable. in the shoulders. joint, cm	41,85	17,78	36,11	22,55	9,50	14,71	45,78	13,02	33,31
Tilt down, cm	15,59	6,71	14,57	8,12	20,88	7,19	17,65	6,15	17,17
Traction force in land, kg	37,21	5,83	35,11	5,09	37,00	3,56	33,00	4,27	35,58
RTF in land, F·kg^{-1}	0,51	0,06	0,53	0,07	0,54	0,05	0,51	0,06	0,52
Traction force in water, kg	16,53	2,04	13,89	2,52	14,75	2,06	16,25	1,77	15,36
RTF in water, F·kg^{-1}	0,23	0,02	0,21	0,04	0,21	0,01	0,25	0,03	0,23
URTF, c. u.	0,45	0,07	0,40	0,10	0,40	0,05	0,50	0,08	0,44
V 25 m, m·c^{-1}	1,99	0,11	1,86	0,08	1,83	0,05	1,58	0,07	1,82
V 75 m, m·c^{-1}	1,77	0,10	1,65	0,11	1,63	0,06	1,40	0,06	1,61
ICB (AH) V75/V25	0,89	0,03	0,82	0,21	0,88	0,02	0,89	0,04	0,87
V 100 m, m·c^{-1}	1,83	0,07	1,64	0,11	1,67	0,04	1,46	0,05	1,65

Politko, E. & Shutieiev, V. (2019), "Determination of the most significant indicators of the preparedness of young men, representatives of various methods of swimming, which limit their sporting achievements", *Slobozhanskyi Herald of Science and Sport*, Vol. 7 No. 3(71), pp. 33-37, doi: 10.5281/zenodo.3371798

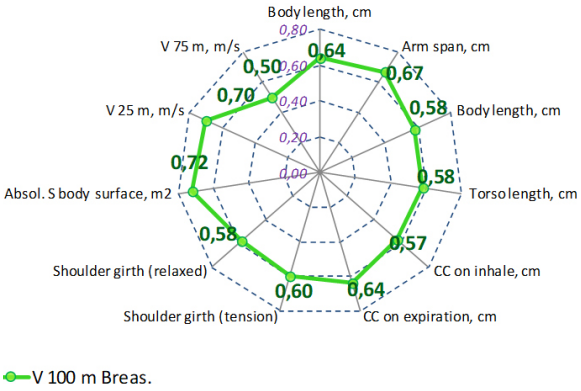

Fig. 3. Most significant indicators of athletes, representatives of the breaststroke swimming, limiting sporting achievements

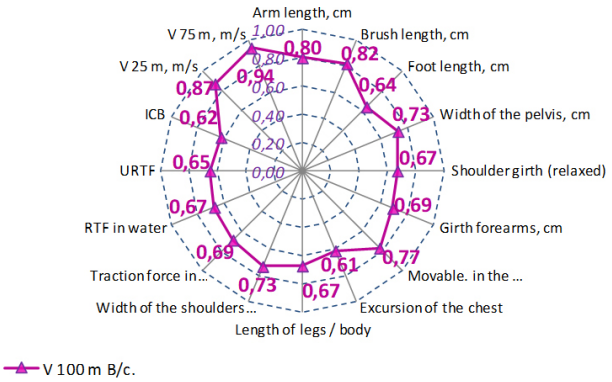

Fig. 4. Most significant indicators of athletes, representatives of the crawl on the back, limiting athletic performance

The study identified the criteria for selecting young swimmers aged 14–16 years, representatives of various specializations, based on a comprehensive study of a wide range of indicators characterizing functional capabilities, special motor skills and morphological fitness of athletes.

Thus, the type of constitution determines the swimmer's power abilities, where specialization leaves an imprint on its morphological structure, thereby affecting the level of physical development. The manifestation of speed qualities are closely related to the level of development of power. The speed capabilities of swimmers is a factor limiting the sporting result at all distances.

So, the objective conduct of sports orientation in swimming depends on the use of certain morpho-functional and pedagogical criteria that reveal a tendency to one or another method of swimming.

Conclusions / Discussion

The results of the conducted research supplement the theoretical positions formulated in the works of N. Zh. Bulgakova [1], V. Yu. Davydova, V. B. Avdeenko [2], V. M. Platonova [9], I. V. Chebotareva [10], that the sports results of swimmers are largely dependent on the characteristics of the body physique. The proportions of the body, which determine the hydrodynamic qualities and indicate the strength (body size of the body) and functional (VC, the ratio of the VC to the weight of the body) capabilities of the swimmers, also have great importance on the result. An important role is played by mobility in the joints, allowing you to most effectively implement the power capabilities, speed, endurance, to master the modern swimming technique.

Data on the physique, the prospects for improving the functional systems of the body are especially needed in the second stage of selection, when the future specialization of the young athlete is determined, and the multi-year preparation process is oriented.

The results confirm the findings of experts [1; 2; 9; 10] that morpho-functional indicators, according to which swimmers significantly differ from each other, determine success in a particular method of swimming. It should be noted that the transitional model characteristics of young athletes, previously presented in the literature, are somewhat outdated today. In addition, in the program for children's sports schools and sports schools [8], tests with control and transitional standards are given without quantitative indicators that could help the coach to choose the swimming specialization correctly, evaluate the quality of testing for effective selection and orientation of swimmers at the stage of specialized basic training. Therefore, the addition of scientific knowledge about the characteristics of constitution and physical preparedness of young swimmers 14–16 years old of various swimming specializations in accordance with modern trends in the development of sports swimming can improve the efficiency of selection and orientation of the most promising athletes.

Prospects for further research are associated with the establishment of the most significant criteria for the selection of young girls, representatives of different swimming methods, limiting their athletic achievements.

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.

References

1. Bulgakova, N.Zh. (1986), *Otbor i podgotovka yunykh plovtsov* [Selection and preparation of young swimmers], Fizkultura i sport, Moscow. (in Russ.)
2. Davydov, V.Yu. & Avdiyenko, V.B. (2012), *Otbor i orientatsiya plovtsov po pokazatelyam teloslozheniya v sisteme mnogoletney podgotovki (Teoreticheskiye i prakticheskiye aspekty)* [Selection and orientation of swimmers in terms of physique in the long-term preparation], VGAFK, Volgograd. (in Russ.)
3. Politko, E.V. (2018), "Age features of the formation of sports qualification and physical development of young swimmers 12-16 years", *Os-*

novy pobudovy trenuvalnoho protsesu v tsyklichnykh vydakh sportu: zbirnyk naukovykh prats, No. 2. pp. 75-79, available at: http://journals.uran.ua/cvs_konf/issue/archive. (in Russ.)
4. Politko, E.V. (2018), "Model characteristics of physical development and special physical preparedness of swimmers 12–15 years old", *Slobozans`kij naukovo-sportivnij visnik,* No. 2 (64), pp. 45-49. (in Russ.)
5. Politko, E.V. (2015), *Osobennosti morfofunktsionalnykh kharakteristik kvalifitsirovannykh sportsmenov-plovtsov* [Features morphological and functional characteristics of qualified athletes-swimmers], Kharkiv, KhDAFK. (in Russ.)
6. Politko, E.V. (2013), "Current trends in the model morphological and functional characteristics of highly skilled swimmers", *Visnik Chernigivskogo natsionalnogo pedagogichnogo universitetu im. T.G. Shevchenka, Seriya: Ped. nauki. Fizichne vikhovannya ta sport: Zb. u 4-kh t*, No. 112, Vol. 4, pp. 184-188. (in Russ.)
7. Politko, O. & Loboiko, A. (2019), "Interconnection of morpho-functional characteristics and physical fitness with sporting results of swimmers-sprinters, *Osnovy pobudovy trenuvalnoho protsesu v tsyklichnykh vydakh sportu: zbirnyk naukovykh prats*, pp. 66-72, available at: http://journals.uran.ua/cvs_konf/issue/archive. (in Ukr.)
8. Sakhnovsky, K.P. (1995), *Plavannya : navchalna programa dlya dityacho-yunackih sporitvnih shkil, specializovanih dityacho-yunackih shkil olimpiyskogo rezervu, shkil vishchoi sporitvnoi maysternosti* [Swimming: educational program for children-youth sports schools, specialized children-youth schools of the Olympic reserve, schools of the highest sports skill], Kiev. (in Ukr.)
9. Platonov, V.N. (2012), *Sportivnoe plavanie: put k uspekhu: v 2 kn*. [Sports swimming: the path to success: in two books], Olimpiyskaya literatura, Kiev. (in Russ.)
10. Chebotareva, I.V. (1998), "Model characteristics of young athletes with specialization in the chosen way of swimming", *Yubileyniy sbornik trudov uchenyh RGAFK, posvyashchenniy 80-letiyu akademii*, Iss. 3, pp. 49-54 (in Russ.)
11. Shinkaruk, O.A. (2011), *Otbor sportsmenov i oriyentatsiya ikh podgotovki v protsesse mnogoletnego sovershenstvovaniya (na materiale olimpiyskikh vidov sporta)* [The selection of athletes and their orientation in the process of preparing a multi-year improvement (based on Olympic sports)], Kyiv. (in Russ.)
12. Politko, O. (2015), "Features of morphological and functional characteristics of young swimmers 14–18 years", *Slobozhanskyi herald of science and sport*, No. 1(45), pp. 95-101.
13. Politko, Yelena (2016), "The relationship model of technical and tactical and morpho-functional characteristics of highly skilled swimmers specializing in 50 m butterfly", *Slobozhanskyi herald of science and sport*, No. 3(53), pp. 59-63.

Received: 04.05.2019.
Published: 30.06.2019.

Information about the Authors

Elena Politko: *PhD (Physical education and sport); Kharkiv State Academy of Physical Culture: Klochkivska str. 99, Kharkiv, 61058, Ukraine.*
ORCID.ORG/0000-0001-6481-196X
E-mail: elena.politko@gmail.com

Viacheslav Shutieiev: *PhD (Physical education and sport); Kharkiv State Academy of Physical Culture: Klochkivska str. 99, Kharkiv, 61058, Ukraine.*
ORCID.ORG/0000-0001-6459-8564
E-mail: shutey1971@ukr.net

Politko, E. & Shutieiev, V. (2019), "Determination of the most significant indicators of the preparedness of young men, representatives of various methods of swimming, which limit their sporting achievements", *Slobozhanskyi Herald of Science and Sport*, Vol. 7 No. 3(71), pp. 33-37, doi: 10.5281/zenodo.3371798

SLOBOZHANSKYI HERALD OF SCIENCE AND SPORT

UDC 796.082.1

ISSN (English ed. Online) 2311-6374
2019, Vol. 7 No. 3(71), pp. 38-44,
DOI: 10.5281/zenodo.3404329

Modern methods of monitoring and assessing the current status of athletes-combatants in real time

***Yaroslavna Puhach*[1]**
***Valeriy Druz*[1]**
***Andriy Yefremenko*[1]**
***Valeriy Revenko*[2]**
***Mykola Galashko*[1]**
***Vjacheslav Shutieiev*[1]**
***Tetyana Nizhevskaya*[3]**
***Valery Miroshnichenko*[1]**

[1]Kharkiv State Academy of Physical Culture, Kharkiv, Ukraine
[2]Kharkiv National University of Internal Affairs, Kharkiv, Ukraine
[3]H. S. Skovoroda Kharkiv National Pedagogical University, Kharkiv, Ukraine

Purpose: *to establish the most effective methods of monitoring and evaluating the current status of athletes, and on the basis of this, develop methods for remote monitoring of the current state of martial arts in the process of conducting a duel.*

Materials & Methods: *videotapes of competitive fights of athletes participating in Ukrainian championships, world championships, and Olympic Games were used in the research. The methods used are: "high-speed video filming" a biomechanical analysis of the kinematic displacements of the total center of mass of an athlete and individual bio-kinematic parts of the body, followed by the determination of the dynamic efforts that ensure their movement, as well as the statistical stress that determines the availability of these efforts.*

Results & Conclusions: *the use of modern technical video recording tools and computer equipment with appropriate programs for processing video sequences of performed movements and on the basis of established regularities of the flow of biodynamic efforts of competitive movements of martial sportsmen opens up broad possibilities for developing methods for remote contactless monitoring of the current status of athletes.*

Keywords: *semantic spaces, biomechanical analysis, dynamic force.*

Introduction

Currently, there are no objective methods for contactless remote assessment of the current status of athletes leading the fight at sports arenas. This is complicated by the fact that their physical activity takes place in a situational situation and is unpredictable, the actions performed are acyclic and extremely varied both in the arsenal of specific features of movements in a particular form of martial arts, and in the features of their performance. All this as a whole creates great difficulties not only in monitoring the current state, but also in the subsequent analysis of its implementation. The emergence of modern video technology allows the analysis of the actions of athletes, but the assessment of the measure of fatigue on the results of video shooting is not currently carried out, which is an important unresolved task.

Its solution is of interest for almost any sport. This problem is solved in cyclic sports, based on the use of the method of "statistical layering" of performed cycles of movements.

His made it possible to observe quite clearly the dynamics of their frequency-amplitude oscillations, which was successfully carried out in the works on the study of the sprint run by A. Yefremenko [1]. In the works of Van Sin Na [4], G. P. Artemyeva [5], M. N. Galashko [6], Ya. I. Puhach [8] established a characteristic feature of the static force change at the angle of bend between the biokinematic links "thigh-shin", "shoulder-forearm" both in the mode of development of the effort to be overcome and in the case of repayment of the impulse of force. In these studies, for the first time, the dependence of the increase in the effort on the angle of extension of the biokinematic links was established, which is characterized as the quantity $\partial F/\partial \varphi$. This characteristic is described in polar coordinates by a logarithmic spiral, which clearly gives a graphic representation of its changes during fatigue. This characteristic allowed A. N. Iefremenko to find a strictly determined relationship between the kinematic characteristics of the movement of the biological links of the limb in a smooth run at short distances, dynamic efforts, which are provided by their movements, and static voltage, which preserves the working posture of the athlete's body when moving it in the race. Based on the regularity of the behavior of the $\partial F/\partial \varphi$ characteristic and its changes during the run, he was the first to establish a feature of reducing the energy potential during the passage of a distance, which is that the kinetic energy consumption of body mass movement over the distance covered was less than the total loss.

The calculations were carried out on the basis of the analysis of high-speed video filming of the run of athletes of various ranks [9].

The results of these studies formed the basis for a modification of the method of remote assessment of the current status of an athlete-combatant during a duel, in determining its energy costs for conducting receptions against an opponent; protection from enemy attacks; passive actions when preparing your attack or waiting for the actions of the enemy This technique and its use in the conducted research on the example of combat sambo is presented for the first time.

Purpose of the study: establish the most effective methods of monitoring and assessing the current status of athletes, carried out in real time in the process of conducting the fight.

Objectives of the study:

1. To analyze the scientific and methodological literature on the existing methods of control carried out remotely in real time for the current state of the athletes, or the "human operator" who performs his work under special or extreme conditions.

2. To establish the relationship between the complexity of the goal; tasks aimed at achieving it, and the possibilities of existing methods to solve them.

3. Based on the analysis carried out, develop a method that has the necessary solvability to achieve the goal.

4. To test the method obtained.

Material and Methods of the research

Materials: data of video fights performances of athletes.

Research methods: analysis and synthesis of scientific and methodological literature; biomechanical video processing; methods of mathematical approximation of the kinematic displacement of the centers of mass of individual parts of the body and the general center of body mass; graphical presentation of research results in indicative semantic spaces.

Results of the research

Remote monitoring of the current state of a person who is not burdened with any hardware equipment has been unresolved for a long time, as there were no integral methods for assessing the current state. This issue was most acute in transport systems, in aviation and space medicine, engineering psychology [17]. The first, rather effective solution to this problem was found in the development of methods for monitoring the control of the aircraft [21]. It was based on the control over the implementation of the final result of professional work in the management of the pilot of the aircraft by "aircraft control stick". Depending on the current state of the pilot, his accuracy of the flight training program by the aircraft control stick movement varied.

The peculiarity of the construction of this method was that control over the state of the contractor is carried out by a qualitative assessment of the implementation of the final result of a given professional activity. The observed executor was not burdened with any devices while monitoring the course of his functional state.

This method of control in all respects corresponds to its application in the practice of monitoring the action of an athlete-combatant during a sporting match as the type of his professional activity and evaluation of its result by external observation. However, its use to assess the interaction of two athletes is insufficient, since in the first case the error in the control of the aircraft by the pilot is completely predictable on the result of the behavior of the aircraft, and there is always direct contact of the pilot through the aircraft control stick and in the interaction of two opponents in single combat, this method does not allow to give a reasonable forecast of the further development of the process being conducted, as it relates to non-stationary processes.

The valuable result of applying the method described above is that it is based on an integral indicator of a person's general condition, which influences the achievement of the final result performed by the professional activity. Any deviation of the current state from its adequate standard for the work being performed entails an error in the correctness of the action being performed. An equally important result was the established pattern of the exponential growth of the allowed error with a linear dependence of the indicators of the functional state, which is an integral indicator of deviation from its "norm".

Thus, the necessary resolvability of observation becomes possible only if we take into account the integral indicator of the general functional state of a person and the indicator of the magnitude of deviation from the adequate norm of the current state. On the basis of these characteristics, a graphic construction of these relations is carried out in a special attribute semantic space with a single measure of comparable characteristics, which reflects the analytical dependence of the description of the sought pattern. As noted above, this problem was solved by A. Yefremenko when analyzing the energy consumption of the static stress of the working posture and the dynamic efforts that ensure the kinematic displacement of the center of mass of the body parts and the common center of mass in the supporting and unsupported phases of its movement in a runner at a short distance [9].

Based on the foregoing, to assess the current functional state of a martial fighter when conducting a duel, the pattern of changes in the $\partial F/\partial \varphi$ characteristic was used in the plyometric mode of its manifestation in movements during the reactions with support. This is reflected in the nature of the observed static voltage changes its magnitude and duration of the flow. The process of remote monitoring was carried out by a special video camera and an appropriate program for processing the video sequence of the athlete's movements performed in real time. Systematization of the athlete's motor activity throughout the entire fight consists in the division of the performed actions into non-contact movement and con-

Puhach, Y., Druz, V., Yefremenko, A., Revenko, V., Galashko, M., Shutieiev, V., Nizhevskaya, T. & Miroshnichenko, V. (2019), "Modern methods of monitoring and assessing the current status of athletes-combatants in real time", *Slobozhanskyi Herald of Science and Sport*, Vol. 7 No. 3(71), pp. 38-44, doi: 10.5281/zenodo.3404329

tact interaction. In the time series of the athlete's movement, a continuous assessment of the change in magnitudes $\partial F/\partial \varphi$ was carried out, and against its background, an estimate of the value of $\partial F/\partial \varphi$ was carried out, which made it possible to establish the relationship between the variation of the static voltage and the dynamic force observed with it, determined by the athlete. The empirical data, on the basis of which the above stated regularities were established, are presented in tables 1–4.

Static voltage is characterized by an equal force ratio of the voltage of synergists and antagonists. The magnitude of this relationship is always equal to one. The potential energy supply providing such a ratio may vary from the permissible minimum to the maximum possible maximum. Oscillations or ripple of potential energy relative to any point; static voltage is observed within the entire range of its value. The maximum possible value of this process is observed in the middle of the range of static voltage. Depending on the intensity of static voltage and the duration of its preservation, the expenditure of potential energy occurs. The expenditure of potential energy is spent on dynamic efforts, which generates the movements of the bio-kinematic links of the body, which are to a certain extent aimed at maintaining the static position of the working posture when performing movements of professional orientation.

When measuring the static force in various angular values in any biokinematic pair, its quantitative characteristic is established. This value remains the same for both synergists and antagonists. Any motor act is accompanied as a result of changes in dynamic efforts between antagonists and synergists. Since all the considered characteristics are expressed in the same physical quantities, their relationship represents a dimensionless quantity, which is measured within a unit, if the full range of variation of all the relationships encountered is taken as one.

Consumption of potential energy, if it is not replenished during the work, is reduced, which is regarded as fatigue. Geometrically, this can be represented as a reduction in the length of the range, which is adopted by the "conventional unit". For the actual implementation of motor activity aimed at displacing the centers of mass of the bio-kinematic links of the body and the common center of mass of the body, the absolute values of the dynamic efforts necessary to ensure the kinematics of the actions performed remain the same.

This leads to a change in the structure of static stress, manifested in a change in the working posture of an athlete, which in turn leads to changes in the speed and trajectory of movement of both the common center of mass of the whole body and of its individual kinematic links, the technique, movement is disturbed, the increase in allowed errors increases, the efficiency factor decreases power consumption. Characteristics of temporal, spatial and power indicators undergo a mismatch. If this process is not comparable with the same to the opponent, it is manifested in the superiority of one whose energy potential is higher.

Since the process of fatigue is reflected in the change in the kinematics of motion, and it is described in strictly defined analytical equations, the video monitoring performed allows us to estimate the progress of this process in real time. Its representation in dimensionless quantities in semantic space allows us to express the qualitative characteristics of the state of fatigue in quantitative terms of the observed analytical dependence.

It is almost impossible to reveal this pattern by conventional research methods, which are used when comparing various variants of relations of a measure of static voltage of its pulsating oscillation, while variations in the dynamic efforts of synergists and antagonists ensuring the execution of a motor act. Especially if this comparison is based on group average data. As an example, it is enough to consider the structure of the analysis of the variation of static voltage and dynamic efforts of synergists and antagonists in the organization of the equifinal result of the performed professional activity.

The magnitude of the possible manifestation of static force depends on the innate body type, current physical condition, level of physical fitness. In the ongoing research measurements were taken static forces. Regardless of the current state, innate data, body type, current physical condition and level of physical fitness, static stress is characterized by the fact that the relationship between the dynamometry of synergists and antagonists remains equal. All the parameters listed above lose the significance of the absolute values, and only the indication of the fluctuation of the range of the ripple boundaries of the dynamic force from the minimum value to the maximum value remains. The boundaries of this range in any case correspond to some current value of static voltage equal to one.

Since the generators of this characteristic are dynamic efforts of synergists and antagonists, their unequal relations also give a dimensionless characteristic, which varies from 0 to 1 subject to the introduction of a measure $\frac{2(SV-S)}{SV}$ or $\frac{2(SV-A)}{SV}$ where is SV – current static voltage; S – the maximum observed dynamic synergistic effort; A – the minimum observed dynamic force of the antagonist, which is typical for the implementation of the action performed. In this case, the difference of the resulting static voltage oscillations is the range of its pulsating oscillation (P). In this representation of the four interdependent characteristics, such a parameter as time is excluded. We are talking only about the amplitude interdependence, characteristics considered. Tables 1–4 present the data of one athlete, whose readings are reflections of the relationship between the synergist and antagonist tension at different angles φ between the lower leg and thigh, reflecting the static stress of the working posture, in ensuring the flow of dynamic efforts of the movements performed.

Variants of this kind of relationship, depending on their mutual conditionality, can be created much more, but it is practically impossible to establish a general connection between all four characteristics in this type of analysis.

Table 1

The characteristic of the static stress of the working posture, reflecting the relationship of the pulsating dynamics of the efforts of synergists and antagonists with different angular deviations of the biokinematic elements of the "hip-shin" pair. Data systematized by the size of the pulsating range of efforts of the synergist-antagonist when performing a motor act (°)

No.	S	A	P	SV	No.	S	A	P	SV
1.	100	20	20	90	17.	120	60	60	90
2.	120	100	20	110	18.	140	80	60	110
3.	140	120	20	130	19.	160	100	60	130
4.	160	140	20	150	20.	180	120	60	150
5.	180	160	20	170	21.	100	20	60	60
6.	80	50	30	65	22.	120	40	80	80
7.	100	70	30	85	23.	140	60	80	100
8.	110	80	30	95	24.	160	80	80	120
9.	120	90	30	105	25.	180	100	80	140
10.	160	130	30	145	26.	130	50	80	90
11.	180	150	30	165	27.	120	30	90	75
12.	100	60	30	80	28.	140	50	90	95
13.	120	80	40	100	29.	150	60	90	105
14.	160	120	40	140	30.	160	70	90	115
15.	180	140	40	160	31.	170	80	90	125
16.	100	40	40	70	32.	180	90	90	135

Remark. *SV is the statistical voltage; S is the synergist's dynamic effort; A – dynamic effort of the antagonist in the frame analysis of the performed movement by the athlete, P – pulsating oscillation.*

Table 2

Ratios of the characteristic of static voltage with maximum effort, synergists and dynamics of the efforts of antagonists in providing a motor act and changing the value of pulsation of the range in different angular positions of the kinematic pair "thigh-shin". The data is selected from table 1

S	120	120	120	120	120	120
A	100	90	80	60	40	30
P	20	30	40	60	80	90
SV	110	105	100	90	80	75

In the subsequent analysis of these data, the economy of energy consumption for each selected group of movements was evaluated, which was used to determine the optimal tactical behavior and the economy of energy consumption for conducting attacking and defensive actions. In general, the analysis of the fight was carried out to assess its initial and final energy potential, as well as the pulsation of this potential in the time of the entire fight.

With accurate information about the anthropometric characteristics of the growth-weight indicators, a similar calculation was carried out for the enemy, which later allowed to establish its energy consumption dynamics and correlation of profitability ratios in the interaction of each fragment of the fight.

The lack of previously existing video monitoring technology, appropriate software and the necessary computer equipment, as well as developed feature semantic spaces with a single measure of comparable characteristics introduced in them, reflecting the presented empirical data in an orderly form, while establishing the consistency of the studied characteristics of the interacting characteristics, not allowed to solve problems of the complexity.

Table 3

The ratio of changes in synergistic efforts, static voltage pulsations with a constant indicator of the efforts of antagonists. The data is selected from table 1

A	80	80	80	80	80	80
S	100	110	120	140	160	170
P	20	30	40	60	80	90
SV	90	95	100	110	120	125

From the analysis it follows that:

1) for comparing and commensurability of the observed interdependent relations in processes and phenomena, a unified measure of their representation in non-changeable units is necessary in order to obtain the proportion of their ratio to each other in commencement to something third, as the value of the standard of comparison. They can be the range of fluctuations of these values from its max to min; or their sum (compared values) to their current value. In this case - the opened share ratio of each part to the whole. The change of the whole remains uncertain. They are the current potential of the entire system. In this case, only the qualitative component of the whole is reflected, but not its value;
2) the stability of the occurrence of the considered ratios of the compared quantities is expressed in their constancy of manifestation, which, with their multiple layering, is reflected in the indicator "how much?".

Choosing the characteristic of any comparable value (the interval "max-min", or the value of the relationship), it is necessary to accumulate its combination, after which it came and what follows after it. "What emerged from the past", "what gave birth to the present". The constancy of statistical accumulation in

Puhach, Y., Druz, V., Yefremenko, A., Revenko, V., Galashko, M., Shutieiev, V., Nizhevskaya, T. & Miroshnichenko, V. (2019), "Modern methods of monitoring and assessing the current status of athletes-combatants in real time", *Slobozhanskyi Herald of Science and Sport*, Vol. 7 No. 3(71), pp. 38-44, doi: 10.5281/zenodo.3404329

the current present, as the basis of the observed indicator, and the variation around it of the past from which it arose, and the subsequent that it gave rise, gives a "structure of the constancy of the occurrence of constant relationships", which reflects its qualitative structure and the variability of the compared structure. Its universality of the emergence and transition into the next, that is, the triad "generating-existing-generated", or "past-present-next", or "previous-present-future";

3) the manifestation of a statistical accumulation of "constancy of observation of the following structures of constancy of the occurrence of constant relations" is an expression of a certain self-organizing system that emerged from the generator environment, which finds its presentation in a specific analytical expression, and its stability is determined by "constant" coefficients when the established values of the parameters "constantly", manifested analytical expressions, reflecting the pattern the process of self-organization and its accessible universality in the generation of the subsequent variability of self-organizing systems as a set of autonomous units interacting with each other.

In all cases, it was a question of the qualitative organization of this process without taking into account the potential energy-mass exchange necessary for its maintenance, which consisted in the simultaneous and sequential flow of various processes, which characterizes the qualitative feature of their organization. The simultaneous occurrence of the same processes reflects the strength of their severity (amplitude), and successively the same processes, reflect the duration of their action.

This variability of possible combinations and "jointly proceeding processes" in a certain space with an appropriate density of their combination generates the stability of their occurrence, which is reflected by the amplitude-frequency dependence of their periodic repeatability, which has a strictly determined analytical apparatus reflecting the formation of this process.

When testing the material obtained, a method was used to estimate the athlete's energy potential to change the plyometric response of the $\partial F/\partial \varphi$ indicator, which reflects the measure of static voltage during the development of fatigue during the current work and dynamic efforts, manifested in changes in the $\partial F/\partial t$ indicator, determining the speed of movement of the bio-kinematic links of the body and its common center mass.

The essence of it was to determine the magnitude of the change between the characteristic of the preceding signal to the measured next. From the entire video series, a set of identical signals was selected, which were located according to their size from the weakest to the strongest. Regarding them, a variation of outgoing and subsequent signals was noted; those that formed it, and those that formed it. In fact, this method, which was proposed by Galton in the method of "collective photography", was tested by Sheldon and, taking into account modern technical advances, in a modified version of its application, our own are used in scientific research carried out at Kharkiv State Academy of physical culture [22; 23].

All the calculations described were carried out in real time. The final signal processing was represented in the form of a graphical expression of a nomogram of two combined coordinate grids rotated relative to each other at an angle of 45°. The first rectangular grid represents the vertical (ordinate) change in energy potential in its maximum manifestation in a controlled individual. Horizontal (abscissa) there were changes in its minimal manifestation. The values of the boundaries of the pulsations were taken from the video series, which determined the range of pulsations in the change in the energy potential of the controlled individual.

The second rectangular grid represented by the ordinate value the current value of the pulsation energy potential when the controlled motor activity, and the abscissa represents the magnitude of the static voltage determined by changes in conducted performance plyometric control. The static voltage scale (abscissa in the second coordinate grid) in the first coordinate grid is the bisector of the angle of this coordinate grid.

The general picture of the observed interdependent processes, reflected in the indicative semantic space with the measure introduced in fractions of sigmal values, is presented in Figure 1.

This method of monitoring and current analysis of the data obtained can be used in any kind of sports and professional activities.

The limiting complexity of the widespread use of this method

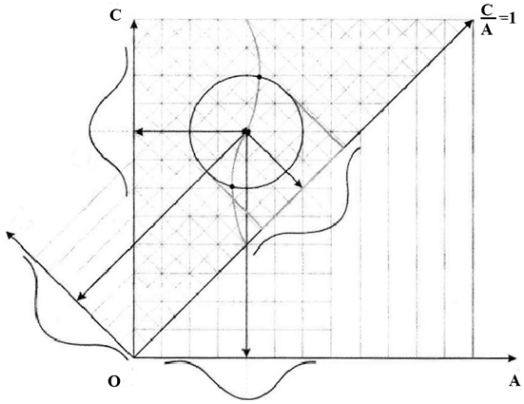

Fig. 1. The pattern of movement of the common point of the indicator of the energy potential ripple in its orderly representation in the indicative semantic space with its arbitrary manifestation in the potential naturally occurring process of a single combat fighter: S – reflects the value of synergetic efforts in the relationship of potential with its antagonist A in providing equal static voltage represented by all relations, when S/(A=1), as the coefficient α of constant relations of static voltage, which is the diagonal of the coordinate system S; A. The orthogonal to this diagonal is the coordinate axis of the pulsation of the coefficient S/(A=1) and this diagonal itself constitutes a space that has a single origin with the space S; A is rotated by an angle α=45°. The zone of joint intersection of these spaces is an area in which the interaction of a common point is reflected, which unites the interaction of all 4 parameters. Its movement generates an analytic regularity reflecting the interdependence of the behavior of that point.

is the technique used to provide it, which includes appropriate video equipment, computer equipment, appropriate software and specialists in its operation, which will later constitute the field of scientific and practical support for the training of high-ranking athletes.

Conclusions / Discussion

Based on the use of modern technical video equipment and computer equipment with appropriate programs for processing video sequences of performed movements and on the basis of established regularities of the flow of biodynamic characteristics in performing competitive movements of martial artists, a method of remote contactless monitoring of its current state has been developed.

Observing results obtained allow us to estimate the most energy-loss athletes in motor activity pursued controlled duel structure, whereby the tactical possible to determine the behavior of the athlete.

In the training process, the use of this method of monitoring the athlete's state allows for mastering the most economical techniques for performing difficult-coordinated actions, and when analyzing the "opponent" equipment, establish his weakest positions in the conduct of the fight.

Further development of this direction will be connected with its wider practical implementation.

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.

References

1. Yefremenko, A.M. (2014), "Influence of the complex of means of restoration of efficiency on operational and current functional condition of sprinters", *Moloda sportyvna nauka Ukrainy*, No. 1, pp. 67-72 (in Ukr.)
2. Druz, V.A., Omelchenko, M.V. & Omelchenko, D.A. (2015), "Fundamentals of sprint technique", *Slobozans`kij naukovo-sportivnij visnik*, No. 47, pp. 41-45. (in Russ.)
3. Van Sin Na. (2012), *Sovershenstvovanie tehniki vyipolneniya sorevnovatelnyih uprazhneniy kvalifitsirovannyih sportsmenov v pauerliftinge : dis. kand. nauk fiz.vosp. i sporta* [Improving the technique of performing competitive exercises of qualified athletes in powerlifting: PhD dis.], KSAPC, Kharkiv, 210 p. (in Russ.)
4. Artemeva, G.P., Pugach, Ya.I. & Druz, V.A. (2014), *Problema adaptatsii v strukture nauchnyih issledovaniy sistemyi olimpiyskogo obrazovaniya* [The Problem of Adaptation in the Structure of Scientific Research on the System of Olympic Education], KSAPC, Kharkiv. (in Russ.)
5. Halashko, M.N. (2016), *Vykorystannia morfofunktsiunalnykh pokaznykiv dlia prohnozuvannia uspishnosti sportyvnoi diialnosti armrestleriv: avtoref. dys. kand.nauk z fiz. vykhovannia ta sportu* [Morphofunctional Indicators for Predicting Successful Sports Activities Armrestlers: PhD thesis abstract], Kharkiv, 22 p. (in Russ.)
6. Puhach, Ya.I. (2013), "Osnovnyie polozheniya postroeniya semanticheskogo prostranstva dlya uporyadochennogo predstavleniya rezultatov issledovaniya", *Materialyi IX Mezhdunarodnoy nauchno-prakticheskoy konferentsii "B'deschego oprosyi otsveta na naukata"*, P. 39, Sofiya, pp. 5-13. (in Russ.)
7. Yefremenko, A.M. (2015), "Complex p_dkhid to the power of each year's celebrated sprinter", *Moloda sportyvna nauka Ukrainy*, No. 1(19), pp. 82-86. (in Russ.)
8. Druz, V. et al. (2016), "Kinematic characteristics of a sprinting technique and morphofunctional structures of its providing", *Journal of Education, Health and sport*, Vol. 6(11), pp. 271-280. (in Russ.)
9. Voronov, A.A. (1979), *Ustoychivost, upravlyaemost, nablyudaemost* [Stability, controllability, observability], Nauka, Moscow. (in Russ.)
10. Anohin, P.K. (1973), *Printsipialnyie voprosyi obschey teorii funktsionalnyih sistem. Printsipyi sistemnoy organizatsii funktsii* [Principal Issues of the General Theory of Functional Systems. Principles of system organization of the function], Nauka, Moscow. (in Russ.)
11. Zade, L. (1974), *Osnovyi novogo podhoda k analizu slozhnyih sistem protsessov prinyatiya resheniy* [Fundamentals of the new approach to the analysis of complex systems of decision-making processes], Znanie, Moscow. (in Russ.)
12. Bertalanffy, L. (1960), *Problems of life; an evaluation of modern biological and scientific thought*, Hoper Torctbooks, New York.
13. Haken, G. (1985), *Sinergetika ierarhiy neustochivostey v samoorganizuyuschihsya sistemah i ustroystvah* [Synergetics of hierarchies of instabilities in self-organizing systems and devices], Mir, Moscow. (in Russ.)
14. Samsonkin, V.N. (1997), *Teoreticheskie osnovyi avtomatizirovannogo kontrolya chelovecheskogo faktora v cheloveko-mashinnyih sistemah na zheleznodorozhnom transporte: dis. dokt. teh. nauk* [Theoretical Foundations of the Automated Control of the Human Factor in Man-Machine Systems in Railway Transport], Kharkiv, 440 p. (in Russ.)
15. Samsonkin, V.N., Druz, V.A. & Fedorovich, E.S. (2010), *Modelirovanie v samoorganizuyuschih sistemah* [Modeling in self-organizing systems], Donetsk. (in Russ.)
16. Zade, L. (1976), *Ponyatiya lingvisticheskoy peremennoy i ego primenenie k prinyatiyu resheniya* [The concepts of a linguistic variable and its application to decision making], Mir, Moscow. (in Russ.)
17. Sepp, E.I. (1959), *Istoriya razvitiya nervnoy sistemyi pozvonochnyih* [History of the development of the nervous system of vertebrates], Medgiz, Moscow. (in Russ.)
18. Sarkisov, M. (1972), *Ocherki po strukturnyim osnovam gomeostaza* [Essays on the structural bases of homeostasis], Meditsina, Moscow. (in Russ.)
19. Menshov, A.I. & Ryilskiy, G.I. (1976), *Chelovek v sisteme upravleniya letatelnyimi apparatami (ergonomika)* [Man in the aircraft control system (ergonomics)], Mashinostroenie, Moscow. (in Russ.)
20. Puhach, Ya.I., Sokolova, T.E. & Efremenko, A.N. (2017), "The use of modern technical advances to develop new methods for studying adaptation processes in order to improve the technology for training highly qualified athletes", *Aktualnyie nauchnyie issledovaniya v sovremennom mire*, Iss. 12(32), Part 5, pp. 45-53. (in Russ.)
21. Azhippo, A.Yu., Puhach, Ya.I., Pyatisotskaya, S.S., Zhernovnikova, Ya.V. & Druz, V.A. (2015), *Ontologiya teorii postroeniya i otsenki urovnya fizicheskogo razvitiya i fizicheskogo sostoyaniya (monografiya)* [Ontology of the theory of construction and assessment of the level of physical development and physical condition], KSAPC, Kharkiv. (in Russ.)
22. Haken, H. (1983), *Synergetics. An introduction*, 3rd ed., Springer, Berlin, Heidelberg, New York.
23. Bertalanfffy, L. (1950), "The theory of Open System in Physics and Biology", *Science*, 13 January, No. 111, pp. 23-29.
24. Ladeh, L.A. (1973), "Outline of a New Approach to the Analysis of Complex System and Decision Processes", *IEEE Trans on System, Man,*

Puhach, Y., Druz, V., Yefremenko, A., Revenko, V., Galashko, M., Shutieiev, V., Nizhevskaya, T. & Miroshnichenko, V. (2019), "Modern methods of monitoring and assessing the current status of athletes-combatants in real time", *Slobozhanskyi Herald of Science and Sport*, Vol. 7 No. 3(71), pp. 38-44, doi: 10.5281/zenodo.3404329

and Cybern., Vol. SM-3, No.1, January.

Received: 14.05.2019.
Published: 30.06.2019.

Information about the Authors

Yaroslavna Puhach: *PhD (physical education and sport); Kharkiv State Academy of Physical Culture: Klochkivska str. 99, Kharkiv, 61058, Ukraine.*
ORCID.ORG/0000-0001-5460-772X
E-mail: sanadruz@gmail.com

Valeriy Druz: *Doctor of Science (Biology), Professor; Kharkiv State Academy of Physical Culture: Klochkivska 99, Kharkiv, 61058, Ukraine.*
ORCID.ORG/0000-0002-4628-6791
E-mail: valeriidruz@gmail.com

Andriy Yefremenko: *PhD (Physical Education and Sport); Kharkiv State Academy of Physical Culture: Klochkovskaya str. 99, Kharkiv, 61058, Ukraine.*
ORCID.ORG/0000-0003-0924-0281
E-mail: ukrnac@ukr.net

Valeriy Revenko: *PhD (Pedagogical Science), docent; Kharkiv National University of Internal Affairs, L. Landau avenue, 27, Kharkiv, 61080, Ukraine.*
ORCID.ORG/0000-0002-3003-3538
E-mail: revphd@gmail.com

Mykola Galashko: *Kharkiv State Academy of Physical Culture, Klochkovskaya 99, Kharkiv, 61058, Ukraine*
ORCID.ORG/0000-0001-5278-9806
E-mail: kaf-va-b@ukr.net

Vjacheslav Shutieiev: *PhD (Physical Education and Sport); Kharkiv State Academy of Physical Culture, Klochkovskaya 99, Kharkiv, 61058, Ukraine.*
ORCID.ORG/0000-0002-5262-2085
E-mail: shutey1971@mail.ru

Tetyana Nizhevskaya: *PhD (Pedagogical Science); H. S. Skovoroda Kharkiv National Pedagogical University, Valentynivska st., 2, Kharkiv, 61000, Ukraine.*
ORCID.ORG/0000-0003-2151-2067
E-mail: nymbis@gmail.com

Valery Miroshnichenko: *PhD (Pedagogical Science), docent; H. S. Skovoroda Kharkiv National Pedagogical University, Valentynivska st., 2, Kharkiv, 61000, Ukraine*
ORCID.ORG/0000-0003-2362-9226
E-mail: mvtet@ukr.net

SLOBOZHANSKYI HERALD OF SCIENCE AND SPORT

UDK 796.077:796.03(477.54)

ISSN (English ed. Online) 2311-6374
2019, Vol. 7 No. 3(71), pp. 45-49
DOI: 10.5281/zenodo.3404479

Peculiarities of organization of propaganda of non-Olympic sports in Kharkiv

***Svetlana Stadnik*[1]**
***Taras Bondar*[2]**
***Olena Orlenko*[1]**
***Irina Petrenko*[1]**

[1]*Kharkiv State Academy of Physical Culture, Kharkiv, Ukraine*
[2]*University of Customs and Finance, Dnipro, Ukraine*

This work is actual due to rapid growth of the popularity of non-Olympic sports in the city of Kharkiv. Identification of organizational reserves in non-Olympic propaganda system of sports in the city of Kharkiv and identification of areas of its improvement is aimed at the development of non-Olympic movement in the city.

Purpose: *definition of features and ways to improve the system of propaganda of non-Olympic sports in the city of Kharkiv.*

Material & Methods: *during the research a set of scientific methods was used: Analysis of literary sources; Analysis of documentary materials; Analysis of Internet resources; System analysis; Organizational analysis; Survey (questionnaire), methods of mathematical statistics. In a study coaches and clients of fitness clubs in Kharkiv and students of Kharkiv sate academy of physical culture who are involved in non-Olympic sports (n=50) participated.*

Results: *a system of propaganda of non-Olympic sports in the city of Kharkiv from the perspective of a systematic approach is characterized. Analyzed local promoter activity of management of the State's authority s in the sphere of physical culture and sport, the Federation and the other sports organizations of non-Olympic sports. The regional mass media have been identified, which cover information on non-Olympic sports. Organizational reserves are revealed.*

Conclusions: *the propaganda system of non-Olympic sports in the city of Kharkiv is characterized by its singularities in use of existing forms and means of propaganda in the existing resource provision and in regional media. Directions of improving the system of propaganda of non-Olympic sports in the city of Kharkiv are offered.*

Keywords: *system, reserves, directions, improving, activities.*

Introduction

The modern practice of functioning and development of non-Olympic sports, as well as its social importance, are subjects of scientific interest. The need to research various aspects of system of non-Olympic sports is pointed by researches of scientists [5]. So far, in the literature the authors have presented the historical aspects of the emergence and development of non-Olympic sports, organizational and legal bases of non-Olympic sports regulation in the world and in Ukraine [8]. N. G. Dolbysheva & E. Yu. Savaretz analyzed the main directions of activity of controls authorities that provide non-Olympic sports in Ukraine [4]. Actual problems and prospects of development of strategy of non-Olympic sports in Ukraine are presented in works [9; 11].

In official documents which regulate the sphere of physical culture and sport, it is emphasizes that the first important task is forming in the population needs to systematic physical culture and sports. This underlines the great importance of propaganda in the development of non-Olympic movement. In domestic literature [3; 12] and foreign authors [13; 14] the role of propaganda and influence of the media on the development of sport, in particular the impact of social networks on sports sponsorship and marketing are examined [17; 20; 21].

In works of some authors [1; 3; 6; 10; 12] the beginning of solution of studied problem has been started. In particular: study by A. A. Tomenko related to the study of non-Olympic sports' coverage of issues in the domestic media [12]. S. A. Stadnik & M. A. Skrinnik characterized regional media as propaganda sources of non-Olympic sports [10]. Yu. N. Zhdamirova & I. V. Petrenko considered mass physical culture and sports activities that take place in the city of Kharkiv [6]. A. Yu. Aghyppo & A. S. Bondar presented sports and recreational sports organizations in Kharkiv [1]. A. S. Bondar & V. S. Mamay especially paid attention to the lighting of Olympic and non-Olympic sports on the Internet [3]. At the same time, there are unresolved questions of the functioning and science provement of organization of propaganda for the development of non-Olympic sports in the city of Kharkiv.

Studying the system of propaganda of non-Olympic sports in the city of Kharkiv with the system approach aimed at identification of its characteristics and organizational reserves. This

Stadnik, S., Bondar, T., Orlenko, O. & Petrenko, I. (2019), "Peculiarities of organization of propaganda of non-Olympic sports in Kharkiv", *Slobozhanskyi Herald of Science and Sport*, Vol. 7 No. 3(71), pp. 45-49, doi: 10.5281/zenodo.3404479

will provide an opportunity to identify areas for improvement of the existing non-Olympic sports promotion system that will contribute to the development of non-Olympic movement in the city of Kharkiv.

Purpose of the study: to define the features and directions of improvement the system of propaganda of non-Olympic sports in the city of Kharkiv.

Material and Methods of the research

Participants. Coaches and clients of fitness clubs in Kharkiv (n=29), as well as 3d-grade students of the Kharkiv state academy of physical culture, involved in non-Olympic sports (n=21), took part in the study. 50 people were interviewed, 58% of them men and 42% women. The average age of respondents was 21–30 years – 58%, the maximum 41–50 years – 16%, the minimum – up to 20 years (4%). All respondents are involved in non-Olympic sports and have lived in the city of Kharkiv for at least 5 years. All participants gave informed consent to participate in this survey.

Organization of research. In order to identify the state of development of non-Olympic sports in the city of Kharkiv, as well as to determine the content of propaganda of activity, methods of analysis of legal documents and analysis of Internet resources were used. The method of system analysis made it possible to determine the structural characteristic of the system of propaganda of non-Olympic sports in the city of Kharkiv. Application of the method of organizational analysis made it possible to identify organizational reserves. The survey was conducted in the form of a questionnaire in order to identify the opinion of Kharkiv inhabitants as for organization of propaganda of non-Olympic movement in the city of Kharkiv.

Statistical analysis. Excel program was used in the study.

Results of the research

In our study "a system of propaganda of non-Olympic sports", was seen as a set of interrelated or interacting elements which common goal is to convince the population of the city of Kharkiv in the use and need of training non-Olympic sports. It is found that the propaganda of non-Olympic sports system consists of the external environment, input, output and feedback of the final result of the system.

The external environment is a combination of factors that influence propaganda activities. Joining to non-Olympic sports propaganda is propaganda subjects, which we conventionally combined into 3 groups. This element, influenced by the external environment, using forms and means of propaganda, existing resources, regional media, influence the object of propaganda with the aim of achieving the final result at the output. Usage of a systematic approach requires a feedback to determine the importance of the processes in the operation of the system.

Local authorities in the city of Kharkiv, presented by the Department of Family, Youth and Sports of the Kharkiv City Council (hereinafter – the Department) and its structural divisions: Management and marketing department in the field of sport; Management department of physical culture and sports; Management Investment Development and image projects, as well as the Committee on the Family, Youth and Sports in the 9 districts of the city.

Objectives and activities of the Department and its business units, aimed at promoting sports movement, including non-Olympic sports are identified. These are tasks of organizing and carrying out and, taking into account the complex market research, large-scale sporting events, as well as their promotion on the Internet, in regional, national and international media.

It was found that the Department held in the city every year image sports events on the development of non-Olympic view s sports festival of extreme sports; social project "I can"; Martial arts festival; Sports fair "Kharkiv – the sports capital"; Festival on intellectual sports "Intelliada"; Sports corporate tournament "The Battle of Corporations"; Competition "Sports initiatives of Kharkiv". The results of the survey give grounds to assert that the above mentioned image-sports events rise interest in the city's population. In particular, 66% of respondents would like to become a part of such events.

The analysis of calendar plans of the Administration of Physical Culture and Sports Department has shown that each year the city hosts about 300 sports events. Out of them, 60% are activities of non-Olympic sports. In the course of our survey it is revealed that the majority (66%) of respondents are interested in sports events that are held in the city on the power non-Olympic sports (weightlifting, arm sport, bodybuilding, power lifting, strongman).

At the same time, the analysis of propaganda activities of local government authorities in the field of Physical Education and Sports has revealed the organizing reserve. This project of the city target complex program to promote non-Olympic sports in the regional media, coordination and control over the implementation of which is entrusted to the Department of Family, Youth and Sports of the Kharkiv City Council and its structural divisions.

To public sports organizations which develop non-Olympic sports in the city of Kharkiv, we attribute the federation of non-Olympic sports and sports society. It was revealed that currently in Kharkiv there are 65 regional and city federations of non-Olympic sports. As our research has shown, the federation promotes sport through sports events, championships, cups; participation in national and international competitions in sports and public events that take place in the city, in the country; establishing contacts with different levels of government, educational institutions, businesses, institutions; Organization and holding of meetings with successful sportsmen, coaches, sports functionaries of the federation on the basis of educational institutions of all levels, enterprises, institu-

tions; Production and distribution of booklets, posters, banners, brochures, leaflets; placing news reports and interviews in the media, creating websites or pages on social networks and others.

In addition to sports federations in Kharkiv, popularization of non-Olympic sports makes Kharkiv regional organization of sports society "Dynamo" (the FSS "Dynamo"). The analysis of schedules of fitness and sports activities of FSO "Dynamo" during 2013–2016 years has shown that the city annually held championships "Dynamo" according to the program of complex competitions "Dinamiada", "Olympics" and "Olympics-Health" in non-Olympic and professional kinds of sport.

The results of the survey show that in the city of Kharkiv, according to the respondents, mostly develop various non-Olympic kinds of martial arts (84%), as well as such non-Olympic sports such as bodybuilding (66%), power lifting (58%), fitness (50%). This is ensured by the operation of private sports schools of martial arts, fitness-clubs, fitness centers, etc.

It was revealed that today in the city operates 145 fitness clubs, 37 CYSS of state, communal property forms, as well as sports and subordinate companies and agencies. The number of pupils there is 62789. CYSS of the city cultivate 14 non-Olympic sports.

In Kharkiv regional high school of physical training and sports, along with sport reserve, training of Olympic sports branch in chess is functioning.

Kharkiv is also known for the development of non-Olympic kinds of sports as rugby league. First of Rugby League team "Legion XIII" (rugby-13), was created precisely in Kharkiv in 2006.

The study showed that in the city extreme sports are also developing on the basis of Kharkiv flying club named after V. S. Grizodubova, climbing club "Format", and mountaineering club, rollerblading "Ya-roller", Kharkiv regional hang gliding club, "Pioneer" Karting Club, "Leader", "Metallist", "Duffy", skate park. However, as the results of our survey showed, only 16% of respondents noted that they happily spend their free time skipping with a parachute, or doing sports tourism, paintball, carting.

Active rest of residents and visitors of the city is provided by functioning s squash courts, a bowling club s, x Billiard clubs, paintball Cloud b on in. For example, a petanque club "Fair Play", Ukraine's only golf resort "Superior", sport-shooting club "AFAR-Ukraine". These are non-state actors that have a population of paid sports and health services, and realize boiling its activities through its own commercial and business activities.

An important element of our propaganda system is the regional mass media (mass media). In our study, there are defined 6 radio stations, 10 newspapers and magazines, 15 television channels as well as Internet resources, which provide information of non-Olympic sports. Identified organizational reserve, this is the creation of specialized regional media for non-Olympic sports (television or internet channels, telecast, website, magazine or newspaper), substantial part of which will be not only informative and advertising, but also cognitive, analytical. Another organizational reserve is the organization of trainings for workers of federations and other organizations of non-Olympic sports to create effective advertising and administer their own Internet sites.

During the study, the respondents' assessment of the organization of the propaganda of non-Olympic sports in Kharkiv was revealed. In particular, 50% of respondents rated the level of the organization as low and the remaining 50% as average. In our opinion, such assessment demonstrates the need to activate the organizational reserves, identified by us in the activities of state and public authorities, sports and sports organizations, regional media on the promotion of non-Olympic sports in the city of Kharkiv.

Conclusions / Discussion

The modern practice of functioning and development of non-Olympic sports necessitate conducting of integrated research in order to identify trends in the formation of new concepts and developing innovative technologies to ensure the organizational and management system of non-Olympic sport. We share the opinion of M. Dutchak & N. Dolbysheva [5] that among the prospective areas of research of problems of features of development of non-Olympic sports important place is occupied by analysis of local executive bodies and public organizations of physical culture and sports orientation.

In our study, propaganda of non-Olympic sports in the city of Kharkiv was first considered from the perspective of systematic approach. The system approach in the field of physical culture and sports, according to N. V. Zhmarev [7] represents a methodological scientific approach aimed at identifying the elements of the system and analyze the interrelationships between them. Using the systematic approach to the study of the organization of promotional activities for the development of non-Olympic sports, we believe it is appropriate, as the system is social, artificial and open.

Previously, foreign authors considered the planning and management of sports events [15; 18; 19] It has been suggested [4] that, among the main directions of activity of state and public governing bodies ensuring the development of non-Olympic sport, are the preparation and conduction of competitions of various levels. Our research supplements existing data of the functioning and characteristics of the activities of state and public authorities in the field of physical culture and sports in the aspect of organizing propaganda of the development of non-Olympic sports in the city of Kharkiv.

The obtained results of the research confirm city's normative and programmatic documents, in particular, that the government bodies of the city of Kharkiv develop the sphere of physical culture and sports as a priority, having a strategic direc-

Stadnik, S., Bondar, T., Orlenko, O. & Petrenko, I. (2019), "Peculiarities of organization of propaganda of non-Olympic sports in Kharkiv", *Slobozhanskyi Herald of Science and Sport*, Vol. 7 No. 3(71), pp. 45-49, doi: 10.5281/zenodo.3404479

tion. Our data supplement the results of the study, which are outlined in the work of Yu. N. Zhdamirova & I. V. Petrenko [6], concerning the activities of the Department of Family, Youth and Sports of the Kharkiv City Council as for the organization and holding of sports and mass image events.

Our research suggests that non-Olympic sports are fashionable and necessary for health promotion. This is the opinion of all 100% of respondents from Kharkiv and a number of researchers of the problems of development of non-Olympic sport in Ukraine [2; 8]. However, the results of the poll contradict the author's statement [1] that in the city of Kharkiv extreme popularity, especially among youth, is acquired by extreme non-Olympic sports. In particular, the majority of respondents (84%) did not organize their active recreation in the city using extreme sports.

An important role in the promotion of non-Olympic sports is played by the media. Previously A. A. Tomenko pointed out that in Ukraine there are no specialized printed publications on non-Olympic sports. Our data supplement already existing data [12; 16]. In particular, we analyzed Kharkiv regional mass media (radio stations, print media, television channels, Internet resources) regarding the presentation of information about non-Olympic kinds of sport.

The results of our survey, as well as works [3; 10], show that Internet resources, including social networks, are the most popular among regional media [17; 20]. It was found out that the sports portal "Sports Kharkiv" has a special value in covering the non-Olympic sports in the city in terms of the number of views per day. For a day, this site has 2,732 views, for the month 81,960, and for a year almost a million – 997,180 views.

In the regional normative and programmatic documents aimed at the development of the sphere of physical culture and sports, it is emphasized that all necessary conditions are created in the city to strengthen the health of the population. This position is only half confirmed by our studies in terms of the created conditions in the city for practicing non-Olympic sports. So 58% of respondents think, and the remaining 42% – adhere to the opposite point of view. According to 50% of respondents, it is necessary to strengthen the promotion of non-Olympic sports in the city. In our opinion, these respondents' answers give grounds to talk about improving the organization of the propaganda of non-Olympic sports in the city.

This study confirms the practical recommendations and suggestions of scientists engaged in studying the problems of development of non-Olympic sport [5; 8; 9; 11]. Our study also complements the above directions. For the first time, organizational reserves were identified in the existing system of propaganda of non-Olympic sports in the city of Kharkiv.

Thus, the organization of the promotion of non-Olympic sports in the city of Kharkiv has its own characteristics. Kharkiv is known for annual sports events of non-Olympic sports: festivals and extreme sports, martial arts, intellectual sports of the "Intelliada", etc. It is confirmed that the propaganda and development of the non-Olympic movement in the city is ensured by the functioning of local state government bodies, 65 regional and city federations of non-Olympic sports, FSO "Dynamo", 37 sports schools, 1 physical education college, 145 fitness clubs, teams of Rugby League "Legion XIII", flying club named after V. S. Grizdubova, 4 carting clubs, the only golf resort in Ukraine "Superior", etc. The results of our study indicate the need to improve the system of promoting non-Olympic sports in the city.

Based on the identified organizational reserves, we consider it expedient to propose directions for improving the system of promoting non-Olympic sports in the city of Kharkiv. Firstly, comprehensive coverage of various aspects of non-Olympic movement in regional media by creating specialized printed publications, television and radio programs, portals, Internet sites, etc. Secondly, the optimization of the management of non-Olympic sports by local government authorities through the development of the city's targeted integrated program for the promotion of non-Olympic sports in regional media. Thirdly, the development of the activities of federations and other organizations in non-Olympic sports was for attracting sponsors, popularizing non-Olympic sports by organizing and conducting trainings on creating effective advertising and administering their own Internet sites.

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.

References

1. Azhyppo, O. & Bondar, A. (2014), "Features of recreational and physical culture sports activities of children and youth in Ukraine", *Sportyvna medytsina,* No. 1, pp. 41-45. (in Ukr.)
2. Bondar, A.S. & Warywoda, O.O. (2016), "The role of non-Olympic sport in modern society", *Stratehichne upravlinnia rozvytkom fizychnoi kultury i sportu v konteksti 25-richchia nezalezhnosti Ukrainy: zbirnyk materialiv IV rehionalnoi naukovo-praktychnoi internet-konferentsii z mizhnarodnoiu uchastiu*, Kharkiv, pp. 188-193. (in Ukr.)
3. Bondar, A.S. & Mamaj, V.S. (2016), "Features of illumination of physical culture and sports in Internet resources", *Zbirnyk naukovykh prats Kharkivskoi derzhavnoi akademii fizychnoi kultury*, No. 3, pp. 75-78. (in Ukr.)
4. Dolbysheva, N.G. & Savarets, E.Yu. (2012), "The main activities of the governing bodies providing non-Olympic sports in Ukraine", *Slobozans`kij naukovo-sportivnij visnik*, No. 5, pp. 126-129. (in Russ.)
5. Dutchak, M.V. & Dolbysheva, N.G. (2012), "Perspective directions of scientific research of peculiarities of functioning and development of non-Olympic sport in Ukraine", *Sportyvnyi visnyk Prydniprovia*, No. 1, pp. 202-206. (in Ukr.)
6. Zhdamyrova, Y.M. & Petrenko, I.V. (2016), "Development of mass physical culture and sports in the city of Kharkiv", *Stratehichne upravlin-*

nia rozvytkom fizychnoi kultury i sportu v konteksti 25-richchia nezalezhnosti Ukrainy: zbirnyk materialiv IV rehionalnoi naukovo-praktychnoi internet-konferentsii z mizhnarodnoiu uchastiu, Kharkiv, pp. 117-121. (in Ukr.)
7. Zhmarev, N.V. (1984), *Systemnyi podkhod i tselevoe upravlenye v sporte* [System approach and target management in sport], Kiev. (in Russ.)
8. Imas, E.V., Matveev, S.F. & Borisova, O.V. (2015), *Neolimpiiskyi sport* [Non-Olympic sport], Kiev, 184 p. (in Ukr.)
9. Leonov, Ya.V. & Putyatina, G.M. (2014), "Strategic Prospects for the Development of the Neolympic Sport in Ukraine", *Slobozans`kij naukovo-sportivnij visnik*, No. 5(43), pp. 29-34. (in Ukr.)
10. Stadnyk, S.O. & Skrynnyk, M.A. (2017), "Regional mass media as a source of propaganda for non-Olympic sports", *Stratehichne upravlinnia rozvytkom fizychnoi kultury i sportu: zbirnyk naukovykh prats*, Kharkiv, pp. 166-171, available at: http://hdafk. Kharkiv.ua/ua/naukova-robota/dsrtet4 (in Ukr.)
11. Tikhonova, N.V. & Gradusov, V.A. (2014), "The state of development of sports, technical and applied sports in the sports and fitness organizations of Ukraine", *Pedahohika, psykholohiia ta medyko-biolohichni problemy fizychnoho vykhovannia i sportu,* No. 10, pp. 52-56.
12. Томенко, О.А. (2015), "Features of the coverage of the problems of the development of non-Olympic sports in the domestic mass media", *Stratehichne upravlinnia rozvytkom fizychnoi kultury i sportu: zbirnyk materialiv III rehionalnoi naukovo-praktychnoi konferentsii za uchastiu mizhnarodnykh spetsialistiv,* Kharkiv, pp. 157-162. (in Ukr.)
13. Afroozeh, M.S., Hamidi, M. & Elahi, A. (2012), "Identification of Vantage points of Universities' Sports Council Members Regarding Media Approach to Sports", *Journal of Research Communication*, No. 19(1), pp. 55-70.
14. Asadi, A. & Rezaee Soufi M. (2014), "Analysis of current situation and desirable role of mass media in development of volleyball sport field amongst students of sports sciences", *Communication Management in Sports Media*, No. 2(5), pp. 59-63.
15. Daniel Bjдrsholm (2017), "Sport and Social Entrepreneurship: a Review of a Concept in Progress", *Journal of Sport Management*, Vol. 31(2), pp. 191-206.
16. Emami, M. & Mallaei, M. (2013), "Analysis of Sports News Content: Case Study of Channel 3", *Communication Management in Sports Media*, No. 1(3), pp. 15-24.
17. Gashaw Abeza, Ann Peqoraro, Michael I. Naraine, Benoit Sequin & Norm O'Reilly (2014), "Activating a global sport sponsorship with social media: an analysis of TOP sponsors, Twitter, and the 2014 Olympic Games", *International Journal of Sport Management and Marketing*, Vol. 15, No. 3/4. pp. 184-213.
18. Ghaith Rabadi, Wael Khallouli, Mohammed Al-Salem & Ahmed Ghoniem (2015), "Planning and management of major sporting events: a survey", *Journal of Planning and Scheduling*, Vol. 2, No. 2, pp. 154-178.
19. Maenning, W. & Zimbalist, A. (2013), *International Handbook on the Economics of Mega sporting Events*, Edward Elgar.
20. Michelle O'Shea & Abel Duarte Alonso (2013), "Fan moderation of professional sports organisations' social media content: strategic brilliance or pending disaster?", *International Journal of Web Based Communities*, Vol. 9, No. 4, pp. 554-570.
21. Walid A. Nakara, Fatim-Zohra Benmoussa & Annabelle Jaouen (2012), "Entrepreneurship and social media marketing: evidence from French small business", *International Journal of Entrepreneurship and Small Business*, Vol. 16, No. 4, pp. 386-405.

Received: 23.04.2019.
Published: 30.06.2019.

Information about the Authors

Svitlana Stadnyk: *PhD (Physikal Education and Srort), Kharkiv State Academy of Physikal Cuiture: Klochkivska str. 99, Kharkiv, 61058, Ukraine.*
ORCID.ORG/0000-0001-6694-1098
E-mail: svetlanastadnik87@gmail.com

Taras Bondar: *PhD (Physikal Education and Srort), University of Customs and Finance: 49000, Dnipro, St. Volodymyr Vernadsky 2/4, Ukraine.*
ORCID.ORG/0000-0002-1389-6614
E-mail: tsbondar@gmail.com

Olena Orlenko: *PhD (History), Kharkiv State Academy of Physikal Cuiture: Klochkivska str. 99, Kharkiv, 61058, Ukraine.*
ORCID.ORG/0000-0003-4436-487X
E-mail: olena_orlenko@ukr.net

Iryna Petrenko: *PhD (Physical Education and Sport); Kharkiv State Academy of Physical Culture: Klochkivska str., 99, Kharkiv, 61058, Ukraine.*
ORCID.ORG/0000-0003-4252-1130
E-mail: ivpetrenko18@ukr.net

Stadnik, S., Bondar, T., Orlenko, O. & Petrenko, I. (2019), "Peculiarities of organization of propaganda of non-Olympic sports in Kharkiv", *Slobozhanskyi Herald of Science and Sport*, Vol. 7 No. 3(71), pp. 45-49, doi: 10.5281/zenodo.3404479

SLOBOZHANSKYI HERALD OF SCIENCE AND SPORT

UDK 796.92-796.92.093.642

ISSN (English ed. Online) 2311-6374
2019, Vol. 7 No. 3(71), pp. 50-55
DOI: 10.5281/zenodo.3371830

Formation of a specific biological cycle in young skiers-racers and biathletes 11–15 years, depending on the level and direction of physical activity

Aleksandra Utkina *Kharkiv State Academy of Physical Culture, Kharkiv, Ukraine*

The article presents the results of the analysis of the ratio of the training process according to the types of training and the performed cyclic physical activity and their influence on the formation of a specific biological cycle in female skiers-racers and biathletes 11–15 years old at the initial training stage and preliminary basic training.

Purpose: *to analyze the cyclic physical activity performed during the annual macrocycle in the period of the formation of a specific biological cycle of female skiers-racers and biathletes for 11, 12, 13, 14 and 15 years.*

Material & Methods: *analysis of literary sources and planning documents, self-control diaries; survey and questioning; methods of mathematical statistics. In total, 88 young athletes of different ages took part in the study. The respondents included: skiers-racers 11–15 years old, biathletes 11–15 years old, trainers.*

Results: *features of the formation of menstrual function in female skiers-racers and biathletes 11–15 years of age under the influence of a specific load were determined.*

Conclusions: *out of 42 female skiers-racers aged 11–15 years, 53% had no menstruation, 29% had menarche or 1–2 menstruation, 12% had irregular menstruations and 5% had regular menstruations, and also from 46 female athletes 55% have no menstruation, 23% have menarche or 1–2 menstruation, 19% have irregular menstruation, and only 3% have regular menstruation.*

Keywords: *skiers-racers and biathletes 11–15 years old, menstrual function, cyclic exercise, intensity zones.*

Introduction

The modern development of cross-country skiing and biathlon is characterized by an increase in speed-strength endurance while traveling a distance, which makes it necessary to search for reserves to improve competitive performance, especially for women. In addition, these ski sports are associated with significant physical and psycho-emotional loads that exceed the adaptive capacity of the body of young female athletes [3; 5].

At the same time, the planning of sports training in most cases is carried out without taking into account the peculiarities of the female body and the current readiness of the systems of the body of young athletes to perceive a particular physical activity [6; 8].

In the works of V. V. Mulyk, S. K. Fomin, V. I. Pivovarov [3; 4] it was proved that the use of specific physical loads without taking into account the features of a female organism negatively affects the functional state and sports result in skiing and biathlon.

According to scientists (Yu. T. Pokholenchuk, N. V. Svechnikova, L. Ya.-G. Shakhlin), the processes of the sexual development of the girl proceeds in the pre- and puberty periods, during which time sexual reproduction undergoes transformation in the organism, as a result which girl becomes a woman [2; 6].

Particular importance is given to the effect of specific loads on the development of all functions and systems of the growing organism, especially in skiing and biathlon. At the same time it is impossible without a scientific approach to organizing the training process of young athletes and without taking into account individual anatomical and physiological features in the future to achieve high sports results [3; 7]. This position is of particular importance in the training process of young athletes, since training loads, especially in cyclic sports, are very significant [5].

In connection with this, the study of the formation and progress of the ovarian-menstrual cycle (OMC) in young athletes specializing in skiing and biathlon will allow deeper consideration of this problem, and the results of the study should be recommended to trainers when constructing the training process.

Purpose of the study: to analyze the cyclic physical activity performed during the annual macrocycle in the period of the formation of a specific biological cycle of female skiers-racers and biathletes for 11, 12, 13, 14 and 15 years.

The implementation of this goal envisaged the following

tasks: to analyze the training loads during the one-year macrocycle of female skiers-racers and biathletes for 11–15 years to determine the effect of physical activity on the formation of a specific biological cycle of female skiers-racers and biathletes for 11–15 years.

Material and Methods of the research

An analysis of literary sources and planning documents, analysis of diaries, surveys, questionnaires; methods of mathematical statistics. The research was conducted during the summer training process. The volume and intensity of different training tools were analyzed, which were divided in size (small, medium, substantial, large) and direction (high-speed, anaerobic, aerobic) of young athletes of the Kharkiv Regional High School of Physical Culture, Children and Youth Sports School Kharkiv and Kharkiv region. In total, 88 young athletes of different ages participated in the research. The composition of respondents included: female skiers-racers 11–15 years old, biathletes 11–15 years old, coaches.

Results of the research

Preparing a young female athlete is a multifaceted process, and all of his parties are interconnected, the proportion of each of them changes at different stages of the training process. With the development of preparedness and improvement of sports results, the role of taking into account the biological characteristics of adolescence increases [7; 8].

A number of specialists [1; 3] in the field of gynecology and physiology believe that in adolescence, a link between the level of work capacity and endurance with the function of the ovaries is traced. The later, the girl appears menstruation, the more often there are high levels of fatigue at lower stresses.

The research was conducted during the summer training process, where the volume and intensity of various training tools was analyzed, the plans of training young athletes of 11–15 years with the chosen sport (skiing, biathlon).

The means of *general physical training* include: physical exercises in gymnastics, athletics, sports and outdoor games, cross-country running, cycling and other exercises in different quantities depending on age.

Special physical training consisted of exercises, according to the structure of efforts at the time of execution corresponded to movements that are inherent in skiing (work on simulators, imitation with ski poles alternately and at the same time, movement on a ski-roller with simultaneous steps and others).

Technical and tactical training involved the use of training tools that involve the use of elements of ski equipment in various competitive situations (overcoming ascents, descents, turns, braking both on skis and on roller skis). Participation in the competition was carried out in accordance with the calendar of competitions.

It was determined that physical, technical and tactical training and participation in competitions were distributed as follows: in female skiers-racers for 11 years, general physical training – 59%, special – 19%, technical and tactical – 18%, participation in competitions – 4%; in 12 years, general physical training – 45%, special – 34%, technical and tactical – 12%, participation in competitions – 9%; at the age of 13: general physical training – 40%, special – 41%, technical and tactical - 10%, participation in competitions – 9%; at the age of 14, general physical training – 31%, special – 48%, technical-tactical – 10%, participation in competitions – 11%; at 15 years old: general physical training – 22%, special – 54%, technical-tactical – 10%, participation in competitions – 14% (Figure 1).

Regarding ski racing, the training process in biathlon consists of ski (racing) and rifle training. Rifle training involves the use of pneumatic and then rifled firearms, therefore, at the initial stage, safety precautions are taken when shooting in the shooting range and at the shooting range; the shooting technique is mastered and improved at rest and during physical exertion from a prone position, with an emphasis on the firing technique from a prone position from a belt and from an air (or other lightweight) rifle; studied the material part of small-caliber rifles BI-6; BI-7.

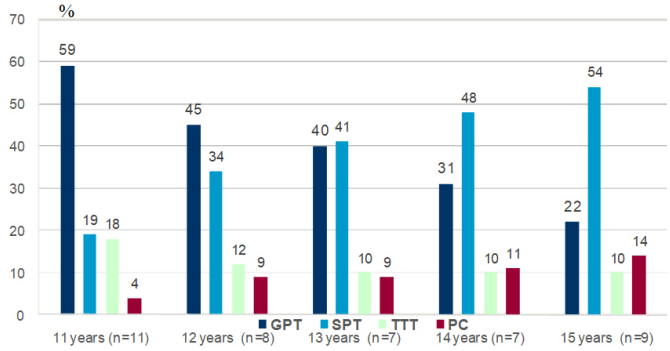

Fig. 1. Analysis of the ratio of the training process by type of training in female skiers-racers 11, 12, 13, 14 and 15 years (%): *GPT – general physical training; SPT – special physical training; TTT – technical and tactical training; PC – participation in competitions*

The analysis of general and special training, technical and tactical training, shooting and comprehensive training in young female biathletes 11–15 years, where the female biathletes 11 years determined the following ratio: total – 58%, special – 14%, technical and tactical – 10% rifle 11%, complex – 1%, participation in competitions 4% (Figure 2). In biathlon women of 12 and 13 years old, general physical training is 44% and 39%, special physical training – 20% and 24%, technical and tactical training – 12% and 10%, rifle training – 14% and 14%, complex training – 3 % and 4%, participation in competitions – 7% and 9% (Figure 2).

In female biathletes of 14 and 15 years, general physical training was 28% and 23%, special physical training – 28% and 32%, technical and tactical training 12% and 10%, rifle training 16% and 14%, comprehensive training 5% and 9 %, par-

Utkina, A. (2019), "Formation of a specific biological cycle in young skiers-racers and biathletes 11–15 years, depending on the level and direction of physical activity", *Slobozhanskyi Herald of Science and Sport*, Vol. 7 No. 3(71), pp. 50-55, doi: 10.5281/zenodo.3371830

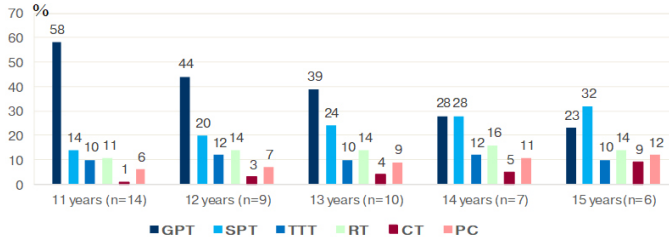

Fig. 2. Analysis of the ratio of the training process by type of training in female biathletes 11, 12, 13, 14 and 15 years (%): *GPT – general physical training; SPT – special physical training; TTT – technical and tactical training; RT – rifle training; CT – complex training; PC – participation in competitions*

ticipation in competitions 11% and 12% (Figure 2).

The analysis of the cyclic physical exercise performed in skiers-racers 11–15 years old is given in Table 1, and suggests that the indicators of the volume of cyclic exercise in 12-year-old skiers-racers relative to skiers-racers 11 years increased by 447,5 km (t=5,81; p<0,001); at the age of 13 relative to 12 years at 618,1 km (t=14,49; p<0,001); at the age of 14 relative to 13 years at 566,7 km (t=8,75; p<0,001); at the age of 15 relative to 14 years at 349,6 km (t=3,32; p<0,001) (Table 1).

The volume of cyclic physical activity from skiing and skiing training, running and imitation in female skiers-racers for 12 years is 297,7 km (t=6,03; p<0,001) more relative to the data of female skiers-racers for 11 years, in 13 years – by 252,7 km (t=4,25; p<0,01) relative to 12 years, 14 years 157,2 km (t=7,56; p<0,001) relative to 13 years; 15 years 157,2 km (t=2,22; p<0,05) relative to 14 years (Table 1).

The amount of ski-training preparation increased annually from 365,6 km to 484,8 km (t=2,48; p<0,05) at 12 years, from 484,8 km to 513,0 km (t=0,50; p<0,05) at 13 years old, from 513,0 km to 702,1 km (t=2,24; p<0,05) at 14 years, from 702,1 km to 903,6 km (t=2,59; p<0,05) at 15 years (Table 1).

Also, the volume of running and imitation statistically changed in skiers-racers of 12 years relative to indicators of skiers-racers of 11 years and in indicators of skiers-racers of 13 years relative to indicators of skiers-racers of 12 years (p<0,01–0,001).

Significant loads were performed with different intensity (Table 1). So, 11 years old female athletes 64,4% of the work was carried out at a heart rate (HR) of up to 140 beats·min^{-1}, 27,0% – at 140-160 beats·min^{-1}, 6,4% – at 160–180 beats·min^{-1}, 2,2% – 180 beats·min^{-1} and above; in 12 years: 45,2%, 33,4%, 17,3%, 2,2%, respectively; at 13 years: 38,9%, 31,2%, 21,2%, 8,7%, respectively; at 14 years: 34,7%, 26,2%, 24,8%, 14,3%, respectively; at 15 years: 38,5%, 20,4%, 26,2%, 14,9% respectively.

Table 1

Analysis of the cyclic physical load performed by female skiers-racers 11–15 years for a one-year macrocycle

Cyclic physical load	Skiing					Evaluation of statistical difference	
	11 years (n=11) $\bar{X}_1 \pm m_1$	12 years (n=8) $\bar{X}_2 \pm m_2$	13 years (n=7) $\bar{X}_3 \pm m_3$	14 years (n=7) $\bar{X}_4 \pm m_4$	15 years (n=9) $\bar{X}_5 \pm m_5$	t	p
Total amount of cyclic load, km	1868,1±65,88	2315,6±39,80	2933,7±15,31	3500,4±62,93	3850,0±84,32	$t_{1,2}$=5,81; $t_{2,3}$=14,49; $t_{3,4}$=8,75; $t_{4,5}$=3,32	$p_{1,2}$<0,001; $p_{2,3}$<0,001; $p_{3,4}$<0,001; $p_{4,5}$<0,01
Total amount of ski training, km	557,1±19,56	854,8±45,30	1107,5±38,50	1458,2±25,91	1615,4±65,82	$t_{1,2}$=6,03; $t_{2,3}$=4,25; $t_{3,4}$=7,56; $t_{4,5}$=2,22	$p_{1,2}$<0,001; $p_{2,3}$<0,001; $p_{3,4}$<0,01; $p_{4,5}$<0,05
Total amount of ski-roller training, km	365,6±41,38	484,8±24,64	513,0±51,21	702,1±67,33	903,6±38,90	$t_{1,2}$=2,48; $t_{2,3}$=0,50; $t_{3,4}$=2,24; $t_{4,5}$=2,59	$p_{1,2}$<0,05; $p_{2,}$>0,05; $p_{3,4}$<0,05; $p_{4,5}$<0,05
The total amount of running, imitation, km	826,2±43,80	1095,2±41,40	1313,2±37,60	1305,4±21,8	1331,0±31,70	$t_{1,2}$=4,46; $t_{2,3}$=3,90; $t_{3,4}$=0,18; $t_{4,5}$=0,67	$p_{1,2}$<0,001; $p_{2,3}$<0,01; $p_{3,4}$>0,05; $p_{4,5}$>0,05
Heart rate, beats min^{-1},%:							
up to 140	64,4±16,57	45,2±11,98	38,9±22,56	34,7±15,50	38,5±15,70	$t_{1,2}$=0,94; $t_{2,3}$=0,25; $t_{3,4}$=0,15; $t_{4,5}$=0,17	$p_{1,2}$>0,05; $p_{2,3}$>0,05; $p_{3,4}$>0,05; $p_{4,5}$>0,05
140-160	27,0±1,67	33,4±2,21	31,2±6,56	26,2±1,67	20,4±1,09	$t_{1,2}$=2,31; $t_{2,3}$=0,21; $t_{3,4}$=0,59; $t_{4,5}$=2,91	$p_{1,2}$<0,05; $p_{2,3}$>0,05; $p_{3,4}$>0,05; $p_{4,5}$<0,05
160-180	6,4±3,56	17,3±2,67	21,2±1,56	24,8±0,35	26,2±1,67	$t_{1,2}$=2,45; $t_{2,3}$=1,26; $t_{3,4}$=2,25; $t_{4,5}$=0,82	$p_{1,2}$<0,05; $p_{2,3}$>0,05; $p_{3,4}$<0,05; $p_{4,5}$>0,05
180 and above	2,2±0,23	4,1±0,48	8,7±2,34	14,3±0,76	14,9±0,45	$t_{1,2}$=3,57; $t_{2,3}$=1,93; $t_{3,4}$=2,28; $t_{4,5}$=0,68	$p_{1,2}$<0,01; $p_{2,3}$>0,05; $p_{3,4}$<0,05; $p_{4,5}$>0,05
Amount of load of various intensity, km:							
up to 140	1203,5±14,56	1046,9±41,80	1141,2±23,80	1182,2±25,41	1534,1±19,58	$t_{1,2}$=3,54; $t_{2,3}$=1,96; $t_{3,4}$=1,18; $t_{4,5}$=10,97	$p_{1,2}$<0,01; $p_{2,3}$>0,05; $p_{3,4}$>0,05; $p_{4,5}$<0,001
140–160	504,1±36,33	773,5±27,46	915,3±27,52	994,7±21,71	810,1±14,98	$t_{1,2}$=5,92; $t_{2,3}$=3,65; $t_{3,4}$=2,27; $t_{4,5}$=7,00	$p_{1,2}$<0,001; $p_{2,3}$<0,001; $p_{3,4}$<0,05; $p_{4,5}$<0,001
160–180	119,4±33,71	400,6±16,70	622,0±27,32	842,4±28,36	965,5±20,71	$t_{1,2}$=16,75; $t_{2,3}$=6,91; $t_{3,4}$=5,60; $t_{4,5}$=3,51	$p_{1,2}$<0,001; $p_{2,3}$<0,001; $p_{3,4}$<0,001; $p_{4,5}$<0,01
180 and above	41,1±1,67	94,6±12,58	255,2±27,52	481,1±11,60	540,3±21,56	$t_{1,2}$=4,22; $t_{2,3}$=7,56; $t_{3,4}$=10,07; $t_{4,5}$=2,42	$p_{1,2}$<0,001; $p_{2,3}$<0,05; $p_{3,4}$<0,001; $p_{4,5}$<0,05

The data of the performed volume of cyclic physical load in kilometers by intensity zones (Table 1) were also analyzed, where the statistical difference was obtained in the pulse zone up to 140 beats min^{-1} between races of female skiers 11 and 12 years old (t=3,54; p<0,01), 14 and 15 years old (t=10,97; p<0,001); in the pulse zone – 140-160 beats min^{-1} between 11 and 12 years old female skier races (t=5,92; p<0,01),

12 and 13 years (t=3,65; p<0,01), 13 and 14 years (t=2,27; p<0,05), 14 and 15 years (t=7,00; p<0,001) in the pulse zone 160-180 beats min^{-1} between indicators of female skiers 11 and 12 years old (t=16,75; p<0,001), 12 and 13 years old (t=6,91; p<0,001), 13 and 14 years old (t=5,60; p<0,001), 14 and 15 years (t=3,51; p<0,01); in the pulse zone 160-180 beats min^{-1} between the indicators of female skiers 11 and 12 years old (t=4,22; p<0,01), 12 and 13 years old (t=7,56; p<0,001), 13 and 14 years old (t=10,07; p<0,001), 14 and 15 years (t=2,42; p<0,01) (Table 1).

Table 2 presents the data of cyclic physical activity and physical preparedness of female biathletes 11–15 years old, where, when analyzing self-control diaries during the one-year macrocycle, the highest statistical difference was determined in terms of the total cyclic load in the age range of female biathletes 12–13 years old (t=6,92; p<0,001), 13–14 years (t=5,19; p<0,001), 14–15 years (t=4,47; p<0,01), and 11–12 years (t=2,84; p<0,05) (Table 2).

The highest difference was obtained due to a change in the volume of ski and ski-roller training in biathletes in the age range of 13–14 years (t=5,99; t=5,35; p<0,001), while in terms of cross-country running and no imitation changes were detected (p>0,05) (Table 2).

The functioning of the cardiovascular system of female biathletes of 11, 12, 13, 14 and 15 years in various intensity zones during the growth period is very important because it reflects the work of the cardiovascular system of the athletes.

The load in the first zone (up to 140 beats min^{-1}) at 11, 12, 13, 14, 15 years was: 65,3%, 43,3%, 28,9%, 36,3%, 32,2%, respectively; in the second (140-160 beats min^{-1}) – 25,6%, 31,8%, 36,2%, 25,8%, 28,5%; in the third (160–180 beats min^{-1}) 7,4%, 18,7%, 23,2%, 20,1%, 23,7%; in the fourth (180 beats min^{-1} and above) 1,7%, 6,2%, 11,7%, 17,8%, 15,6%, respectively (Table 2).

In biathletes 11–15 years old, the intensity of the cyclic load of the indicated age groups in all pulse zones was significantly higher than the next age (p<0,05–0,001), but in the third zone (160–180 beats min^{-1}) at the age of 13 14 and 14–15 years of statistical difference is not defined (p>0,05) (Table 2).

In the age period of 11–15 years, the formation of a specific biological cycle of girls takes place. Our survey and interviews of young skiers-racers 11–15 years of age on the formation of a specific biological cycle as a result of physical activity used determined that regular periods of 2 athletes are 14 and 15

Table 2

Analysis of the cyclic physical load performed by female biathletes 11–15 years for a one-year macrocycle

Cyclic physical load	Skiing					Evaluation of statistical difference	
	11 years (n=14)	12 years (n=9)	13 years (n=10)	14 years (n=7)	15 years (n=6)		
	$\bar{X}_1 \pm m_1$	$\bar{X}_2 \pm m_2$	$\bar{X}_3 \pm m_3$	$\bar{X}_4 \pm m_4$	$\bar{X}_5 \pm m_5$	t	p
Total amount of cyclic load, km	2352,4±87,21	2652,6±59,70	3105,2±26,78	3650,5±101,52	4211,3±73,53	$t_{1,2}$=2,84; $t_{2,3}$=6,92; $t_{3,4}$=5,19; $t_{4,5}$=4,47	$p_{1,2}$<0,05; $p_{2,3}$<0,001; $p_{3,4}$<0,001; $p_{4,5}$<0,001
Total amount of ski training, km	673,7±34,50	850,5±46,78	1006,5±45,30	1383,5±43,62	1450,2±61,45	$t_{1,2}$=3,04; $t_{2,3}$=2,40; $t_{3,4}$=5,99; $t_{4,5}$=0,89	$p_{1,2}$<0,01; $p_{2,3}$<0,001; $p_{3,4}$<0,001$p_{4,5}$>0,05
Total amount of ski-roller training, km	150,7±27,48	303,4±32,71	500,4±41,32	802,6±38,53	1204,0±78,88	$t_{1,2}$=3,57; $t_{2,3}$=3,74; $t_{3,4}$=5,35; $t_{4,5}$=4,57	$p_{1,2}$<0,01; $p_{2,3}$<0,01; $p_{3,4}$<0,001; $p_{4,5}$<0,001
The total amount of running, imitation, km	1528,0±51,6	1498,7±34,78	1598,3±82,20	1464,4±80,87	1557,1±94,31	$t_{1,2}$=0,47; $t_{2,3}$=1,12; $t_{3,4}$=0,20; $t_{4,5}$=0,20	$p_{1,2}$>0,05; $p_{2,3}$>0,05; $p_{3,4}$>0,05; $p_{4,5}$>0,05
Heart rate, beats min^{-1},%:							
up to 140	65,3±6,38	43,3±3,67	28,9±4,79	36,3±7,47	32,2±7,61	$t_{1,2}$=2,99; $t_{2,3}$=2,39; $t_{3,4}$=0,83; $t_{4,5}$=0,38	$p_{1,2}$<0,05; $p_{2,3}$<0,05; $p_{3,4}$>0,05; $p_{4,5}$>0,05
140–160	25,6±1,38	31,8±3,37	36,2±1,15	25,8±0,58	28,5±1,13	$t_{1,2}$=2,48; $t_{2,3}$=1,84; $t_{3,4}$=8,07; $t_{4,5}$=1,67	$p_{1,2}$<0,05; $p_{2,3}$>0,05 $p_{3,4}$<0,001; $p_{4,5}$>0,05
160–180	7,4±0,48	18,7±1,14	23,2±0,37	20,1±0,61	23,7±0,92	$t_{1,2}$=9,14; $t_{2,3}$=3,75; $t_{3,4}$=4,35; $t_{4,5}$=3,26	$p_{1,2}$<0,001; $p_{2,3}$<0,01; $p_{3,4}$<0,01; $p_{4,5}$<0,01
180 and above	1,7±0,04	6,2±0,31	11,7±0,37	17,8±0,12	15,6±0,26	$t_{1,2}$=14,40; $t_{2,3}$=11,39; $t_{3,4}$=15,68; $t_{4,5}$=7,68	$p_{1,2}$<0,001; $p_{2,3}$<0,01; $p_{3,4}$<0,001; $p_{4,5}$<0,001
Amount of load of various intensity, km:							
up to 140	1536,1±34,61	1140,5±28,67	897,5±51,34	1319,2±41,22	1603,6±47,38	$t_{1,2}$=8,80; $t_{2,3}$=4,13; $t_{3,4}$=6,40; $t_{4,5}$=4,53	$p_{1,2}$<0,001; $p_{2,3}$<0,01; $p_{3,4}$<0,001; $p_{4,5}$<0,001
140–160	602,8±77,56	852,5±28,61	1128,3±52,75	946,7±38,18	1203,2±72,28	$t_{1,2}$=3,02; $t_{2,3}$=4,60; $t_{3,4}$=2,79; $t_{4,5}$=3,14	$p_{1,2}$<0,01; $p_{2,3}$<0,01; $p_{3,4}$<0,05; $p_{4,5}$<0,01
160–180	175,6±33,56	499,9±38,71	715,2±61,28	738,5±44,51	729,3±28,92	$t_{1,2}$=6,33; $t_{2,3}$=2,97; $t_{3,4}$=0,31; $t_{4,5}$=0,17	$p_{1,2}$<0,01; $p_{2,3}$<0,01; $p_{3,4}$>0,05; $p_{4,5}$>0,05
180 and above	37,9±11,47	159,7±19,34	364,2±21,51	645,5±6,78	675,2±8,91	$t_{1,2}$=5,42; $t_{2,3}$=7,07; $t_{3,4}$=12,47; $t_{4,5}$=2,65	$p_{1,2}$<0,001; $p_{2,3}$<0,001; $p_{3,4}$<0,01; $p_{4,5}$<0,05

Utkina, A. (2019), "Formation of a specific biological cycle in young skiers-racers and biathletes 11–15 years, depending on the level and direction of physical activity", *Slobozhanskyi Herald of Science and Sport*, Vol. 7 No. 3(71), pp. 50-55, doi: 10.5281/zenodo.3371830

years old, irregular periods of 5 athletes 13, 14 and 15 years and 1–2 menstruation (menarche) in 12 athletes of all age groups (Figure 1).

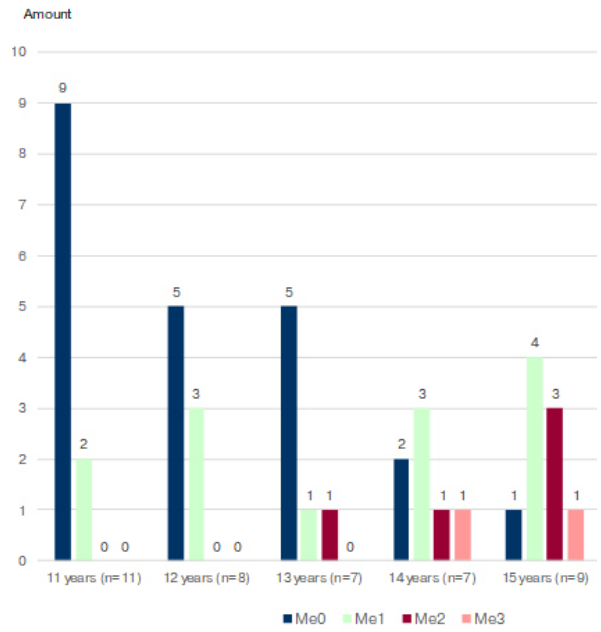

Fig. 1. Analysis of the formation of a specific biological cycle in female skiers-racers 1115 years

The data obtained from female biathletes showed that regular menstruation in 1 athlete 15 years (of 6 female athletes) irregular menstruation in the first 13 years (of 10 female athletes), in 3 14 years (of 7 female athletes) and in 4 15 years 1–2 menstruation and menarche onset in 3 11 years (of 14 female athletes), in 3 12 years (of 9 female athletes), in 2 13 years, in 2 14 years and in the first 15 years the absence of a specific cycle in the 11th 11 years (of 14 female athletes), in the 6th – 12 years, in the 7th 13 years, in the 1st 14 years (Figure 2).

Conclusions / Discussion

More and younger athletes appear on the international arena that successfully compete with recognized masters, but a large percentage of young skiers and biathletes who were promising at a young age do not achieve high athletic results, one of the reasons is high loads, including the period of formation of a specific biological cycle. The above mentioned study of the characteristics of the onset and formation of a specific biological cycle and the expediency of using various physical exercises in size and direction with the use of separate means of ski-racing training.

It is established that the development of motor skills, as well as the increase in athletic performance in adolescents depends

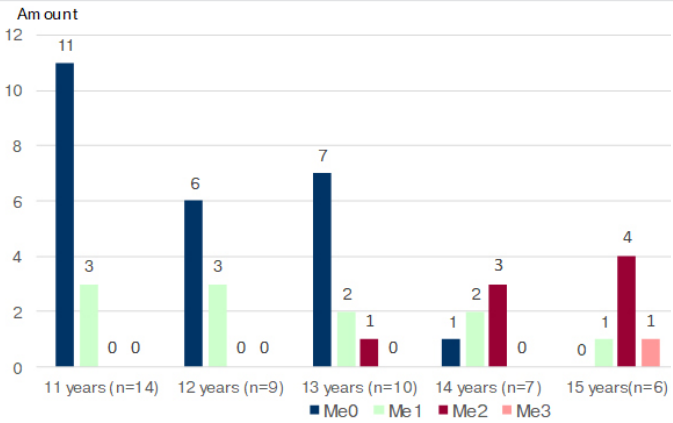

Fig. 2. Analysis of the formation of a specific biological cycle in female biathletes 11–15 years

on the individual rate of sexual development. From this it follows that the level of activity of the sex glands affects the indices of motor qualities, the level of motor activity and should have a certain influence on the function of the ovaries and the female reproductive system as a whole, especially during the period of formation of the CMC [1; 2].

In connection with this, for the direct effect of the training load on the body of a young athlete, it is necessary to use such means and methods of their use that activate muscle activity, stimulate in these muscles and other components of the functional system of deployment of mechanisms of adaptation, similar to those occurring during the competition [3; 4].

It was determined that in the period of formation of a specific biological cycle in skiers-racers and biathletes, that is, at the age of 11–15 years, the volume of ski and ski-roller training, running, imitation statistically increases from year to year ($p<0,05–0,001$). Under the influence of physical activity, the period of formation and occurrence of a specific biological cycle of young athletes 11–15 years old according to the survey and questioning took place in different ways. Thus, out of 42 female skiers-racers aged 11–15 years, 53% determined the absence of menstruation, 29% menarche or 1–2 menstruation, 12% irregular menstruation and 5% regular menstruation and from 46 biathlon women 55 % have no menstruation, 23% have menarche or 1–2 menstruation, 19% have irregular menstruation and only 3% have regular menstruation.

Thus, the formation and functioning of a specific biological cycle is significantly influenced by training loads, which requires their consideration.

Prospects for further research will be focused on the development of training programs for young female athletes 11–13 years old specializing in skiing and biathlon.

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.

References

1. Mazurin, A.V. & Voroncov I.M. (2001), *Propevdika detskix boleznej* [Propedeutics of childhood diseases], SPb. (in Russ.)
2. Shahlina, L. (2001), *Mediko-biologicheskie osnovy sportivnoj trenirovki zhenshhin* [Medical and biological bases of women's sports training], NUPCSU, Kiev. (in Russ.)
3 Mulik, V.V. (2001), *Sistema mnogoletnego sportivnogo sovershenstvovaniya v uslozhnennykh usloviyakh sopryazheniya osnovnykh storon podgotovlennosti sportsmenov (na materiale lyzhnogo sporta): avtoref. d-ra nauk po fiz. vosp. i sportu* [The system of long-term sports perfection in difficult conditions conjugation main parties of athletes (on the skiing material): DS thesis], Kharkiv, 40 p. (in Russ.)
4. Pivovarova, V.I., Radzieskij, A.R. & Fomin, S.K. (1984), "Problemy sportivnoj podgotovki zhenshhin s uchetom osobennostej adaptacii ix organizma k bolshim fizicheskim nagruzkam", *Teoriya i praktika fizicheskoj kultury*, No. 7, pp. 35-38. (in Russ.)
5. Platonov, V.N. (1995), *Zakonomernosti i principy sistemy sportivnoj podgotovki* [Patterns and principles of the sports training system], Moscow. (in Russ.)
6. Poholenchuk, Y.T. (1993), *Optimizaciya trenirovochnogo processa sportsmenok s celyu povysheniya sportivnogo masterstva i soxraneniya zdorovya* [Optimization of training process of sportswomen with thepurpose of increase of sporting mastery and maintenance ofhealth: DS dis.], USUPCS, Kiev, 367 p. (in Russ.)
7. Prudnikova, M.S. (2008), "Issledovanie fizicheskogo razvitiya yunyx velosipedistok 12-15 let v period stanovleniya reproduktivnoj funkcii", *Pedagogika, psixologiya ta mediko-biologichni problemi fizichnogo vixovannya i sportu*, No. 3. pp. 117-120. (in Russ.)
8. Shahlina, L. (1995), *Mediko-biologicheskie osnovy upravleniya processom sportivnoj trenirovki zhenshhin: dis. d-ra med. nauk 14.03.25* [Physician biological government bases by the process of the sporting training of women: DS diss.], Kiev, USUPCS, 359 p. (in Russ.)

Received: 17.05.2019.
Published: 30.06.2019.

Information about the Authors

Aleksandra Utkina: *teacher, Kharkiv State Academy of Physical Culture: 99 Klochkivska Str., Kharkiv, 61058, Ukraine.*
ORCID.ORG/0000-0001-9343-4120
E-mail: oleksandra.khokhlova@gmail.com

Utkina, A. (2019), "Formation of a specific biological cycle in young skiers-racers and biathletes 11–15 years, depending on the level and direction of physical activity", *Slobozhanskyi Herald of Science and Sport*, Vol. 7 No. 3(71), pp. 50-55, doi: 10.5281/zenodo.3371830

SLOBOZHANSKYI HERALD OF SCIENCE AND SPORT

UDK 796.81-043.61

ISSN (English ed. Online) 2311-6374
2019, Vol. 7 No. 3(71), pp. 56-61
DOI: 10.5281/zenodo.3371843

Relationship of special and functional preparedness of freestyle wrestlers at different stages of sports training

Leonid Volkov
Stepan Zakharkiv

Pereyaslav-Khmelnytsky State Pedagogical University Gregory Skovoroda, Pereyaslav-Khmelnitsky, Kyiv region, Ukraine

The presented experimental data indicate that at all stages of the long-term training of freestyle wrestlers between the ages of 11–12 years old and 17–18 years old there are reliable relationships between the indicators of special and functional readiness. The greatest numbers of reliable relationships have tests on special preparedness – "rushing on the wrestler's bridge in 1 minute", "coups on the wrestler's bridge in 1 minute". The conducted studies confirm the reliably high interconnection of the components of special and functional preparedness when training adolescents and young men in wrestling. Separate components of these types of training change the information content depending on the stages of preparation, require changes in the total and selective amounts of training loads.

Purpose: *explore the relationship of the main components of the special and functional preparedness of adolescents and young men engaged in freestyle wrestling at different stages of many years of sports training.*

Material & Methods: *the study is organized on the basis of the Olympic College of Ivan Poddubny with the participation of 90 athletes aged 11 to 18 years. In the course of the experiment, the following methods were used: theoretical analysis, synthesis of practical experience, pedagogical testing, pulsometry, reflexometry, heat measurement, mathematical statistics, correlation analysis.*

Results: *the interrelation of special and functional preparedness of freestyle wrestlers from 11 to 18 years old, studying at different stages of sports training, is established.*

Conclusions: *the study of the problem of the relationship of special and functional preparedness of freestyle wrestlers requires the development of an integrated methodology using the idea of a systems approach. At all stages of athletic training for teenagers and young men aged 11–12 years old to 17–18 years old engaged in freestyle wrestling, there are reliable relationships between the components of special and functional preparedness. According to the informativeness of these indicators vary from the stage of preparation; it requires changes in the volume of training loads of selective and general orientation.*

Keywords: *wrestling, interrelation of types of training, informativeness of components of preparedness, informativeness of components of functional preparedness, complex research methodology.*

Introduction

The functionality of an athlete, in the modern sense, [12; 16; 17] are considered as integral characteristics of the functions of human qualities, which directly or indirectly determine the effectiveness of competitive activity and constitute the content of the functional (auxiliary) training. Determining the role and influence of means and methods of functional training [12], the ratio of components of functional training in conjunction with the special at different stages form the basis for the development of multi-year planning of training loads of both general and selective orientation, this applies to all sports, including freestyle wrestling.

To achieve positive results, competitive activity requires the participation of all body systems from an athlete. But depending on sports, when performing competitive exercises, there are systems that play a major role and supporting auxiliary.

According to scientists [9; 12; 14; 16], the most frequently functional state is determined by the central nervous system, which accompanies any activity, including sports. Such conclusions in sporting martial arts are confirmed by the studies of V. Volkov [12], V. Klychko [10], V. Yagel [17]. The studies performed are important for sports practice, but, as far as freestyle wrestlers are concerned, they are episodic and do not carry information about all stages of many years of sports training.

The analysis [4; 7; 12; 17] shows that a significant role in the training and competitive activities of athletes, including freestyle wrestlers, has a functional state of the cardiovascular system, the level of which largely determines the health, performance and adaptive abilities of athletes to physical stress.

The lack of necessary information about the relationship of special preparedness and functionality of the cardiovascu-

lar system of freestyle wrestlers requires research, have both theoretical and practical importance not only for wrestling, but also for other sports.

Purpose of the study: explore the relationship of the main components of the special and functional preparedness of adolescents and young men engaged in freestyle wrestling at different stages of many years of sports training.

Material and Methods of the research

The studies were organized on the basis of the Olympic College of Ivan Poddubny with the participation of 90 athletes aged from 11 to 18 years.

All athletes for college went through a preliminary stage of preparation and completed the youth category in freestyle wrestling.

During the experiment, the following methods were used [8; 13; 15]: theoretical analysis, generalization of practical experience, pedagogical testing, pulsometry, reflexometry, heat measurement, mathematical statistics.

In studies in determining the functional capabilities of the nervous system, the device "ДПФІ-1М" was used, and the cardiovascular system – the Harvard step test and special wrestling tests.

Analytical and graphical methods were used to analyze the correlation matrices, which allowed to determine reliable relationships between the components of the special and functional preparedness of freestyle wrestlers who study at different stages of sports training.

Results of the research

1. The relationship of indicators of special preparedness and reflexometry (LTMR). In previous studies [7], it was determined that the most informative indicator of the functioning of the nervous system of freestyle wrestlers (great weakness) is the dynamics of the latent time of the motor reaction (LTMR) to sound.

According to research data [3; 8; 10, 11; 17], "strength" and, accordingly, "weakness", as the second pole of this property, manifests itself in the degree of endurance of the nervous system for long-term actions and strong short-term stimulus.

The determination of these indices of the nervous system in freestyle wrestlers was carried out using the device "ДПФІ-1М", in the program of which 10 measurements of the LTMR indices in dynamics with different intervals were laid. The results of the experiment and became the subject of the analysis (Table 1, Figure 1).

Initial training, 11–12 years. The analysis of the correlation matrix of the LTMR functional indicators for the sound of freestyle wrestlers at the initial sports training stage was reliably interconnected (r=0,62) with the 7th LTMR indicator and the component of special preparedness, measured by the "rushing on the wrestler's bridge in 1 minute" test. It should be noted that all the values characterizing the level of special preparedness of wrestlers at this stage are reliably related to each other at the level of r=0,50–0,98. At such a high and reliable correlation level (r=0,50–0,90), indicators characterizing the functional capabilities of the cardiovascular system are interrelated.

So, the analysis of the correlation matrix allows, first of all, to note the high correlation interrelation of all ten LTMR dynamics indicators, as well as the indicators characterizing the recovery after the wrestling tests.

From the 10 indicators of LTMR, the 2nd, 4th and 7th dimensions have the greatest information content (the number of reliable relationships) (Table 1, Figure 1).

Preliminary basic training, 13–14 years. Biological processes that are characteristic of adolescents 13–14 years of age largely affect not only the activity of the development of individual body systems, but also the indicators of the formation of physical [4; 10; 17], including the functional capabilities of the growing organism.

This process requires considerable energy [3; 7; 15], which is reflected in the indicators of the interrelationships of the functional and special preparedness of the young wrestlers. So, if in the previous, initial stage, we observe a significant amount of reliable interrelationships of LTMR indicators and their significant informativeness, then at the next stage of basic training of free-style wrestlers (Table 1) these interrelations disappear. This year, the 2nd, 4th, 6th, and $\bar{X}r$ measurements have a significant impact on interrelations with other indicators.

As in the previous stage of preparation, reliable relationships are characteristic of indicators characterizing recovery processes (HR, beats min^{-1}) both after the wrestling test and the Harvard step test.

So, for this stage of training of young wrestlers, it is characteristic of the fact that the relationship between the LTMR indicators and the components of special preparedness is significantly reduced; a decrease is also observed between the 10th dimensions of the LTMR.

Specialized basic training, 15–16 years. At all stages of sports training, we observe significant changes in the interrelations of all types of free-style wrestling training.

If at the previous stage of preparation (13–14 years), reliable interrelations between all components of special and functional readiness decreased, then at the stage of specialized basic training these interrelations spread.

Thus, the $\bar{X}r$ LCHRR indicators (Table 1) become the most informative, reliably associated with other dimensions of LTMR for sound, and the 4th, 6th and 3rd dimensions of LTMR have

Volkov, L. & Zakharkiv, S. (2019), "Relationship of special and functional preparedness of freestyle wrestlers at different stages of sports training", *Slobozhanskyi Herald of Science and Sport*, Vol. 7 No. 3(71), pp. 56-61, doi: 10.5281/zenodo.3371843

the greatest informativeness.

It should be noted the reliable relationship between the indicators of special preparedness and recovery indicators (HR, beats min^{-1}) after performing a special wrestling test "throws for 1 min".

It should be noted the reliable relationship between the indicators of special preparedness and recovery indicators (HR, beats min^{-1}) after performing a special wrestling test "throws for 1 min".

In-depth specialized training, 17–18 years old. Freestyle wrestlers who undergo a training process at the stage of in-depth specialized training (Table 1) – these are athletes of high qualification, masters of sports, reflected on the results of correlation analysis and informativeness of all components of preparedness.

LTMR indicators are interrelated with components of special preparedness - wrestling tests, and with indicators that indicate the dynamics of the recovery of the body after performing a special wrestling test "coups on the wrestler's bridge in 1 minute". This test, for its part, is interconnected with another wrestling test "rushing on the wrestler's bridge in 1 minute" (r=0,89).

Regarding the dynamics indicators of LTMR, most of them are interconnected at the level of r=0,60–0,90, and the highest number of reliable relationships and a high level of information content are the 1st, 4th, 6th and $\overline{X}r$ indicators.

The research results are confirmed (Figure 1) with a special analysis of the age characteristics of interrelations at the level of r=0,60 LTMR indicators and components of the special preparedness of wrestlers at various stages of many years of sports training.

Table 1

Summary table of interrelations and informatively of reflexometry indicators (LTMR for sound) and special preparedness of freestyle wrestlers at various stages of preparation

№ i/o	Indicators	Initial, 11-12 years			Preliminary basic, 13-14 years		
		Inform. Xr	Place selective	Commo n place	Inform. Xr	Place selective	Commo n place
1	1 Dimension	44	VII	VII	15	VII	XI
2	2 Dimension	58	I	I	24	III	VI
3	3 Dimension	53	V	V	23	IV	VII
4	4 Dimension	57	II	II	24	III	VI
5	5 Dimension	51	VI	VI	22	V	VIII
6	6 Dimension	56	III	III	24	III	VI
7	7 Dimension	58	I	I	27	II	IV
8	8 Dimension	54	IV	IV	15	VII	XI
9	9 Dimension	57	II	II	16	VI	X
10	10 Dimension	53	V	V	15	VII	XI
11	Xr	58	I	I	32	I	II
12	Rushing on the wrestler's b	35	I	VIII	25	IV	V
13	Coups on the wrestler's brid	20	VII	XIII	22	VI	VIII
14	HR, beats in 1 minute	26	IV	XI	30	II	III
15	Throws for 1 minute	27	III	X	23	V	VII
16	Recovery after throws HR beats min	32	II	IX	18	VII	IX
17	1 Recovery HR beats/min	25	V	XII	34	I	I
18	2 Recovery HR beats/min	16	VIII	XIV	27	III	IV
19	3 Recovery HR beats/min	24	VI	XII	30	II	III

№ i/o	Indicators	Specialized basic, 15-16 years			In-depth specialized, 17-18 years		
		Inform. Xr	Place selective	Commo n place	Inform. Xr	Place selective	Commo n place
1	1 Dimension	30	VIII	IX	43	IV	IV
2	2 Dimension	43	IV	IV	43	IV	IV
3	3 Dimension	43	IV	IV	19	IX	XII
4	4 Dimension	48	II	II	46	II	II
5	5 Dimension	42	V	V	32	VIII	IX
6	6 Dimension	47	III	III	49	I	I
7	7 Dimension	40	VI	VI	43	IV	IV
8	8 Dimension	26	IX	XI	41	VI	VI
9	9 Dimension	22	X	XII	35	VII	VIII
10	10 Dimension	38	VII	VII	42	V	V
11	Xr	51	I	I	45	III	III
12	Rushing on the wrestler's b	29	V	X	39	I	VII
13	Coups on the wrestler's brid	32	III	VIII	30	III	X
14	HR, beats in 1 minute	10	VII	XV	24	IV	XI
15	Throws for 1 minute	12	VII	XIV	13	VII	XIV
16	Recovery after throws HR beats min	40	I	VI	18	VI	XIII
17	1 Recovery HR beats/min	38	II	VII	35	II	VIII
18	2 Recovery HR beats/min	30	IV	IX	19	V	XII
19	3 Recovery HR beats/min	19	VI	XII	18	VI	XIII

2. Interrelation of indices of special preparedness and tapping metrics (maximum rate of movements). Indicators of the maximum rate of movement, according to many researchers [8; 9; 15] and sports practice [3; 7; 10; 11], allow us to obtain data on the strength of the nervous system. This test, according to Professor E. P. Ilyin [8], allows us to determine the endurance of the nervous system, and in connection with this mandatory condition for the execution of this test is the maximum rate.

The results of the analysis of the correlation matrices indicate that at the initial preparation stage, the 2nd and 5th indicators of tapping metrics are in a reliable relationship with the special wrestling test "throws for 1 min" (r=0,55, r=0,59).

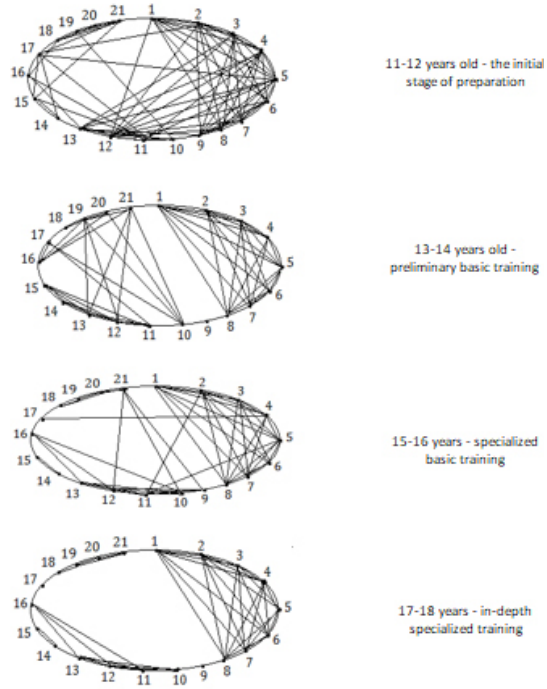

Fig. 1. Age features of interrelations (r>0,6) of functional indicators of LTMR and special preparedness of wrestlers at various stages of preparation:
1–10 – measurements; 11 – $\overline{X}r$ LTMR; 12 – "rushing on the wrestler's bridge in 1 minute"; 13 – "coups on the wrestler's bridge in 1 minute"; 14 – HR, beats· min^{-1}; 15 – the number of throws; 16 – recovery after throws; 17–19 – recovery.

This test also has a high degree of informational content with another wrestling test – "rushing on the wrestler's bridge in 1 minute" (r=0,52) and "coups on the wrestler's bridge in 1 minute" (r=0,88). Consequently, this fact confirms the interrelation of the indicators of tapping metrics with the indicators of the special preparedness of freestyle wrestlers of 11–12 years.

The determination of the informativeness of the indicators of tapping metrics, according to the results of the analysis of the correlation matrix (Table 2), makes it necessary to recognize the 5th dimension (21–25 s) as the most significant in the study. This conclusion is also confirmed by further studies, which determined the age characteristics of interrelations (r>0,6) and indicators of the functional and special preparedness of wrestlers at various stages of preparation (Figure 2).

At the stage of preliminary basic training (13–14 years), the young wrestlers, like all adolescents, begin puberty, affecting the whole growing organism.

The changes are reflected in the results of the correlation analysis of the indicators of tapping metrics and the special preparedness of young wrestlers. There are no significant changes in the relationship, as in the previous age, all the indicators of heating metrics at the level of r=0,70–0,90.

Of the indicators of special preparedness, the highest correlations among themselves are "coups and rushing on the wrestler's bridge in 1 minute". In addition, it should be noted that these indicators of special preparedness are interconnected with the results of recovery (HR, beats min^{-1}) after performing the Harvard step test.

The 1st (1–5 s), 5th (21–25 s), and 3 rd (11–13 s) measurements have the greatest information content (Table 2) of the indicators of tapping metrics. The correlation of the recovery (HR, beats min^{-1}) when performing the Harvard step test shows high informational content.

At the stage of specialized basic training (15–16 years), the number of interrelations of high correlation dependence is significantly reduced (Figure 2), and their information content also changes (Table 2). The only exceptions are the interrelationships of the indicators of heating measurements, which testify to their high informativeness (r=0,60–0,90) and the 4th indicator (16–20 s), which at the level of r=0,50 is interrelated with the indicator of special preparedness " throws for 1 min".

At this stage of sports training, reliable connections are at the level of r=0,91 "rushing on the wrestler's bridge in 1 minute " and " coups on the wrestler's bridge in 1 minute". Significant information (Table 2) at this stage have indicators of recovery (HR, beats min^{-1}) after performing the Harvard step test (2,3 minutes) and the special wrestling test "throws for 1 minute".

It should be noted that at the stage of specialized basic training, the indicators of "coups and rushing on the wrestler's

Table 2

Summary table of interrelations and informative indicators of tapping metrics and special preparedness of freestyle wrestlers at various stages of preparation

№ п/о	Indicators	Initial, 11-12 years			Preliminary basic, 13-14 years		
		Inform. Xr	Place selectiv	Common place	Інформ.	Place selectiv	Common place
1	1. 1-5 s	42	VII	VII	37	I	I
2	2. 6-10 s	47	III	IV	34	IV	IV
3	3. 11-15 s	45	V	V	35	III	III
4	4. 16-20 s	51	II	II	33	V	V
5	5. 21-25 s	53	I	I	36	II	II
6	6. 26-30 s	46	IV	V	32	VI	VI
7	Σ	44	VI	VI	33	V	V
8	Xr	44	VI	VI	33	V	V
9	HST index	45	V	V	21	VII	XII
10	HR, beats /n 1 minute	35	IV	X	28	IV	VIII
11	1 Recovery HR beats/min	40	III	VIII	30	III	VII
12	2 Recovery HR beats/min	46	II	V	35	II	III
13	3 Recovery HR beats/min	48	I	III	37	I	I
14	Rushing on the wrestler's	29	V	XIV	20	V	XIII
15	Coups on the wrestler's b	32	III	XII	23	IV	XI
16	HR, beats /n 1 minute	35	I	X	28	I	VIII
17	Throws for 1 minute	33	II	XI	16	VI	XIV
18	Recovery after throws HR beats min	24	VII	XVII	15	VII	XV
19	1 Recovery HR beats/min	26	VII	XVI	25	III	X
20	2 Recovery HR beats/min	27	VI	XV	28	I	VIII
21	3 Recovery HR beats/min	30	IV	XIII	26	II	IX

№ п/о	Indicators	Specialized basic, 15-16 years			In-depth specialized, 17-18 years		
		Inform. Xr	Place selectiv	Common place	Inform. Xr	Place selectiv	Common place
1	1. 1-5 s	30	VII	VIII	37	II	II
2	2. 6-10 s	39	III	III	36	III	III
3	3. 11-15 s	40	II	II	29	VII	VIII
4	4. 16-20 s	26	IX	X	33	IV	IV
5	5. 21-25 s	44	I	I	31	V	VI
6	6. 26-30 s	36	IV	IV	41	I	I
7	Σ	35	V	V	30	VI	VII
8	Xr	34	VI	VI	30	VI	VII
9	HST index	28	VIII	IX	20	VIII	XIV
10	HR, beats /n 1 minute	26	IV	X	19	IV	XV
11	1 Recovery HR beats/min	35	I	V	32	I	V
12	2 Recovery HR beats/min	33	II	VII	27	II	IX
13	3 Recovery HR beats/min	30	III	VIII	26	III	X
14	Rushing on the wrestler's	17	VII	XV	29	I	VIII
15	Coups on the wrestler's b	16	VI	XIV	23	IV	XIII
16	HR, beats /n 1 minute	20	V	XIII	19	V	XV
17	Throws for 1 minute	21	IV	XII	13	VII	XVII
18	Recovery after throws HR beats min	21	IV	XII	18	VI	XVI
19	1 Recovery HR beats/min	25	III	XI	25	II	XI
20	2 Recovery HR beats/min	28	II	IX	24	III	XII
21	3 Recovery HR beats/min	30	I	VIII	23	IV	XIII

bridge in 1 minute" show reliable and high correlations with recovery (HR, beats min^{-1}) after performing the Harvard step test and a special wrestling test.

Further changes in the relationship of special and functional preparedness of freestyle wrestlers are observed at the next stage of preparation - the stage of advanced specialization (Table 2, Figure 2).

Analyzing the correlation matrix, it should be noted that, as in the previous stages of preparation, the indicators of tapping metrics are interconnected at a high correlation level (r=0,60–0,80), and the 6th is the most informative (26–30 s) 1st (1–5 s) and 2nd (6–10 s) indicators. From the indicators of the special preparedness of "coups and rushing on the wrestler's bridge in 1 minute", which are reliably interconnected at the level of r=0,90.

Correlation analysis shows that the recovery (HR, beats·min^{-1}) after performing the Harvard step test and the special wres-

Volkov, L. & Zakharkiv, S. (2019), "Relationship of special and functional preparedness of freestyle wrestlers at different stages of sports training", *Slobozhanskyi Herald of Science and Sport*, Vol. 7 No. 3(71), pp. 56-61, doi: 10.5281/zenodo.3371843

tling test "throws for 1 min" are significantly interrelated.

According to the results of the Harvard step-test, recovery (HR, beats min^{-1}) has the most informative indicators of the functional status of the cardiovascular system of freestyle wrestlers who study at the in-depth stage of sports training.

Conclusions / Discussion

Practical application is carried out in the conditions of the training process of young wrestlers during training in children's youth sports schools and the educational process of students in higher education institutions of physical culture.

The theoretical and experimental studies on the problem of the relationship of special and functional fitness of adolescents and young men engaged in freestyle wrestling at different stages of many years of sports training, allowed us to draw the following conclusions:

– studying the problem of the relationship of special and functional preparedness of athletes, including representatives of wrestling, need an integrated methodology using the ideas of a systems approach;

– to solve the set tasks, a complex methodology was developed, the contents of which included: pedagogical experiment, pedagogical testing, pulsometry, reflexometry, tapping metrics, methods in mathematical statistics;

– results of the research show that at all stages of sports training for adolescents and young people aged 11–12 years old to 17–18 years old engaged in freestyle wrestling, there are reliable interrelations between the components of special and functional preparedness;

– the highest informational content and a greater number of reliable interrelations from the components of special preparedness have the indicators "rushing on the wrestler's bridge in 1 minute" and "coups on the wrestler's bridge in 1 minute";

– depending on the stage of preparation, from the indicators of tapping metrics, the following measurements have the largest number of reliable relationships with the indicators of special preparedness: initial training – 5 (21–25 s), 4 (16–20 s), 2 (6–10 s) ; previous basic training – 1 (1–5 s), 3 (11–15 s), 5 (21–25 s); specialized basic training – 3 (11–15 s), 2 (6–10 s), 5 (21–25 s); depth specialization – 1 (1–5 s), 2 (6–10 s), 6

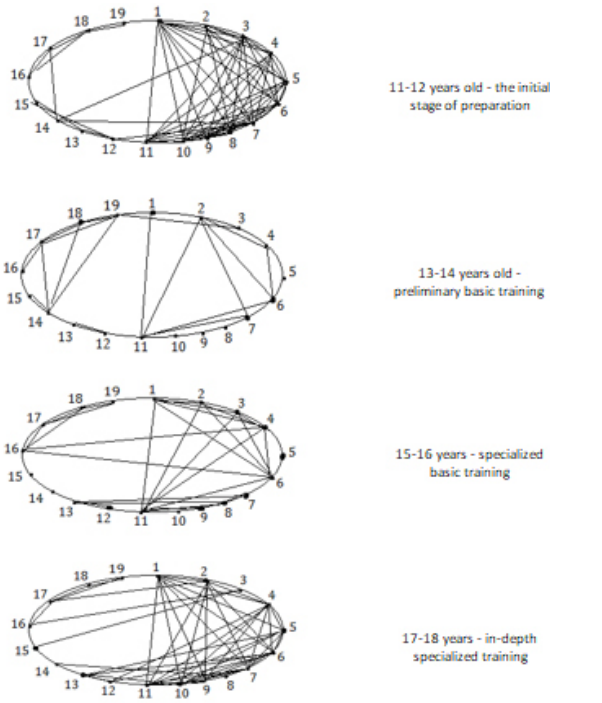

Fig. 2. Age features of interrelations (r>0,6) of tapping metrics and special preparedness of wrestlers at various stages of preparation:
1 – 1–5 s; 2 – 6–10 s; 3 – 11–15 s; 4 – 16–20 s; 5 – 21–25 s; 6 – 26–30 s; 7 – Σ; 8 – $\bar{X}r$; 9 – HST index; 10 – HR, beats min^{-1}; 11-13 – recovery; 14 – " rushing on the wrestler's bridge in 1 minute "; 15 – "coups on the wrestler's bridge in 1 min"; 16 – HR, beats·min^{-1}; 17 – number of throws; 18 – recovery after throws; 19–21 – recovery.

(26–25 s).

It should be noted that at all stages of the preparation of freestyle wrestlers, the recovery indicators (HR, beats min^{-1}) after performing the Harvard step test and the special test ("throws for 1 min") are reliably associated with components of special preparedness. The carried out researches allow to assert that during long-term employment by freestyle wrestling there are reliable interrelations between indicators of special and functional readiness. By informativeness, these indicators vary depending on the stage of preparation, it needs to change the volume of training loads, selective and general orientation.

Further research will focus on the development of multi-year planning of means for special, auxiliary and general training, the ratio depending on the stages of preparation and the age of freestyle wrestlers.

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.

References

1. Boyko, V.F. & Danko, G.F. (2004), *Fizicheskaya podgotovka bortsov* [Physical training of wrestlers], Olimpiyskaya l-ra, Kiev. (in Russ.)
2. Boyko, Ye.I. (1964), *Vremya reaktsii cheloveka* [Human Response Time], Meditsina, Moscow. (in Russ.)
3. Volkov, V.L. (2000), *Kompleksnaya otsenka bazovoy podgotovlennosti. Sostoyaniya zdorovya, fizicheskaya podgotovlennost, funktsionalnye vozmozhnosti, psikhofiziologicheskoe sostoyaniya* [Comprehensive Assessment of Basic Preparedness. Health conditions, physical

fitness, functional capabilities, psycho-physiological conditions], Kiev. (in Russ.)
4. Volkov L.V. (2016), *Teoriya i metodika ditiachogo ta yunatskogo sportu* [Theory and methodology of children's and youth sports], Osvita Ukrainy, Kyiv. (in Ukr.)
5. ASBU (2011), *Vilna borotba: choloviki, zhinki. Navchalna programa dlya dityacho-yunatskikh sportivnikh shkil, spetsializovanikh dityacho-yunatskikh shkil olimpiyskogo rezervu, shkil vishchoï sportivnoï maysternosti ta spetsializovanikh navchalnikh zakladiv sportivnogo profilyu* [Free Struggle: Men, Women. Educational program for children's and youth sports schools, specialized children's and youth schools of the Olympic reserve, schools of higher sporting skills and specialized educational institutions of sports profile], Kiïv. (in Ukr.)
6. Danko, G.V. (2011), *Volnaya borba* [Freestyle Wrestling], Kiev. (in Russ.)
7. Zakharkiv, S.Y. (2018), "Functional readiness of freestyle wrestlers of students at different stages of many years of sports training", *Naukoviy chasopis. seriya 15 "Naukovo-pedagogichni problemi fizichnoï kulturi"*, Vypusk 7 (101) 18, pp. 42-49. (in Russ.)
8. Ilin, Ye.P. (2001), *Differentsialnaya psikhofiziologiya* [Differential Psychophysiology], Piter, Sankt-Peterburg. (in Russ.)
9. Korobeynikova, L., Korobeynikov, G., Richok, T., Danko, V. & Shatskikh, V.Yu. (2016), "Features of manifestation of neurodynamic functions of high-skilled wrestlers in the dynamics of the training process", *Teoriya i metodika fizichnogo vikhovannya i sportu*, No. 4, pp. 57-60. (in Ukr.)
10. Klichko Vitaliy (1999), *Metodika opredeleniya sposobnostey bokserov v sisteme mnogoletnego sportivnogo otbora: Dissert. na soiskanie uchen. stepeni kand. nauk po fiz. vospitaniyu i sportu* [Methodology for determining the abilities of boxers in the system of multi-year sports selection: PhD thesis abstract], NUPES of Ukraine, Kiev, 187 p. (in Russ.)
11. Klichko Vladimir (2000), *Pedagogicheskiy kontrol v sisteme upravleniya bazovoy podgotovkoy kvalifitsirovannykh bokserov: Dissertatsiya na soiskaniya uchen. step. kand. nauk po fiz. vospitaniyu i sportu* [Pedagogical control in the control system of basic training of qualified boxers: PhD thesis abstract], NUPES of Ukraine, Kiev, 169 p. (in Russ.)
12. Mishchenko, V.S. (1990), *Funktsionalnye vozmozhnosti sportsmenov* [Athletes Functionality], Zdorove, Kiev. (in Russ.)
13. Nachinskaya, S.V. (2005), Sportivnaya metrologiya. Uchebnoe posobie dlya stud. vysshch. ucheb. Zavedeniy [Sport Metrology], Izd. Tsentr. "Akademiya", Moscow. (in Russ.)
14. Plakhtienko, V.A. & Bludov, Yu.M. (1983), *Nadezhnost v sporte* [Reliability in Sport], Fizkultura i sport, Moscow. (in Russ.)
15. Romanenko, V.A. (2005), *Diagnostika dvigatelnykh sposobnostey: ucheb. posob.* [Diagnosis of motor abilities: studies. allowance], Don-NU, Donetsk. (in Russ.)
16. Fillipov, M.M. (2006), *Psikhofiziologiya funktsionalnykh sostoyaniy* [Psychophysiology of functional states], MAUP, Kiev. (in Russ.)
17. Yagello Vladislav (2002), *Teoretichno-metodicheskie osnovy sistemy mnogoletney fizicheskoy podgotovki yunykh dzyudoistov* [Theoretical and methodological foundations of the system of long-term physical training of young judoists], Izd-vo AVF, Varshava, Kiev. (in Russ.)

Received: 29.04.2019.
Published: 30.06.2019.

Information about the Authors

Leonid Volkov: *Professor, Doctor of Pedagogical Sciences, Professor of the Department of Theory and Methodology of Physical Education and Sports, State Pedagogical University "Pereyaslav-Khmelnytsky State Pedagogical University named after Gregory Skovoroda": street Sukhomlynsky, 30, Pereyaslav-Khmelnitsky, Kyiv region, 08401, Ukraine.*
ORCID.ORG/0000-0002-4513-1341
E-mail: kafedra.tmtvis@ukr.net

Stepan Zakharkiv: *postgraduate student of the Department of Theory and Methodology of Physical Education and Sports, Pereyaslav-Khmelnytsky State Pedagogical University named after Gregory Skovoroda: street Sukhomlynsky, 30, Pereyaslav-Khmelnitsky, Kiev region, 08401, Ukraine.*
ORCID.ORG/0000-0002-7964-4778
E-mail: stepan72@ukr.net

SLOBOZHANSKIY HERALD OF SCIENCE AND SPORT

The reliability of the presented results correspond to authors

Publication of Kharkiv State Academy of Physical Culture
Kharkiv State Academy of Physical Culture
Klochkivska Str. 99, Kharkiv, 61058, Ukraine
+38 (0572) 705-21-02
hdafk.edu@gmail.com