Key title: Pedagogics, psychology, medical-biological problems of physical training and sports

Abbreviated key title: Pedagog. psychol. med.-biol. probl. phys. train. sports

ISSN 2308-7269 (English ed. online)

Founders: Iermakov Sergii Sidorovich (Ukraine); (doctor of pedagogical sciences, professor, Department of Physical Education, Kharkov National Pedagogical University).

Certificate to registration: KB 22063-11963P 16.05.2016.

Frequency – 6 numbers in a year.

Journal is ratified Ministry of Education and Science of Ukraine:
pedagogical sciences, online (07.10.2016 №1222);
physical education and sport, online (13.03.2017 № 374)

Address of editorial office:
Box 11135, Kharkov-68, 61068, Ukraine,
Tel. 38 099 430 69 22
e-mail: sportart@gmail.com
http://www.sportpedagogy.org.ua

Journal is reflected in databases:

1) Web of Science Core Collection
[Emerging Sources Citation Index (ESCI)]
http://ip-science.thomsonreuters.com/mjl

DOAJ (Directory of Open Access Journals)
http://www.doaj.org

WorldCat – http://www.worldcat.org

SHERPA/RoMEO – http://www.sherpa.ac.uk

Open Science Directory (EBSCO information services) - http://www.opensciencedirectory.net

PBN (Polish Scholarly Bibliography)
https://pbn.nauka.gov.pl/journals/40688

ERIH PLUS (The European Reference Index for the Humanities and the Social Sciences)
– https://dbh.nsd.uib.no

Index Copernicus http://journals.indexcopernicus.com

PIHЦ – http://elibrary.ru

Scilit – http://www.scilit.net

ROAD – http://road.issn.org

2) BASE – http://www.base-search.net

Academic Journals Database
http://journaldatabase.org

CORE http://core.kmi.open.ac.uk

Elektronische Zeitschriftenbibliothek
http://ezb.uni-regensburg.de

OAJI – http://oaji.net/journal-detail.html?number=769

3) V.I.Vernadskiy National Library of Ukraine
http://nbuv.gov.ua

Scientific Periodicals of Ukraine
http://journals.uran.ua/olympicedu.org/pps

AcademicKeys
http://socialsciences.academickeys.com/jour_main.php

academia.edu – https://www.academia.edu

Google Scholar – http://scholar.google.com.ua
EDITORIAL BOARD

Editor-in-chief: Iermakov S.S., Doctor of Pedagogical Sciences, Professor: Kharkov National Pedagogical University (Kharkov, Ukraine); Kazimierz Wielki University (Bydgoszcz, Poland),

Scientific Editors:
Sawczuk Marek, Doctor of Biological Sciences, Faculty of Physical Education and Health Promotion, University of Szczecin (Szczecin, Poland),
Chia Michael, PhD, Professor, Faculty of Phisical Education and Sports, National Institute of Education Nanyang Technological University (Singapore),
Kalina Roman Maciej, Professor, Ph.D., D.Sc., University of Physical Education and Sports (Gdansk, Poland),
Jagiello Wladyslaw, Doctor of Sciences in Physical Education and Sport, professor, Academy of Physical Education and Sport (Gdansk, Poland),
Malinauskas Romualdas, Doctor of Pedagogical Sciences, Professor, Lithuanian Academy of Physical Education (Kaunas, Lithuania),
Maciejewksa-Karłowska Agnieszka, Doctor of Biological Sciences, Faculty of Physical Education and Health Promotion, University of Szczecin (Szczecin, Poland),
Prusik Krzysztof, Doctor of Pedagogical Sciences, Professor, Academy of Physical Education and Sport (Gdansk, Poland),
Tkachuk V.G., Doctor of Biological Sciences, Professor, National Pedagogical Dragomanov University (Kiev, Ukraine),
Yermakova T., Ph.D., Kharkov National Pedagogical University (Kharkov, Ukraine),

Editorial Board:
Boraczyński Tomasz, Ph.D. Physical Education and Sport, Jozef Rusiecki Olsztyn University College (Olsztyn, Poland),
Boychuk Y.D., Doctor of Pedagogical Sciences, Professor, Kharkov National Pedagogical University (Kharkov, Ukraine),
Cieslika Miroslaawa, Ph.D. Physical Education and Sport, Uniwersytet Kazimierza Wielkiego (Bydgoszcz, Poland),
Corona Felice, Doctor of Sciences (Ph. D), Associate Professor, University of Salerno (Salerno, Italy),
Fathloun Mourad, Ph.D. Physical Education and Sport, Research Unit Evaluation and Analysis of Factors Influencing Sport Performance (Kef, Tunisia),
Giovanis Vasilios, Ph. D. (Physical Education and Sport), Faculty of Physical Education and Sport Science, University of Athens, (Athens, Greece),
Khudolii O.M., Doctor of Sciences in Physical Education and Sport, Professor, Kharkov National Pedagogical University (Kharkov, Ukraine),
Ionova O.M., Doctor of Pedagogical Sciences, Professor, World Anthroposophical Society (Dornach, Switzerland),
Kozina Z.L., Doctor of Sciences in Physical Education and Sport, Professor, Private University of Environmental Sciences (Radom, Poland),
Kondakov V.L., Doctor of Pedagogical Sciences, Professor, Belgorod State National Research University (Belgorod, Russia),
Korobeynikov G.V., Doctor of Biological Sciences, Professor, National University of Physical Education and Sport of Ukraine (Kiev, Ukraine),
Nosko N.A., Doctor of Pedagogical Sciences, Professor, National Pedagogical University (Chernigov, Ukraine),
Potop V., Doctor of Sciences in Physical Education and Sport, Professor, Ecological University of Bucharest (Bucharest, Romania),
Prusik Katarzyna, Doctor of Pedagogical Sciences, Professor, Academy of Physical Education and Sport (Gdansk, Poland),
Sobyanin F.I., Doctor of Pedagogical Sciences, Professor, Belgorod State National Research University (Belgorod, Russia),
Yan Wan J., Doctor of Sciences, Professor, College of Physical Education and Sports Science of Hebei Normal University (Shijiazhuang, China),
Abdelkrim Bensbaa, Ph.D. MSc. Physical Education and Sport, Military Center of Physical Education and Sport (Abu Dhabi, United Arab Emirates),
Boychenko S.D., Doctor of Pedagogical Sciences, Professor, Byelorussian State Academy of Physical Culture (Minsk, Byelorussia),
Dmitriev S.V., Doctor of Pedagogical Sciences, Professor, Nizhny Novgorod State Pedagogical University (Lower Novgorod, Russia),
Görner Karol, Doctor of Sciences, Professor, Department of Physical Education and Sports, Matej Bel University (Banska Bystrica, Slovakia),
Jorge Alberto Ramirez Torrealba, Ph. D. (Physical Education and Sport), Pedagogical University (Maracay, Venezuela),
Leikin M.G., Doctor of Philosophy (Ph. D) in Technical Sciences, professor, centre «Gymnastics & Biomechanics» (Portland, USA),
CONTENTS

Baginska O.V. Correlation of factorial weights of separate motor coordination structure indicators, which characterize motor function level of different age groups’ schoolchildren .............................................................100

Ivashchenko O.V. Special aspects of motor abilities development in 6-10 years’ age girls ........................................105

Kovalenko Y.O., Boloban V.N. Analysis of Olympic Games (Rio de Janeiro, 2016) participants’ individual competition compositions in calisthenics ...............................................................................................................111

Podrigalo L.V., Iermakov S.S., Avdiievsksa O.G., Rovnaya O.A., Demochko H.L. Special aspects of Ukrainian schoolchildren’s eating behavior ............................................................................................................................120

Pryshva O.B. Influence of mature men way of life on highly intensive physical activity ..........................................126

Prystypa T., Stefaniak T., Rudenko R. Impact of athletic recovery parameters of hemodynamics in disabled powerlifters with cerebral palsy...............................................................................................................................131

Shuba V.V. Special aspects of Paralympic athletes’ sport activity in the process of self-education ...........................139

Vitomskiy V.V., Lazariieva O.B., Imas E.V., Zhovnir V.A., Emets I.N. Dynamic of bio-geometric profile indicators of children’s with functionally one ventricle posture at stage of physical rehabilitation ..........146

Information ....................................................................................................................................................................152
Correlation of factorial weights of separate motor coordination structure indicators, which characterize motor function level of different age groups’ schoolchildren

Baginska O.V.
Chernigov National Pedagogical University named T. G. Shevchenko

Abstract

**Purpose:** to find out correlation of the most significant indicators’ factorial weights, which characterize motor coordination structure of different age groups’ schoolchildren.

**Material:** in the research 901 schoolchildren of age from 6 to 15 years participated (466 boys and 435 girls). We used computer stabiloanalyzer with biological feedback.

**Results:** we the received factorial loads of separate indicators of motor coordination structure. Correlation of the weights showed change of their significance in the process of effective motor behavior’s ensuring. We found body proportions changes’ substantial influence on formation of compensatory mechanisms in sustaining body vertical position as well as the most important indicators of motor coordination structure, which have noticeable specific weight for all age groups.

**Conclusions:** the received data can be used for modeling the process of schoolchildren’s motor functions’ development. Factorial weights and their correlations facilitate optimization of motor function’s development methodic in the process of physical culture and sports’ practicing.

**Keywords:** coordination, stabilography, balance, movements, factors, schoolchild

Introduction

The problem of physical education process’s perfection in compliance with modern educational demands has been becoming more and more relevant. As on to day we can observe steady tendency to humanization of education, to its personality’s orientation. It updates the question about consideration of individual and individual typological aspects of motor control for children’s and adolescents’ effective motor behavior. Development of coordination is of great significance in formation of motor function in the whole [11, 22]. It is known [6] that coordination is “control over excessive freedom of our motor organs and their transformation into fully controlled systems”. Development of coordination abilities is realized in heterochronic way [10, 20, 25]. Some parameters of motor coordination substantially influence on formation of motor function in general [21, 26]. Consideration of age specifics in formation of motor control mechanisms in physical education and sport training processes will permit to optimize formation of human motor function in the whole [9, 10, 27]. It has been proved [17], that purposeful training methodic shall be based on understanding of laws of motor function and movements’ formation and development in ontogeny. It was found [16] that vertical position regulation mechanisms ensure balance reliability in orthography stance and determine reliability of sportmen’s control over free movements. In the researches [8] it is noted that knowledge of aspects of vertical position firmness formation in ontogeny is a necessary condition for motor skills’ perfection and harmonious development of children and adolescents. The purposefulness of coordination abilities’ more profound study is stressed on in other work [23]. High information potential and objectiveness of motor function’s assessment with the help of bio-mechanical methods were proved by different authors [2, 7, 13]. It is proved [19] that application of computer stabiloanalyzer with biological feedback “Stabilan-01” permits to study and objectively assess coordination abilities and coordination structure of a movement.

In other works mean values of some motor coordination structure indicators were found [3, 5] as well as correlation between them and effectiveness of motor behavior [4, 24]. However, in different age groups these dependences were different [4, 5]. In other works there was proved the purposefulness of motor coordination structure’s modeling as the base of motor function’s formation’s optimization [14, 15]. But in available literature we have not found models of motor functions’ development with determination of their factorial weight for different age schoolchildren groups. Most of researches on this problem are devoted to sportmen or students [7, 15, 16]. There are some data, received in researching primary school age children [14]. Results of sportmen’s studies reflect the aspects of motor behavior control. But they are conditioned by specific of kind of sports and are not suitable for assessment of schoolchildren’s motor function.

**Hypothesis:** it was assumed that some bio-mechanical indicators of motor coordination structure are of different significance in effectiveness of motor behavior control in different age groups. The study of factorial weights and their correlations in 6-15 yrs. schoolchildren can facilitate motor function’s optimization in physical culture and sport practicing processes.

The purpose of the work is to determine the most significant motor coordination structure’s indicators, which characterize 6-15 yrs schoolchildren’s motor function level and find out factorial weights of each of them in every age group.
Material and methods

Participants: in the research 901 schoolchildren of age from 6 to 15 years participated (primary school pupils: 176 girls and 146 boys; secondary school pupils: 200 girls and 270 boys and senior pupils: 59 girls and 50 boys).

Organization of the research: the experiment was carried out in a biomechanical laboratory. We used a computer stabilometer with biological feedback “Stabilan-01” and software StabMed 2.08. The test with visual feedback was fulfilled. Standing on a stabilograph platform, schoolchild shall fix marker in the center of target at big scale of picture. Marker’s movements were regulated by free movement of pupil’s body mass center (BMC).

Statistical analysis: we fulfilled factorial analysis. The data were accumulated in Microsoft Excel exported to data base of SPSS. We received a ten-dimensional space of the tested group. The received data were taken for factorial analysis according to criterion of adequacy of Kaiser – Meyer – Olkin (KMO = 0.82) and Bartlett’s criterion of sphericity (p≤0.05). We also used varimax method of G. Kaiser – one of methods of factors’ analytical processing, which permits to give a variable the highest weight within one factor. Varimax method is analysis of main components.

Results

In our previous research we found dependence between ability for effective control over motor behavior and separate indicators, which characterize motor coordination structure of different age groups’ schoolchildren. We found correlations between effectiveness of motor control and stabilography indicators: \( Q(x) \) – mean square deviation of pressure center by x axis; \( Q(y) \) – mean square deviation of pressure center by y axis; \( R \) – mean total range of body pressure center’s oscillations; \( V \) – mean amplitude value of pupil’s BC movement; \( SV \) – velocity of static kinesiogram square’s change; \( QBF \) – quality of balance function; \( NSV \) – normalized square of vector gram; \( STVV \) – percentage of velocity vector’s sharp turns in respect to total quantity of vectors; \( MLV \) – mean linear velocity; \( AMV \) – mean angle velocity of direction changes of BC movement’s velocity vectors [4, 5].

The first collective factor, which characterizes the ability to keep static balance, has the maximal weight. Its total contribution to general dispersion was: in girls’ group – from 31.61% to 49.81%; in boys’ group – from 35.94% to 48.76 % (depending on age group).

The first factor in all age groups includes such indicators as: \( Q(x) \); \( Q(y) \); \( R \); \( V \); \( SV \); \( QBF \); \( NSV \); \( MLV \). Their significance in different girls’ age groups is shown in fig. 1; for boys – in fig. 2.

The second factor included, mainly, the indicators, which characterize activity of keeping balance processes in all age groups. We found higher significance of this factor in boys and girls’ groups in periods of active increase of body total sizes and change of body proportions. Its total contribution in general dispersion was from 15.35% to

Fig.1. Correlations of significance of separate motor coordination structure’s indicators, which were included in the first collective factor of different age groups’ girls (a – 6 years; b – 7 years; c – 8 years; d – 9 years; e – 10 years; f – 11 years; g – 12 years; h – 13 years; j – 14 years; k – 15 years). Indicators of motor coordination structure:

- \( MO(x) \) – mean sagittal shift;
- \( MO(y) \) – mean frontal shift;
- \( OD \) – Assessment of movement;
- \( Q(x) \) – mean square deviation of pressure center by x axis;
- \( Q(y) \) – mean square deviation of pressure center by y axis;
- \( R \) – mean total range of body pressure center’s oscillations;
- \( V \) – mean amplitude value of pupil’s BC movement;
- \( SV \) – velocity of static kinesiogram square’s change;
- \( QBF \) – quality of balance function;
- \( NSV \) – normalized square of vector gram;
- \( MLV \) – mean linear velocity;
- \( Kriy \) – mean coefficient of curvature;
- \( KAss0(x) \) – asymmetry coefficient in respect to x-axis;
- \( KAss0(y) \) – asymmetry coefficient in respect to y-axis.
25.53% depending on age group.

The third factor included indicators, which reflected shift of histogram in definite direction; asymmetry of BC deviation and individual aspects of BC deviation’s compensation. Its total contribution to general dispersion was from 10.69% to 16.24%.

The received factorial weights permitted to mark out the most significant indicators of motor coordination structure in every age group, as the base for modeling of motor function’s training.

**Discussion**

The fulfilled study is a logical continuation of a number of other experimental researches on formation of school age children’s motor function [3, 4, 5].

The experiment proved the data [8] about improvement of children’s before 7 age yrs. posture regulation and improvement of central mechanisms of 9-10 yrs. children’s motor regulation. We proved the work [16] about worsening of vertical position’s regulation, in case of problems with it in 7 years children. In our research it reflected in reduction of first factor’s specific weight and increase of the second.
factor’s significance. It is a result of resilience’s worsening and more effective task’s fulfillment in active sustaining of body vertical position. It coincides with research [16] and is connected with dynamic of sensor systems’ roles’ changing in the process of 7-9 yrs. children’s mastering movements. The received by us changes of schoolchildren’s factorial structure in the period of puberty coincide with other results [12]. They are explained by morphological functional reconstructions of all systems of children’s organisms. It is also confirmed by confident correlations between changes of motor coordination structure’s main indicators and changes of body total sizes.

The received by us data prove the results of studies of primary school pupils’ motor coordination structure [14], as well as secondary and senior school age children дітей [12, 15, 18]. However, determination of their significance in effectiveness of motor behavior control, correlation of factorial weights, permitted to substantially supplement other researches.

In contrast to other researches [12, 15] in the experiment children with average level of motor activity were involved. It permitted to use the obtained data for modeling the development of schoolchildren’s motor function. Such models are suitable for application in comprehensive educational establishments for optimization of physical culture teaching methodic.

Conclusions
The received data about correlation of separate motor coordination structure indicators’ factorial weight in children of 6 – 15 yrs. age witness about change of their significance in ensuring of motor behavior effectiveness, depending on age group. They can be used for modeling of schoolchildren’s motor function’s development. They are components of organization of physical culture teaching in conditions of modern school.

Conflict of interests
The author declares that there is no conflict of interests.

References:
1. Anokhin PK. Ocherki po fiziologii funkcional’nykh sistem [Essays on physiology of functional systems], Moscow: Medicine; 1975. (in Russian)
2. Arkhipov OA. Biomekhanichni tekhologii u fizichni pidgotovci studentiv [Bio-mechanical technologies in students’ physical training], Kiev: NPU; 2012. (in Ukrainian)
3. Baginska OV. Zdatnist’ do utrimannia rivnovagi ditej [Capability to keep balance in primary school pupils as indicator of their motor function’s development in the process of physical culture practicing]. Naukovo-pedagogichni problemy fizichnoi kul’turi, 2014(44):14-53-56. (in Ukrainian)
4. Baginska OV. Modeliuvannia biodinamichnoi ta koordinacijnoi struktury rukhu v procesi integral’noi ocinki rozvitku ikh rukhovoi funkcii v proces navchannia fizichnoi kul’turi [Ability to keep balance in primary school pupils as indicator of their motor function’s development in the process of physical culture practicing]. Naukovo-pedagogichni problemy fizichnoi kul’turi, 2014;139(1):8 – 12. (in Ukrainian)
5. Baginska OV. Osoblivosti upravlinnia rukhami u shkoliariv riznich vidovikh grup [Special aspects of motor control of different age groups schoolchildren]. Visnik Chernigivs’kogo Nacional’nogo pedagogichnogo universitetu imeni T.G. Shevchenka, 2016;139(1):8 – 12. (in Ukrainian)
9. Gurfinkel’ BC, Koc IaM, Shik ML. Reguliaciia poz cheloveka [Regulation of human position], Moscow: Science; 1965. (in Russian)
11. Donskoj DD. Zakony dvizhenii v sporte [Laws of moving in sports], Moscow, Physical Culture and Sport; 1968. (in Russian)
12. Kosenko IuV, Dmitrenko LM, Mendzherickij AM, Tregubenko OA. S ravnitel’nyj analiz stabilographekhsix i sensomotornykh pokazatelej u zdorovykh shkolnikov i detej s intellektual’noj nedostatochnost’iu v sootvetstvii s urovnom i kh dvigatel’noj aktivnosti [Comparative analysis of healthy children’s stabilograph and sensor-motor indicators and children’s with intellectual deficiency in compliance with their motor activity]. Sovremennye problemy nauki i obrazovaniia, 2016:3;30-35. (in Russian)


17. Rovnij AS. Sensorni mekhanizmy upravlinnia tochnisimi rukhami liudini [Sensor mechanisms of control over fine human movements], Kharkiv; KSIPC: 2001. 995. (in Ukrainian)


22. Zaporozhanov VA, Boraczynski T. Preparation of children with the limited possibilities to tutoring in a comprehensive school - a step to spirituality and humanism. Pedagogics, psychology, medical-biological problems of physical training and sports, 2009;4:52-55.


24. Ivashchenko OV. Modeliuvannya procesu fizichnogo vikhovannia shkoliariv [Modeling of schoolchildren’s physical education process]. Kharkiv: OVS; 2016. (in Ukrainian)


Information about the author:

Baginska O.V.; http://orcid.org/0000-0002-2856-8701; olga-baginskaya@yandex.ua; Chernigov National Pedagogical University named T. G. Shevchenko; Hetman Polubotka str., 53., Chernihiv, 14013, Ukraine.

Cite this article as: Baginska OV. Correlation of factorial weights of separate motor coordination structure indicators, which characterize motor function level of different age groups’ schoolchildren. Pedagogics, psychology, medical-biological problems of physical training and sports, 2017;21(3):100–104. doi:10.15561/18189172.2017.0301

The electronic version of this article is the complete one and can be found online at: http://www.sportpedagogy.org.ua/index.php/PPS/issue/archive

This is an Open Access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited (http://creativecommons.org/licenses/by/4.0/deed.en).

Received: 11.02.2017
Accepted: 25.02.2017; Published: 30.04.2017
Special aspects of motor abilities development in 6-10 years’ age girls

Ivashchenko O.V.
H.S. Skovoroda Kharkiv National Pedagogical University

Abstract

Purpose: To find structural model of motor fitness group dynamic in 6-10 years' age girls.
Material: in the research 6 years girls (n=36), 7 years age girls (n=48), 8 years girls (n=57), 9 years (n=38), and 10 years girls (n=46) participated.
Results: analysis of motor fitness factorial model permitted to obtain information, required for taking decision in management of physical education and working out effective programs of girls' physical training. We found opportunities for receiving metrical estimations of measurements' reliability: stability, concordance and information value of control data for current diagnostic and prognostication of children's physical potentials. In motor fitness factorial models of girls we marked out 6 the most important factors, complied with age: complex development of coordination; quickness, speed power and flexibility; flexibility; strength and motor coordination; coordination and quickness; quickness.
Conclusions: in girls we observed multi-factorial structure of motor fitness. For every age we composed informative tests for motor fitness control.

Keywords: girls, motor abilities, factorial analysis, health, control.

Introduction

The problem of motor activity and health strengthening is rather relevant in Ukraine and in Europe [9, 31]. Health improvement and rising of children’s and teenagers’ workability depends on optimal motor activity, which is ensured by physical education at school [5, 30].

The main task of school age children’s physical education is teaching to motor actions [4, 28, 33]. The training process is regarded from the following positions: organization [7, 23, 30], motivation for motor functioning [10, 35], connection of training efficiency with motor functioning [1, 2], cognitive and motor training [3, 6], influence of motor fitness on training effectiveness [20, 22, 27], influence of physical loads on training effectiveness [16, 24].

One of conditions of schoolchildren’s physical education effectiveness is organization of pedagogic control at physical culture lessons [15, 21]. Effectiveness of pedagogic control depends on the presence of object to be controlled and informative value of indicators, which characterize the changes of his/her state [14, 17, 18]. It was found that modeling is an effective method of receiving new information for realization of current and summarizing control on the base of children’s and teenagers’ testing [13, 19, 26]. Factorial and discriminant analysis is one of methods of statistic modeling. Effectiveness of their application is illustrated by scientific data [12, 25, 34]. The mentioned works witness about demand in searching methodological approaches to solution motor fitness problem and motor fitness control in schoolchildren.

That is why it would be reasonable to analyze special aspects of 6-10 years girls’ motor fitness. On the base of motor abilities’ factorial structure analysis it is possible to receive new information.

The purpose of the research is to find structural model of motor fitness group dynamic in 6-10 years' age girls.

Material and methods

Participants: in the research 6 years girls (n=36), 7 years’ age girls (n=48), 8 years girls (n=57), 9 years (n=38), and 10 years girls (n=46) participated.

Organization of the research: for solution of our tasks we used the following methods of research: analysis of scientific literature, pedagogic testing and methods of mathematical statistic. Factorial analysis we used as the method of modeling.

In testing program we included commonly known tests [23]. For assessment the girls’ motor fitness we registered the results of the following motor tests: static stance on one foot (sec.); walking along segments of hexagon (steps); combined movements of arms, torso and legs (errors); walking along straight line after 5 rotations, deviations (cm); shuttle run 4×9 m (sec.); 30 m run (sec.); frequency of arms’ movements (times); catching of falling Dietrich’s stick (cm); long jump from the spot (cm); 300 meters’ run (sec.); arms’ bending and unbending in mixed hanging on rope (times); torso rising in sitting position during 1 minute (times); torso bending from sitting position (cm); index assessment of backbone mobility; index assessment of shoulder joints’ mobility.

Statistical analysis: for analyzing the structure of motor abilities level we used factorial analysis – the method of principle factors. The determined factors were processed by Varimax criterion.

Results

The structural model of girls’ motor fitness dynamic we fulfilled factorial analysis by 15 indicators of testing. The analysis permitted to determine five factors, explaining 82.824% of variation dispersion in 6 years’ girls.

The first factor (informative value 20.475%) correlates to the largest extent with the following tests’ results: №13 “Torsos bending from sitting position” (.893), №3 “Combined movements of arms, torso and legs” (.814), №1 “Static stance on one foot” (-.743), №14 “Index

© Ivashchenko O.V., 2017
doi:10.15561/18189172.2017.0302

105
assessment of backbone mobility (bridge)” (.717). This factor characterizes flexibility and motor coordination.

The second factor (informative value 19.493%) has the highest correlation with the following tests' results: № 10 “300 meters’ run” (.864), № 2 “Walking along hexagon segments” (.841), № 15 “Index assessment of shoulder joints’ mobility” (.811). This factor characterizes endurance and motor coordination.

The third factor, with informative value of 17.222% correlates to the highest extent with the tests: № 7 “Frequency of arms’ movements” (.840), № 9 “Long jump from the spot” (.816), № 5 “Shuttle run 4×9 m” (.799). The factor was named “Complex development of quickness, speed-power and general coordination”.

The forth factor with informative value of 13.104% has the highest correlation with the tests’ results: № 11 “Arms’ bending and unbending in mixed hanging on rope” (.908), № 4 “Walking along straight line after 5 rotations, deviations” (.896). The factor characterizes power fitness and vestibular stability.

The fifth factor (informative value 12.530%) correlates with test: № 12 “Torso rising in sitting position during 1 minute” (.907) and characterizes power endurance. The factor was named “Power endurance”.

Thus, in factorial model of motor fitness the following parameters are marked out: complex development of flexibility and motor coordination (factor 1); endurance and motor coordination (factor 2); quickness, speed-power and general coordination (factor 3); strength and vestibular stability (factor 4) and power endurance (factors 5).

Analysis permitted to determine five factors, explaining 70.665% of dispersion variants, in 8 years girls.

First factor (informative value 18.051%) has the highest correlation with the following tests: № 6 “30 meters’ run” (.831), № 5 “Shuttle run 4×9 m” (.806), № 12 “Torso rising in sitting position during 1 minute” (.698). The factor characterizes quickness, coordination and power endurance.

Second factor (informative value 13.987%) has the highest correlation with tests: № 2 “Walking along hexagon segments” (.829), № 1 “Static stance on one foot” (.817), № 3 “Combined movements of arms’, torso and legs” (.713). This factor characterizes development of coordination abilities.

Third factor (informative value 10.491%) correlates with the following tests: № 15 “Index assessment of shoulder joints’ mobility” (.686), № 8 “Catching of falling Dietrich’s stick” (.683), № 13 “Torso bending from sitting position” (.647). This factor was named “Flexibility”.

Forth factor (informative value 10.124%) correlates with the following: № 10 “300 meters’ run” (.765), test № 14 “Index assessment of backbone mobility (bridge)” (.672). The factor was named “Endurance”.

Fifth factor (informative value 9.285%) correlates to the largest extent with the following tests’ results: № 4 “Walking along straight line after 5 rotations, deviations” (.761), № 7 “Frequency of arms’ movements” (.683). The factor was named “Motor coordination”.

Sixth factor (informative value 8.727%) correlates with the following tests: № 11 “Arms’ bending and unbending in mixed hanging on rope” (.847). The factor was named “Power endurance”.

Thus, in factorial model of 7 years girls’ motor fitness we determined: complex development of motor abilities (factor 1, 2); coordination (factors 3, 4, 5); flexibility (factor 6). Analysis of communities (h2) showed that the most informative for assessment of 7 years girls’ motor fitness are: test № 8 “Catching of falling Dietrich’s stick (cm)” (.816), test № 3 “Combined movements of arms’, torso and legs” (.792), test № 15 “Index assessment of backbone mobility” (.775), test № 13 “Torso bending from sitting position” (.761).
and unbending in mixed hanging on rope” (.858), test № 8 “Catching of falling Dietrich’s stick” (.818), test № 1 “Static posture on one foot” (.754).

In 9 years girls analysis resulted in five factors, which explain 64.657% of dispersion variants.

First factor (informative value 16.610%) has the highest correlation with the following tests results: № 9 “Long jump from the spot” (.776), № 11 “Arms’ bending and unbending in mixed hanging on rope” (.776), № 13 “Torso bending from sitting position” (.739). This factor characterizes strength and flexibility.

Second factor (informative value 13.762%) has the highest correlation with the following: № 3 “Combined movements of arms, torso and legs” (-.694), № 6 “30 meters’ run” (.633). The factor characterizes motor coordination and quickness.

Third factor (informative value 12.926%) correlates to the greatest extent with the following tests: № 15 “Index assessment of shoulder joints’ mobility” (.747), № 4 “Walking along straight line after 5 rotations, deviations” (.701). The factor characterizes flexibility and motor coordination.

Forth factor (informative value 11.699%) correlates with results of tests: № 2 “Walking along hexagon segments” (.848), № 5 “Shuttle run 4×9 m” (.661). This factor was named “Motor coordination”.

Fifth factor (informative value 9.660%) correlates with № 1 “Static stance on one foot” (.904) and characterizes coordination. The factor was named “Coordination”.

Thus, factorial model of 9 years girls’ motor fitness is characterized by the following parameters: strength and flexibility (factor 1); motor coordination and quickness (factor 2); flexibility and motor coordination (factor 3); coordination (factors 4, 5). Analysis of communities (h2) showed that for 9 yrs girls’ motor fitness the most informative are: test № 2 “Walking along hexagon segments” (.941), test № 11 “Arms’ bending and unbending in mixed hanging on rope” (.894), test № 15 “Index assessment of shoulder joints’ mobility” (.892), test № 3 “Combined movements of arm, torso and legs” (.887).

**Discussion**

The received results supplement the data about factorial and discriminate analysis’s application for determination of children’s and teenagers’ motor fitness structure [8, 11, 29]. In other works high prognostic value of factorial analysis in determination of model and informative indicators of primary school age children was studied [27, 28]. The received data are very important for assessment of primary schoolchildren’s readiness for motor actions’ training. They supplement the data about development of motor abilities influence on effectiveness of learning [32] and point at demand in strength’s training [8, 11].

Our results prove the data of other study [36]. These authors note that such approach permits to obtain metrical results of measurements’ reliability: stability, concordance and informative value of control data for current diagnostic and prognostication of children’s sport potentials.

In other work discriminat analysis permitted to find informative tests for comprehensive control of primary school boys’ motor fitness [24]. It confirms the correctness of the chosen by us direction of research.

The received by us results expand information about special aspects of children’s and teenagers’ motor abilities’ development and about possibility to obtain new information with the help of modeling [21, 35]. The results of our research witness that the received information is required for taking decisions in managing of physical education and for working out of effective physical training programs for 6-10 yrs girls.

**Conclusions:**

Factorial analysis permitted to form the model of motor fitness and specify informative tests for their pedagogic control in every age group.
In factorial model of girls’ motor fitness the highest specific weight is in the following:

6 years – complex development of flexibility and motor coordination (factor 1), endurance and motor coordination (factor 2); quickness, speed-power and general coordination (factor 3); strength and vestibular stability (factor 4); power endurance (factor 5).

7 years – complex development of motor abilities (factors 1, 2); coordination (factors 3, 4, 5), flexibility (factor 6).

8 years – complex development of quickness, coordination and power endurance (factor 1); coordination abilities (factors 2, 5); flexibility (factor 3); endurance (factor 4); strength (factor 6).

9 years – power abilities and flexibility (factor 1); motor coordination and flexibility (factor 2); flexibility and motor coordination (factor 3), coordination (factors 4, 5).

10 years – coordination abilities (factor 1); quickness, speed-power and flexibility (factor 2); flexibility (factor 3); strength and motor coordination (factor 4); coordination and quickness (factor 5); quickness (factor 6).

The most informative tests for assessment of 6-10 yrs girls’ motor fitness are:

Test №2 “Walking along hexagon segments” (.961), №4 “Walking along straight line after 5 rotations, deviations” (.946), №15 “Index assessment of shoulder joints’ mobility” (.931) (6 yrs girls);

Test №8 “Catching of falling Dietrich’s stick” (.816), test №3 “Combined movements of arms, torso and legs” (.792), test №15 “Index assessment of shoulder joints’ mobility” (.775), test №13 “Torso bending from sitting position” (.761) (7 yrs girls);

Test №11 “Arms’ bending and unbending in mixed hanging on rope” (.858), test №8 “Catching of falling Dietrich’s stick” (.818), test №1 “Static stance on one foot” (.754) (8 yrs girls);

Test №1 “Static stance on one foot” (.868), test №2 “Walking along hexagon segments” (.822), test №13 “Torso bending from sitting position” (.840) (9 yrs girls);

Test №2 “Walking along hexagon segments” (.941), test №11 “Arms’ bending and unbending in mixed hanging on rope” (.894), test №15 “Index assessment of shoulder joints’ mobility” (.892), test №3 “Combined movements of arms, torso and legs” (.887) (10 yrs. girls).

Acknowledgements

The study has been fulfilled in compliance with plan of scientific-research works of Ministry education and science, youth and sports of Ukraine by topic 13.04. “Modeling of children’s and adolescents’ motor abilities’ training and development” (2013–2014) (state registration number 0113U002102).

Conflict of interests

The author declares that there is no conflict of interests.


29. Kozina Zh. Teoretichni osnovi i rezul’tati praktichnogo zastosuvannia sistemnogo analizu v naukovyi doslidzhienniam u inovativnih ob'iektiv i procesiv [Systemic approach and mathematical modeling of biological and natural objects and processes]. *Teoriia i metodika fizichnogo vikhovannia i sportu*, 2016;1:36–42. (in Ukrainian)


31. Repko E, Kozin S, Kostyrko A. Obuchenje dvigat'elm dejstvam detej doshkol'nogo i mladshego shkol'nogo vozrasta na osnove ikh psikhologicheskikh i fizicheskikh osobennyostei na primere skolazanija [Training of pre school age and junior school age children to motor actions on the base of their psychological and physical characteristics on example of rock climbing]. *Zdorov'e, sport, reabilitaciia*, 2016; 2:46–50. (in Ukrainian)


Information about the author:
Ivashchenko O.V.; http://orcid.org/0000-0002-2708-5636; tmfv@tmfv.com.ua; H.S. Skovoroda Kharkiv National Pedagogical University; Alchevskyh str. 29, Kharkov, 61002, Ukraine.

Cite this article as: Ivashchenko OV. Special aspects of motor abilities development in 6-10 years’ age girls. Pedagogics, psychology, medical-biological problems of physical training and sports, 2017;21(3):105–110. doi:10.15561/18189172.2017.0302

The electronic version of this article is the complete one and can be found online at: http://www.sportpedagogy.org.ua/index.php/PPS/issue/archive

This is an Open Access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited (http://creativecommons.org/licenses/by/4.0/deed.en).

Received: 24.03.2017
Accepted: 10.04.2017; Published: 30.04.2017
Analysis of Olympic Games (Rio de Janeiro, 2016) participants’ individual competition compositions in calisthenics
Kovalenko Y.O., Boloban V.N.
National University of Physical Education and Sport of Ukraine

Abstract

Purpose: to show structural elements of individual competition compositions of female gymnasts – Olympic Games (Rio de Janeiro, 2016) finalists.

Material: video-computer analysis of Olympic Games participants’ exercises; analysis of competition records.

Results: it was found that female gymnasts’ individual fitness is characterized by the following: correlation of time for Body Difficulty elements’ fulfillment and Apparatus Difficulty elements. It is expressed in quickness of preparation to element’s fulfillment; in logical and technically accurate transition from element to element. Accent on static elements permitted for sportswomen to reduce movements’ area. With dynamic style of elements’ fulfillment movements’ area was larger.

Conclusions: Most female gymnasts demonstrated natural elements’ distribution in compositions. Space movements opened the best views of static and dynamic elements’ fulfillment that was an evidence of female gymnasts’ high sportsmanship.

Keywords: female gymnast, individual exercise, composition, apparatus, construction, coordination, space, time, result.

Introduction

Calisthenics competitions at Olympic Games (OG) have been becoming traditional recent time. During Olympic cycle (2013-2016) competition rules were substantially changed [16]. Requirements to composition, difficulty of exercises and performance skillfulness came to the fore. Referees shall assess choreography, entertaining potential, exercises’ difficulty and space-time movements on site. With it, quantity of body elements was shortened in favor of tracks and apparatus’s manipulation. Sportswomen, who harmoniously combine technically correct fulfillment of Body Difficulty and Apparatus Difficulty elements with artistry of competition compositions, are assessed highly [11]. Artistry is motor functioning at high performance level and art taste [3, 7, 17-20]. In gymnastic artistry is understood as perfectness, completeness, expressiveness, elegance, uniqueness of movements and exercise in the whole [1]. Mistakes of artistry are: deficit of lightness, confidence, elegance; awkward movements, incomplete, tensed performance. In calisthenics artistry is an important element of performing mastery. It is a component of experts’ final evaluation of female gymnasts’ competition compositions [4].

In the researches, fulfilled two years, before Olympic Games 2016 [5], there were registered technical mistakes in fulfillment space-time indicators of individual exercises’ structural elements. It was found that space time movements in the structure of the fulfilled individual exercises are the basis of competition compositions [13]. Results of such researches proved validity of IFG (International Federation of Gymnastic) actions, directed at compositions’ perfection, based on increased requirements to difficulty and performing mastery. Composition picture is created by the following: correct and logical grouping of elements and their combinations on site; accurate space movements of a gymnast. Time characteristics permit to evaluate gymnast’s ability to fulfill elements of competition compositions. Such evaluation depends on quickness of preparation for elements and directly time of elements’ fulfillment.

Analysis of structural elements of female gymnasts – Olympic Games participants’ individual competition compositions is conditioned by need in determination of key structural elements, owing to which female gymnasts became finalists.

The purpose of the research is to show structural elements of individual competition compositions of female gymnasts – Olympic Games (Rio de Janeiro, 2016) finalists.

The tasks of the research:
1. Basing on analysis of special literature to study theoretical base of competition compositions’ individual exercises in calisthenics.
2. To study space-time structural elements of individual competition compositions of female gymnasts – Olympic Games (Rio de Janeiro, 2016) finalists.

Material and methods

Participants: we fulfilled video-computer analysis of 5 female gymnasts’ performances. All they were the finalists of calisthenics Olympic Games 2016 (4 kinds of individual multiathlon). Competition compositions were performed by female gymnasts from: Azerbaijan (AZE), Bulgaria (BUL), Byelorussia (BLR), Russian Federation (RUS), Ukraine (UKR) (see table).

Organization of the research: video-computer analysis of Olympic Games participants’ exercises and analysis of competition records were carried out. The purpose of video-analysis was study of space-time structural elements of individual compositions.

In the process of analysis we considered the following structural elements:
1. Time, spent for body difficulty elements’ fulfillment;
2. Time, spent for Apparatus Difficulty elements’ fulfillment;
fulfillment:
- Dance tracks (S);
- Elements of sportsmanship (M);
- Elements of risk (R);
3. Space movements of female gymnasts on site.

Statistical analysis: the materials of the research were processed with the help of mathematical statistic methods (Excel, Statistika) [8].

Results
Analysis of video records of the strongest female gymnasts’ individual exercises permitted to specify duration of compositions. In average it was 1,30 ± 0,03". It witnesses about absence of rough technical mistakes, connected with exceeding the time of competitions. Final results see in table below.

It was found that the most time for body difficulty elements was spent by Bulgarian gymnast (BUL) Neviana Vladinova. It was conditioned by fulfillment of jump combination, consisted first of single jump jete en tournant with torso backward arching and then of two jumps jete en tournant. When fulfilling jete en tournant in rings the gymnast realized throw in static position and waited for apparatus after throw (that was a technical mistake). In exercise with hoop Neviana Vladinova demonstrated interesting elements of sportsmanship and elements of risk. She accentuated on throwing of apparatus by legs and other parts of body without visual control. It made composition more expressive and difficult. Yana Kudryavtseva, female gymnast from Russian Federation (RUS) showed the least time, spent for body difficulty elements. She demonstrated the varied use of apparatus. In her performance sportsmanship elements were integral with dance tracks and risk elements. Fulfillment of body

<table>
<thead>
<tr>
<th>№</th>
<th>Name and surname of female gymnast, country, place and sum of points</th>
<th>Kind of individual multiathlon</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Margarita Mamun</td>
<td>D=9,55</td>
<td>E=9,5</td>
<td>D=9,65</td>
<td>E=9,5</td>
<td>D=9,55</td>
</tr>
<tr>
<td>RUS Place:1 (76,483)</td>
<td>Sc=19,050(2)</td>
<td>Sc=19,150(2)</td>
<td>Sc=19,05(1)</td>
<td>Sc=19,25(1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Marina Durunda</td>
<td>D=8,65</td>
<td>E=8,3</td>
<td>D=8,775</td>
<td>E=8,76</td>
<td>D=8,95</td>
</tr>
<tr>
<td>AZE Place:9 (69,748)</td>
<td>Sc=16,95(10)</td>
<td>Sc=17,541(9)</td>
<td>Sc=17,16(6)</td>
<td>Sc=17,541(6)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Yana Kudryavtseva</td>
<td>D=9,7</td>
<td>E=9,525</td>
<td>D=9,65</td>
<td>E=9,6</td>
<td>D=8,7</td>
</tr>
<tr>
<td>RUS Place:2 (75,608)</td>
<td>Sc=19,225(1)</td>
<td>Sc=19,25(1)</td>
<td>Sc=17,88(5)</td>
<td>Sc=19,25(1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Katsiaryna Halkina</td>
<td>D=9,0</td>
<td>E=8,966</td>
<td>D=9,00</td>
<td>E=8,966</td>
<td>D=8,75</td>
</tr>
<tr>
<td>BLR Place:6 (70,932)</td>
<td>Sc=17,966(6)</td>
<td>Sc=17,966(6)</td>
<td>Sc=17,65(8)</td>
<td>Sc=17,35(7)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Kseniya Mustafatseva</td>
<td>D=8,9</td>
<td>E=8,8</td>
<td>D=8,65</td>
<td>E=8,233</td>
<td>D=8,65</td>
</tr>
<tr>
<td>FRA Place:10 (68,240)</td>
<td>Sc=17,7(8)</td>
<td>Sc=16,833(10)</td>
<td>Sc=16,91(6)</td>
<td>Sc=16,74(10)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Melitina Staniouta</td>
<td>D=9,0</td>
<td>E=9,2</td>
<td>D=9,05</td>
<td>E=9,2</td>
<td>D=8,4</td>
</tr>
<tr>
<td>BLR Place:5 (71,133)</td>
<td>Sc=18,2(4)</td>
<td>Sc=18,2(5)</td>
<td>Sc=16,63(10)</td>
<td>Sc=18,05(5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Carolina Rodriguez</td>
<td>D=8,75</td>
<td>E=8,866</td>
<td>D=8,75</td>
<td>E=8,933</td>
<td>D=8,8</td>
</tr>
<tr>
<td>ESP Place:8 (69,949)</td>
<td>Sc=17,616(9)</td>
<td>Sc=17,683(8)</td>
<td>Sc=17,7(7)</td>
<td>Sc=16,95(9)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Son Yeon Jae</td>
<td>D=9,15</td>
<td>E=9,066</td>
<td>D=9,2</td>
<td>E=9,066</td>
<td>D=9,2</td>
</tr>
<tr>
<td>KOR Place:4 (72,898)</td>
<td>Sc=18,216(3)</td>
<td>Sc=18,266(4)</td>
<td>Sc=18,3(3)</td>
<td>Sc=18,116(4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Ganna Rizatdinova</td>
<td>D=9,1</td>
<td>E=9,1</td>
<td>D=9,25</td>
<td>E=9,2</td>
<td>D=9,25</td>
</tr>
<tr>
<td>UKR Place:3 (73,583)</td>
<td>Sc=18,2(4)</td>
<td>Sc=18,4(3)</td>
<td>Sc=18,45(2)</td>
<td>Sc=18,483(3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Neviana Vladinova</td>
<td>D=9,05</td>
<td>E=8,833</td>
<td>D=9,05</td>
<td>E=8,7</td>
<td>D=9,15</td>
</tr>
<tr>
<td>BUL Place:7 (70,733)</td>
<td>Sc=17,833(7)</td>
<td>Sc=17,75(7)</td>
<td>Sc=18,05(4)</td>
<td>Sc=17,05(8)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes: D – difficulty; E – performance; Sc – final points.
difficulty elements and apparatus difficulty elements took fractions of seconds. It witnesses about perfect technical fitness (see fig. 1).

Effective space movements in hoop exercise were registered in female gymnasts of Russian Federation (RUS) and Ukraine (UKR). Gymnasts covered the largest moving area (distance, covered by female gymnast in fulfillment of exercise). Yana Kudryavtseva [silver prize winner of OG 2016, Russian Federation (RUS)] started exercise from fixed moment of balance. Then she fulfilled diagonal dance track, coming in central position for turn in attitude. Covering 50% of site by semi-circumference she fulfilled dance track. This track smoothly passed into jump with rotation. These actions were preparatory for realization of the most important diagonal element: element of sportsmanship Dive Split Leap with high throw of apparatus and catching it (in rotation) behind the back in jump.

Ganna Rizatdinova, [silver prize winner of OG 2016, Ukraine (UKR)] improved her space movements’ indicators, comparing with previous researches in 2012-2015. She often moved on foreground in front of referees’ group and fulfilled elements of body difficulty at the highest technical level. Combination of three jeté en tournant was fulfilled circumferentially, with high amplitude and lightness (see fig. 2).

In exercise with ball the least time indicators were registered in gymnast from Republic of Byelorussia (BLR) Melitina Staniouta. She showed the highest degree of apparatus’s manipulation. All sportsmanship elements were built on use of rolls, repulses, passes of apparatus. The composition was completed by two sequential elements of sportsmanship. Risk element was fulfilled after rotating element – jump. This helped for gymnast to save time for additional throw of apparatus.

Azerbaijan (AZE) gymnast, Marina Durunda, in exercise with ball combined elements and kept balance not leaving support. Effective element of skillfulness (ball’s repulse by chest) was realized in element Stag leap. Besides, 14” were spent for fulfillment of two rotations’ combinations: rotating 7 pirouettes she earned high points in elements of body difficulty (see fig. 3).

In exercise with ball all female gymnasts shortened the time of space movements on site. Exclusion was only gymnast from Russian Federation (RUS) Yana Kudryavtseva. In her exercise there are diagonal, semi-circumferential, vertical and horizontal movements in respect to referees’ group. The least space movements were demonstrated by gymnast from Byelorussia (BLR) Melitina Staniouta. She covered site perimeter only one time that was minimal indicator among the studied compositions (see fig. 4).

In exercises with clubs time indicators did not change. To large extent it is characterized by technical and general fitness of female gymnasts. It permits to fulfill element without durable preparation and combine skillfulness and risk elements with elements of apparatus difficulty. Azerbaijan (AZE) gymnast demonstrated very high level. She fulfilled elements of body difficulty longer them al the rest. Many elements were completed by passing to acrobatic element that gives bonus of 0.1 point. Ganna Rizatdinova demonstrated maximal quantity of rotations.

Fig. 1. Indicators of time, spent for fulfillment of individual compositions’ with hoop structural elements, by female gymnasts from countries: A – AZE (Azerbaijan); B – BUL (Bulgaria); C – BLR (Republic of Byelorussia); D – RUS (Russian Federation); E – UKR (Ukraine);

- Green: Elements of body difficulty (BD);
- Blue: Elements of apparatus difficulty (AD);
- Brown: Dance tracks (S);
- Purple: Elements of sportsmanship (M);
- Yellow: Elements of risk (R);

113
Fig. 2. Kinds of female gymnasts’ movements on site in competition compositions with hoop:
A – Hoop composition of Azerbaijan (AZE) gymnast; B – Hoop composition of Bulgaria (BUL) gymnast; (BUL); C –
Hoop composition of gymnast from Republic of Byelorussia (BLR); D – Hoop composition of gymnast from Russian
Federation (RUS); E – Hoop composition of gymnast from Ukraine (UKR);
▲  - Beginning of exercise;
■  - End of exercise.

Fig. 3. Indicators of time, spent for fulfillment of individual compositions’ with ball structural elements, by female
gymnasts from countries:  A – AZE (Azerbaijan);  B – BUL (Bulgaria);  C – BLR (Republic of Byelorussia);  D – RUS (Russian
Federation);  E – UKR (Ukraine);
Elements of body difficulty (BD);
Elements of apparatus difficulty (AD):
Dance tracks (S);
Elements of sportsmanship (M);
Elements of risk (R);
in pirouettes attitude, penche. With long fulfillment of
exercise it brought positive effects: maximal assessment
of body difficulty elements, expressiveness and prevailing
over other gymnasts. In exercise one skillfulness element
was registered (2’’ in combination with body difficulty
element: balance. In this exercise accent was made on
body difficulty elements as well as on dance tracks (3, 8” each and 1 of 11’’). Competition rules dictate that
track shall be registered if fulfilled at 8” without technical mistakes (see fig. 5).
Fig. 4. Kinds of female gymnasts’ movements on site in competition compositions with ball: A – Ball composition of Azerbaijan (AZE) gymnast; B – Ball composition of Bulgaria (BUL) gymnast; (BUL); C – Ball composition of gymnast from Republic of Byelorussia (BLR); D – Ball composition of gymnast from Russian Federation (RUS); E – Ball composition of gymnast from Ukraine (UKR);

- Beginning of exercise;
- End of exercise.

Fig. 5. Indicators of time, spent for fulfillment of individual compositions’ with clubs structural elements, by female gymnasts from countries: A – AZE (Azerbaijan); B – BUL (Bulgaria); C – BLR (Republic of Byelorussia); D – RUS (Russian Federation); E – UKR (Ukraine);

- Elements of body difficulty (BD);
- Elements of apparatus difficulty (AD);
- Dance tracks (#);
- Elements of sportsmanship (M);
- Elements of risk (R);

In space moving on site, gymnast from Ukraine (UKR) (musical accompaniment in performance of Michael Jackson) movement “zigzag” should be noted, which was possible to be watched in suite as well. Sharp turns and diagonal movements reflected the character of music. Exercise of Bulgarian (BUL) gymnast Neviana Vladinova had all kinds of changeover: diagonal, semi-circumference. Besides, the gymnast moved vertically and horizontally in respect to ground jury. When fulfilling exercise with clubs, Neviana passed one circle of the
site, but with it, she came into angles very deeply. When fulfilling balance penche, she chose closed view in respect to referees’ group. It complicated watching of this element by referees.

The final chord of female gymnasts on Olympic site was exercise with ribbon. 4 gymnasts chose rhythmic music, characteristic for Brazil, as accompaniment. Visually, it accelerated the temp of gymnasts’ movements. Ganna Rizatdinova fulfilled exercise under accompaniment of rhythmic drumming, exciting Brazil audience by her durable turns and amplitude jumps. Yana Kudryavtseva was exclusion. For her Olympic Games brought a little

Fig. 6. Kinds of female gymnasts’ movements on site in competition compositions with clubs: A – Club composition of Azerbaijan (AZE) gymnast; B – Club composition of Bulgaria (BUL) gymnast; C – Club composition of gymnast from Republic of Byelorussia (BLR); D – Club composition of gymnast from Russian Federation (RUS); E – Club composition of gymnast from Ukraine (UKR);

- Beginning of exercise;
- End of exercise.

Fig. 7. Indicators of time, spent for fulfillment of individual compositions’ with ribbon structural elements, by female gymnasts from countries: A – AZE (Azerbaijan); B – BUL (Bulgaria); C – BLR (Republic of Byelorussia); D – RUS (Russian Federation); E – UKR (Ukraine);

- Elements of body difficulty (BD);
- Elements of apparatus difficulty (AD):
- Dance tracks (S);
- Elements of sportsmanship (M);
- Elements of risk (R);
disappointment. The gymnast made mistake in club exercise and lost her Olympic medal in favor of her team mate Margarita Mamun (Olympic champion in 2016). Final performance of Yana Kudryavtseva was under lyrical accompaniment. Exercise was fulfilled “on one breath”. The most beautiful passages from one element to another were smoothed by pictures of ribbon. The longest time was spent to dance tracks. It opened all technical skillfulness and elegance of this female gymnast. Body elements were fulfilled with passing to acrobatic elements and elements of dynamic balance (see fig. 7).

In space moving on site Yana Kudryavtseva takes leading positions. She fulfilled diagonal and semi-circumference several times. It permitted for her to show all ideal sides of choreographic fitness. Female gymnast Melitina Staniouta made mistake in club exercise and did not become a prize-winner. Ambitious and original dance tracks were fulfilled four times by diagonal and by straight line. The gymnast accented attention at referees’ jury and spectators. Gymnasts from Azerbaijan (AZE), Bulgaria (BUL) and Ukraine (UKR) improved the site moving in exercise with ribbon. According to rules, ribbon shall not be stopped and shall not touch the floor even for a moment. That is why gymnasts moved without any stops. They demonstrated movements by diagonal, circumference and by straight line as well as jumps combinations, risk elements and dance tracks (see fig. 8).

Discussion

At present calisthenics is popularized throughout the world. It is witnessed by increasing of quantity of countries, which cultivate calisthenics and are the members of International Federation of gymnastic. The means of calisthenics are universal: composition, music, apparatuses, dance steps, jumps, turns, balance and waves. These elements permit for female gymnasts to optimally and harmoniously demonstrate the highest coordination, flexibility, jumping [2, 14]. Methodic of calisthenics trainings is headily spread throughout the world. It is facilitated by active and creative work of experienced coaches from Ukraine (UKR), Russian Federation (RUS), Republic of Byelorussia (BLR); as well as of many scientists [6, 10, 15]; specialists from federation and managers. In final competitions of individual multiathlon at OG 2016 high level of sport-technical skillfulness was demonstrated by leaders of world gymnastic: from Russian Federation (RUS), Ukraine (UKR), Republic of Byelorussia (BLR). Female gymnasts from Republic of Korea (KOR), Bulgaria (BUL), Azerbaijan (AZE), Spain (ESP), France (FRA) were their worthy opponents. Below finalists there were also strong gymnasts from USA (USA), Kazakhstan (KAZ), Israel (ISR), Georgia (GEO), Greece (GRE), Japan (JPN) and Uzbekistan (UZB). They demonstrated rather qualified results, which separated them from final of competition by tenth, hundredth and thousandth of point. Such minimal gap illustrates high contest in world calisthenics. To gain victory it is necessary: to demonstrate competition compositions at high sport-technical and artistic level; to have balance psychic state in all competition period [9]. Competition composition is an outcome of coach’s and female gymnast’s mutual work. Such work shall be directed at

Fig. 8. Kinds of female gymnasts’ movements on site in competition compositions with ribbon: A – Ribbon composition of Azerbaijan (AZE) gymnast; B – Ribbon composition of Bulgaria (BUL) gymnast; C – Ribbon composition of gymnast from Republic of Byelorussia (BLR); D – Ribbon composition of gymnast from Russian Federation (RUS); E – Club composition of gymnast from Ukraine (UKR);

- Beginning of exercise;
- End of exercise.
opening sportswoman’s potential; her character. Besides, it is necessary to conceal motor actions, which are difficult for a gymnast. For this purpose it is necessary to accentuate elements, which female gymnast fulfills in the best manner. That is why it is important to consider structural elements in building composition: time, spent for body difficulty elements and apparatus difficulty elements; space movements on site. It is also proved by other researches [5]. We have studied structural elements of 4 kinds of multiatlon in 5 elite female gymnasts from: Azerbaijan (AZE), Bulgaria (BUL), Republic of Byelorussia (BLR), Russian Federation (RUS) and Ukraine (UKR). Our results show that time indicators to large extent are characterized by gymnasts’ technical fitness. Ganna Rizatdinova demonstrated high level of space time structural elements. It permitted for the fitness. Yana Kudryavtseva – silver prize-winner in OG 2016. Margarita Mamun, prize-winners Yana Kudryavtseva and Ganna Rizatdinova demonstrated the best possible manipulation of apparatus and body. The transmitted musical accompaniment very sensually and performed elements in the best views by diagonal, semi-circumferential and straight line. Gymnast from Byelorussia (BLR) Melitina Staniouta) performed elements with apparatus at high technical fitness level and emotional reflection of music.

2. Analysis of female gymnasts’ individual exercises’ competition compositions proved their high fitness level. Sportswomen demonstrated high sportsmanship and its important component – performing mastery. OG champion Margarita Mamun, prize-winners Yana Kudryavtseva and Ganna Rizatdinova demonstrated the best possible manipulation of apparatus and body. When building competition composition it is important to consider the chosen pattern and correct time for preparation for elements’ fulfillment. Besides, it is necessary to choose correct space view of the demonstrated static and dynamic composition’s elements. Deep analysis of individual exercises’ space-time structural elements will permit to credibly assess competition composition and work out modern methodic of its perfection.

Conclusions

1. Competition composition of individual exercises in calisthenics consists of body difficulty and apparatus difficulty elements (dance tracks, elements of skillfulness and elements of risk). Procedure of difficulties’ fulfillment is free. Difficulties shall be organized and performed logically, smoothly passing in to intermediate movements and elements. Together with idea they shall create composition. It is more than series of difficulties.

2. Analysis of female gymnasts’ individual exercises’ competition compositions proved their high fitness level. Female gymnasts demonstrated combination of body difficulty and apparatus difficulty elements. It also shortens the time of exercise’s fulfillment, eliminating duplicated preparation for performance. Thus the time for preparation for element itself is also saved. In this case, for 1’30” gymnast demonstrates more elements, in good view for referees’ assessment. These elements combine with amplitude semi-circumferential, diagonal, straight and polygonal movements. Thus, objective opportunity to visualize idea of competition composition in space is created.

Acknowledgments

The researches have been fulfilled in compliance with combined plan in the sphere of physical culture and sports for 2016-2020, by topic 2.11 (state registration number 0116U002571).

Conflict of interests

The authors declare that there is no conflict of interests.

References:

1. Averkovich EP. Kompoziciia uprazhnenij v khudozhestvennoj gimnastike [Composition of exercises in calisthenics], Moscow: VNIFK; 1989. (in Russian)
2. Boloban VN. Reguliacia pozy tela sportsmena [Regulation of sportsman’s body position]. Kiev: Olympic Literature; 2013. (in Russian)
3. Viner IA. Artistichnost’ i puti ee formirovaniia [Artistry and the ways of its formation], Moscow: Men; 2014. (in Russian)
4. Karpenko LA. Khudozhestvennaia gimnastika [Calisthenics], Moscow: Federation of Russia; 2003. (in Russian)
Information about the authors:
Kovalenko Y.O.; http://orcid.org/0000-0001-9417-501X; kovalenkoyana@mail.ru; National University of Physical Education and Sport of Ukraine; Fizkultury str. 1, Kiev, 03680, Ukraine.

Boloban V.N.; http://orcid.org/0000-0001-9119-0695; wboloban@ukr.net; National University of Physical Education and Sport of Ukraine; Fizkultury str. 1, Kiev, 03680, Ukraine.

Cite this article as: Kovalenko YO, Boloban VN. Analysis of Olympic Games (Rio de Janeiro, 2016) participants’ individual competition compositions in calisthenics. Pedagogics, psychology, medical-biological problems of physical training and sports, 2017;21(3):111–119. doi:10.15561/18189172.2017.0303

The electronic version of this article is the complete one and can be found online at: http://www.sportpedagogy.org.ua/index.php/PPS/issue/archive

This is an Open Access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited (http://creativecommons.org/licenses/by/4.0/deed.en).

Received: 13.02.2017
Accepted: 25.02.2017; Published: 30.04.2017

119
Special aspects of Ukrainian schoolchildren’s eating behavior

Podrigalo L.V.1,2, Iermakov S.S.3, Avdiievska O.G.1, Rovnaya O.A.2, Demochko H.L.4

1V. N. Karazin Kharkiv National University, Ukraine
2Kharkiv State Academy of Physical Culture, Ukraine
3Kazimierz Wielki University, Bydgoszcz, Poland
4Kharkiv National Medical University, Ukraine

Abstract
Purpose: analysis of school age children’s eating behavior.
Material: in questioning 408 schoolchildren (15-16 and 17-18 years’ age) participated. Distribution by sex was practically equal: 56.62% were girls and 43.38% - boys. The questionnaire included questions about frequency of eating some food during recent 30 days. Separate block of questions was devoted to eating habits and presence of the so-called “food trash” in diet. The bent to alimentary diseases was assessed by incidence of excessive body mass in respondents’ families.

Results: The determined food consumption permitted to assume the presence of certain eating stereotype: for boys it is directed at development of muscular mass and for girls – mainly of limiting character, connected with diets for correction of constitution. Analysis of some food eating frequency permitted to mark out alimentary risk factors, which require correction and prophylaxis.

Conclusions: the found special aspects of eating behavior permit to assess children’s health state as pre-nosology of alimentary genesis, manifested in excessive body mass, deficit of essential vitamins, minerals and food fibers; functional disorders of digestion.

Keywords: eating, schoolchildren, diet, eating behavior, physical activity.

Introduction
The existing social-economic situation in Ukraine facilitates increase of children’s pre-nosological states of health [34]. In the worked out prophylaxis programs optimization of eating takes important place. It permits to substantially raise children’s adaptation potential, ensure organism with required biologically active substances [2, 40]. As on to-day eating is considered to be one of the most important life components, conditioning health [7].

Turconi et al. [41] studied eating habits and behavior of Italian adolescents. Among the tested, persons with unhealthy eating and low knowledge in this field prevailed. Scientists from Iran [27] found that increased physical activity and consumption of milk food facilitate reduction of body mass index. Influence of increased motor functioning on body composition is noted also in works of Polish authors [18, 20]. Rather wide scale research [6] was devoted to study risk factors of chronic diseases in USA secondary school pupils. Among them substantial place is taken by factors, connected with eating. In other works the parents’ role in formation of children’s eating habits, is underlined [21]. Important factor is also environmental conditions, which influence on children’s and adolescents’ eating [19].

Eating habits are closely connected with body mass and children’s way of life [4]. Disordered eating behavior and messy food influence on adolescents’ body composition [9, 23, 37]. Adolescents-girls are seriously troubled and unsatisfied with their boy shapes. It is a potential mediator in changing their eating behavior [30]. Especially dangerous is influence of food commercials in primary school on children’s consuming habits [24].

In opinion of Hummel and Hoffmann [16] eating behavior is a complex phenomenon. With its assessment it is necessary to consider cause-effect dependences between food consumption and health. Population studies, conducted in different countries [10, 13, 38] proved significance of eating behavior as mean of diet optimization.

The purpose of the research is analysis of school age children’s eating behavior.

Material and methods
Participants: as source material we used results of anonym questioning of 408 schoolchildren – pupils of 9th (15-16 years’ age) and 11th (17-18th years’ age) form. Distribution by sex was practically equal: 56.62% were girls and 43.38% - boys.

The research was conducted in compliance with WMA Declaration of Helsinki – Ethical Principles for Medical Research Involving Human Subjects, 2013 [44].

The design of the research implied questioning. The questionnaire included questions about frequency of eating some food during recent 30 days. Separate block of questions was devoted to eating habits and presence of the so-called “food trash” in diet. The bent to alimentary diseases was assessed by incidence of excessive body mass in respondents’ families. The research was conducted in spring. It permitted to assume that in diet there was variable assortment of food.

Statistical analysis of the received data was fulfilled with the help of licensed Excel and SPSS programs. Statistical processing included application of variation statistic indicators as well as parametric and non-parametric parameters.
Results

Study of some food products’ eating frequency permits to sufficiently exactly assess variability and completeness of diet. It also permits to prognosticate food influence on functional state of the research participants [35]. The fulfilled analysis showed some gender specific features of main food products’ eating. Meat is confidently (p<0.05) more frequent in daily diet of boys – 31.79±3.55% (girls – 21.78±2.91%). Though, girls eat meat more frequently 2-3 times a week – 50.00±3.53% (boys – 36.99±3.68%). At the same time boys oftener prefer everyday eating of cooked sausages and frankfurters – 26.47±3.39% (girls – 17.83±2.53%). In respect to smoked sausages the situation is opposite: 83±2.53%. In respect to smoked sausages the situation is opposite: girls informed that they do not eat them at all – 28.14±2.97% of girls informed that they do not eat them at all (boys – 18.34±2.99%).

Fish is present in boys’ diet the most frequently. 33.57±4.01% of boys (girls – 22.91±2.80%) said that they eat it regularly. 17.18±2.51% of girl against 0.71±0.71 do not eat fish at all.

Certain distinctness was found in analysis of milk and milk food consumption, which are irreplaceable in children’s eating. With absence of noticeable distinctions in frequency of everyday consumption, girls’ monthly diet contained these products oftener: (10.43±2.02%) against (4.76±1.65%). At the same time they oftener eat fermented milk products: (45.89±3.29%) against (34.68±3.63%), (p<0.05). This assumption is proved by analysis of fresh vegetables and fruits’ eating. Everyday consumption of fresh vegetables is oftener among girls: (76.52±2.80%) against (63.58±3.57%). The same tendency was observed in everyday consumption of fresh fruits: (76.75±2.80%) against (64.71±3.68%). With it, boys much oftener noted full absence of fresh vegetables and fruits in their diets.

Considering the age of our respondents it was interesting to compare frequency of confectionary consumption. It was found that boys’ eating of candies is confidently more frequent: (31.79±3.55%) against (21.78±2.91%). Girls eat these products regularly mainly 2-3 times a week (50.00±3.53%) against (36.99±3.68%).

Concerning pastries and other fancies we did not find substantial differences by gender belonging. About 20% of respondents said about everyday eating and 40% - about regular.

Analyzing consumption of ice-cream, mayonnaises, ketchup and sauce we found practically no gender distinctions. But prevalence of these products in diets also causes certain trouble. Nearly 30% of children informed about everyday eating of ice-cream and 40% - about its regular presence in diet.

Only 16% of children informed about everyday consumption of sauces, ketchups and mayonnaises and 25-30% - about regular.

Definite distinctions were determined in comparison of food consumption in respect to age. For example, older girls pointed that they eat less meat everyday: (40.95±4.82%) against (53.60±4.48%), (p<0.05). In older boys regular eating of smoked sausages is less expressed: (12.24±4.73%) against (30.83±4.23%), (p<0.05). Besides, 11th form girls noted that they more regularly eat curd than younger schoolgirls, accordingly: (39.22±4.86%) against (26.19±3.93%), (p<0.05). At the same time consumption of fermented milk products in general is oftener in junior schoolgirls: (53.97±4.46%) against (36.19±4.71%), (p<0.05). Though about regular consumption of such products senior schoolgirls informed: (41.90±4.84%) against (22.22±3.72%), (p<0.05). Besides, in younger group everyday ice cream consumption was more frequent: (44.44±4.44%) against (22.12±4.09%), (p<0.05).

Much more frequent eating of pastries and fancies was in 9th form girls. In 11th form girls the frequency of such products’ consumption was (27.42±4.02%) against (12.50±3.26%), (p<0.05).

Separate block of questions was devoted to consumption of the so-called “Food trash”. The received data permits to say that such products are rather popular among schoolchildren. Besides, the presence of certain gender specific features was found. Chips and baked breads are confidently more frequent in boys eating: (22.67±3.20%) of them informed about regular eating such food; girls, on the contrary oftener informed about full denial of such products (39.13±3.23%) against (19.77±3.05%).

At the same time 9th form pupils consume chips and baked breads everyday oftener then 11th form pupils (9.76±2.69%) against (2.04±2.04%), (p<0.05).

Fast food products are confidently oftener consumed by boys (11.18±2.42%) against (3.04±1.14%). Girls much oftener note their full absence in diet. Concerning street food eating (shawarma, hot-dogs, pies) situation also can not be called favorable. Only 1-2% of schoolchildren informed about everyday consumption of such food. More than 50% noted that they do not consume such food at all. However, everyday consumption of such food is more frequent among boys: (15.20±2.75%) against (3.91±1.28%). Girls much more frequently refuse street food at all: it was informed by (71.74±2.98%) of girls against (47.37±3.83%) of boys. Results of fast food consumption frequency confirm their higher popularity among boys. For example 11.24±2.44% of boys informed about their regular presence in diet. It is much higher than in girls (3.93±1.29%).

In order to approximately assess possible disorders of alimentary status we analyzed prevalence of excessive body mass in respondents’ families. It was found that in pupils’ parents it is met more frequently: (28.65±3.27%) informed about its presence in fathers and (22.40±3.02%) – in mothers. Besides, 41.67±3.57% of the questioned proved excessive body mass in grandmothers and grandfathers.

Discussion

Study of main food products consuming frequency shall be carried out, considering inter-connections in system, “eating-health”. Special aspects of any diet are...
connected with specific characteristics of health and depend on knowledge in this field. Analysis of primary school age children’s eating [32] showed the deficit of main food substances and average level of knowledge in this field. The highest quantity of knowledge gaps was found with assessment of role of different food groups.

The applied method of assessment of food consumption frequency is commonly accepted and sufficiently precise that is rather important in studies of eating. For example, Humphries L.L. и Gruber J.J. [17] used the method of 24 hours analysis of eating, studied eating behavior and control of university students’ body mass. They found great specific weight of errors of situation by respondents. It requires correction of the received information.

Pilot study of eating organization in Italian schools [37] points at high incidence of diseases, connected with eating disorders. It requires realization of prophylaxis and educational programs.

The found by us more frequent consuming of meat and fish products by boys illustrates increase of irreplaceable amino acids. Refusal of smoked food by girls is a manifestation of healthy orientation of eating (considering great quantity of food ads in smoked food).

Such distribution of food consumption (as main source of proteins) permits to assume the presence of certain eating stereotype: for boys – directed at development of muscular mass; for girls – mainly of restrictive character, connected with demand and desire of body constitution’s correction. About the presence of stereotype Martinchik A.N., Maev I.V., Ianushevich O.O. [26] informed, when they studied eating behavior of adolescents, influencing on their health.

Similar results were received also in other works Chang Y.-J., Lin W., Wong Y. [5] The authors studied correlations of eating, eating behavior and health. In 17.11% of Taiwan secondary schools disorders of eating behavior were proved. Especially frequent eating behavior disorders are in adolescents, who follow limiting diets. They result in deficit of energy, proteins, carbohydrates, zinc, vitamins B6 and B12. Disorders of eating behavior were assessed as risk factor for digestion.

Visser J., Notelovitz T., Szabo C., Fredericks N. [42] studied incidence of eating behavior disordering and weight loss in Jude girls-adolescents. They found that every fifth participant had wrong eating behavior. Every third girl considered her weight excessive. They also proved great incidence of restrictive diets. More than 60% of the participants used them and 19.1% applied extreme weigh loss methodic. Close connection of eating behavior, eating and knowledge in this field was proved by Dixit S. и др. [8]. These authors analyzed the state of girls-adolescents, living in India, in countryside. Insufficient eating is a risk factor for health and can cause obstetric complications in the future.

Certain eating stereotype, mentioned in our research, is also proved by analysis of milk and milk products consumption. Increase of fermented milk share in diet reflects orientation on healthy eating, connected with restriction of fats.

Hart M. [14] thinks that eating behavior disordering. It is the main reason of digestive problems, especially of restrictive character. Its normalization ensures prophylaxis of diseases.

Comparative analysis of fresh vegetables and fruits consumption also illustrates certain specific features of eating. Earlier we have already assumed that orientation on healthy eating differs depending on sex. These facts permit to assume great risk of vitamins’ deficit, as well and mineral substances and food fibers in boys. The results, received by us prove eating behavior data of other authors. For example, Oosthuizen D., Oldewage-Theron W., Napier C. [38] analyzed eating structure of primary and secondary school age children. They determined the most frequently consumed food products; assessed correlations between knowledge in this field and food consumption. The diets, they studied, had expressed carbon-hydrate character, with high content of refined sugar and fats and insufficient consuming of beans vegetables and fruits.


Sharkey J. R., Haines P. S., Zohoori N. [39] proved the presence of correlations between peculiarities of eating and health disorders. The persons with high eating risk have functional disorders 2.4 times more frequently. They also made conclusion about eating characteristics’ importance as screening for required correction.

Bordi P. L., Cranage D. A., Lambert C., Smith J. [3] studied eating behavior of secondary school, age children. They assessed the quantity of food intakes, habits and proclivities, connected with eating. They found wrong eating regimes (the most often it was missing of breakfast). Eating habits were connected with preference of certain food.

The available information about confectionary consumption can also be assessed as unfavorable in respect to health: excess of sweets is a risk factor for digestion and caries. Consuming of pastries and other fancies shall be assessed as alimentary risk factor. Their excess can facilitate excessive body mass and in the future can cause many chronic non-infectious diseases (obesity, diabetes, atherosclerosis and etc.).

Analysis of confectionary and ice-cream consumption permits to assume that diet is overloaded with monosaccharide. Considering modern technologies, we can also speak about overloading by food ads.

Rather frequent consumption of fat-containing sauces permits to assume latent increase of fats’ specific weight in eating. It results in increase of overloading with food ads, which are widely used in their production as well as in strengthening of chemical irritating impact of food. All these shall be assessed as alimentary risk factor.

Thus, analysis of some food products’ consumption frequency permitted to find a number of gender distinctions, which characterize eating stereotype of modern schoolchildren, as well as to mark out alimentary
risk factors, which require correction and prophylaxis. It should be pointed that sociological method of research is rather subjective. That is why its addition with objective methods, permitting to prove assumptions, can be rather promising. In context of health monitoring the preference shall be given to screening assessment.

Williams P. [43] carried out comparative analysis of Australian children and adolescents’ breakfasts. He found that typical breakfast of young Australians was characterized by low content of fat, high content of carbohydrates and sufficient quantity of thiamine, riboflavin, niacin, calcium and magnesium. If not to include cereals in breakfast the probability of the mentioned above elements’ deficit increases. Regular breakfast is considered a sign of healthy eating. The received data are proved by results of other works [1, 12, 31].

Analysis of the so-called “food trash” consuming can serve as one more proof of earlier assumption about healthier eating of girls. Thus, analysis of “food trash” products’ consumption brings us to the following conclusions:

• These products are rather frequent in diet, and their regular consuming shall be assessed as risk factor for digestion;
• Hygienic literacy of girls is much higher than boys’; it is proved by prevailing of girls’ denials of such products;
• Propaganda of healthy eating is insufficient that conditions the demand in such measures’ including in prophylaxis complex.

Analysis of eating organization in schools of province Bluefontane (South Africa) permitted for Mekol L. et.al. [29] to conclude that its organization was unsatisfactory. As one of important risk factors for health they assessed niacin, calcium and magnesium. If not to include cereals in diet of Australian children and adolescents’ breakfasts. He found peculiarities of eating behavior permit to assess for creation of targeted prophylaxis programs. The received results prove validity of eating behavior studying in the frame of school age children health monitoring, considering its specific characteristics for creation of targeted prophylaxis programs. The found peculiarities of eating behavior permit to assess respondents’ health as pre-nosological of alimentary genesis, which is reflected in excessive body mass, deficit of essential vitamins, mineral substances and food fibers, functional disorders of digestion. All these require working out targeted measures, directed at eating and alimentary status correction. Substantiation and working out of eating behavior objective criteria for adding of information about health; establishing of “feedback” of alimentary factor’s influence on it are rather important and relevant tasks.

Conclusions

Thus, the received results prove validity of eating behavior studying in the frame of school age children health monitoring, considering its specific characteristics for creation of targeted prophylaxis programs. The found peculiarities of eating behavior permit to assess respondents’ health as pre-nosological of alimentary genesis, which is reflected in excessive body mass, deficit of essential vitamins, mineral substances and food fibers, functional disorders of digestion. All these require working out targeted measures, directed at eating and alimentary status correction. Substantiation and working out of eating behavior objective criteria for adding of information about health; establishing of “feedback” of alimentary factor’s influence on it are rather important and relevant tasks.

Conflict of interests

The authors declare that there is no conflict of interests.

References


condition in children, adolescents and young adults: diagnosis, prognosis and hygienic correction], Kiev: Geneza; 2014.


40. Storozhik AI, Guligas AG, Tumanova VN. Dynamic of vertical stability indicators of junior schoolchildren, who have weakened hearing, under influence of physical education means. Pedagogics, psychology, medical-biological problems of physical training and sports, 2015;6:30-34. doi:10.15561/18189172.2015.0605


Information about the authors:

Podrigalo L.V.; http://orcid.org/0000-0002-7893-524X; l.podrigalo@mail.ru; Kharkov State Academy of Physical Culture; Klochkovskaya str. 99, Kharkiv, 61022, Ukraine.

Iermakov S. S.; http://orcid.org/0000-0002-5039-4517; sportart@gmail.com; Kazimierz Wielki University in Bydgoszcz; Sport str. 2, of.209, 85-064 Bydgoszcz, Poland.

Rovnaya O.A.; http://orcid.org/0000-0003-1519-5632; rovnaya0ga@mail.ru; Kharkov State Academy of Physical Culture; Klochkovskaya str. 99, Kharkiv, 61022, Ukraine.

Avdiievska O.G.; http://orcid.org/0000-0001-5764-5254; olena.avdievska@karazin.ua; V. N. Karazin Kharkiv National University; 4, Suvobody Sq., 61022, Kharkiv, Ukraine.

Demochko H.L.; http://orcid.org/0000-0001-5744-5893; inio2@ukr.net; Kharkiv National Medical University; 4 Nauky Avenue, 61022, Kharkiv, Ukraine.

Cite this article as: Podrigalo LV, Iermakov SS, Avdiievska OG, Rovnaya OA, Demochko HL. Special aspects of Ukrainian schoolchildren’s eating behavior. Pedagogics, psychology, medical-biological problems of physical training and sports, 2017,21(3):120–125. doi:10.15561/18189172.2017.0304

The electronic version of this article is the complete one and can be found online at: http://www.sportpedagogy.org.ua/index.php/PPS/issue/archive

This is an Open Access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited (http://creativecommons.org/licenses/by/4.0/deed.en).

Received: 12.02.2017
Accepted: 25.02.2017; Published: 30.04.2017
Influence of mature men way of life on highly intensive physical activity

Pryshva O.B.
Kherson State University

Abstract

Purpose: Highly intensive physical activity is the most effective for men’s health protection. In modern life conditions its level is insufficient. It requires organism’s appropriate physical activity, which is determined by way of life. Especially important it is before trainings. To study special aspects of different intensity’s physical activity; of eating special food and sleeping regime of mature men before their highly intensive physical trainings.

Material: In experiment men (n=26, age - 35-53 years), who practice healthy life style and independent physical activity of high intensity, participated. We used bio-register Basis B1. Every day we registered: Peak – physical activity of different intensity; duration and quality of sleep; relative weight of consumed food. Besides, we calculated body mass index and physical condition. The study was conducted during 30 days in winter period. The following results were compared: indicators before not planned physical activity and average-monthly indicators.

Results: Before arbitrary physical functioning we found in men: confident weakening of average intensity (by 9-11%) and low intensity (by 10%) physical activity; confident increase of consumed food’s relative weight (by 6.82%), vegetarian food (by 10.64%) and raw food (by 7.61%); confident reduction of animal origin food (by 8.7%). No changes were found in duration and quality of sleep before highly intensive physical functioning.

Conclusions: Specific features of mature men’s way of life before their not planned highly intensive physical functioning are as follows: reduction of general physical activity; increase of consumed food. These factors facilitate energy accumulation in organism for its realization in highly intensive physical functioning the next day.

Keywords: way of life, physical activity (functioning), eating, sleeps, physical condition, men, mature age.

Introduction

Physical activity (PA) is one of required conditions of healthy full-fledged life. Human modern way of life leaves still less and less space for realization of this important function of organism. From minimal required daily distance mature men walk only half [20, 21]. For cardio-vascular system’s (CVS) and general physical condition normalization physical activity of high and moderate intensity is the most effective [7]. But mature man’s organism is not always ready for such intensity. In researches [2, 3] we found dependence of men’s highly intensive physical activity (HIPA) on CVS current condition. It served as indicator of human general physical condition at the beginning of training day, which, probably, is conditioned by life style the day before. The most substantial physiological factors, influencing on human physical condition, are: physical functioning of other intensity, eating and sleep [19], on which physical condition and ability of healthy man to practice HIPA depend. Traditionally components of mature men’s life style are studied for prevention from widely spread age diseases. Recent years the quantity of works devoted to influences of life style components on human physical condition has been increasing [8, 12, 18]. In other work it was proved [17], that optimal HIPA planning for men is realized in days of increase of CVS tension (within standards) in respect to previous day. Other studies also prove dependence of physical condition on PA, immobile way of life, rest regime [13, 16, 19].

Eating regime and consumed food products are the most significant factors in formation of human physical condition [12]. Besides, there is inter-dependence between eating and physical activity [6]. The author found influence of some food products on men’s PA [18]. Besides, it was found that some food products influence on human physical condition and improve sport results [5].

Sleep plays important role in control of organism’s metabolism. Sleep quality is directly connected with human life quality [4]. As per the data of many researches sleep of adult person shall take from 7 to 8 hours a day. Sleep deficiency reduces PA level. At the same time sleep sufficiency facilitates increase of PA [8]. Night sleep can be regarded in day and night format as a source of energy accumulation before active phase. Besides, it can be regarded as result of day active phase. Organism shall have enough energy for next day. In case of incomplete sleep organism can start the day with energy deficit. Human organism has to compensate this deficit from other sources and one of them can be excessive eating [9]. Besides, certain dependences between the set of consumed food products, their quality and sleep duration were determined [11, 15], as well as between PA kinds and sleep quality [10].

Hypothesis: it was assumed that specific features of life style before HIPA will help to understand of stimuli emersion for HIPA in men and simulate these specificities.
for increase PA trainings’ quantity.

**Purpose:** to study special aspects of different intensity physical activity; eating special food; sleeping regime of mature men before their highly intensive physical trainings.

**Material and methods**

**Participants:** in experiment men (n=26, age - 35-53 years), who practice healthy style and independent physical activity of high intensity in the forms of health related run, swimming and fitness, participated. All participants were instructed at medical-biological disciplines’ department of Kherson state university. In the research bio-registers BASIS B1, BASIS PEAK were used.

**Organization of the research:** the studies were fulfilled at the south of Ukraine in winter period 2015. During 30 days we studied special aspects of men’s life style before not planned HIPA trainings and compared them with everyday indicators. The participants practiced usual life style and every day registered their physical condition indicators in the morning: body weight, heart beats rate (HBR) blood pressure (BP); general weight of consumed food products as per their origin: animal, vegetarian, raw. During day and night bio-registers registered physical activity: high (85% from maximal admissible for the age – 145bpm and higher), average (from 70% to 84%, - 121-145bpm) ad low (from 50% to 69%, - 88-120 bpm). We noted: daily PA – as quantity of steps (steps/day) in each zone; PA time (min/day), except low intensity; PA intensity (steps/min). Besides, we registered sleep duration (min) and its quality in percents (%) per day and in night time.

According to experimental requirements HIPA trainings shall not be planned beforehand. Men practiced HIPA only if individual wish appeared.

**Statistical analysis:** basing on daily reports of the participants and bio-registers’ indicators we calculated: body mass index (BMI) (kg/m²); index of cardio-vascular system’s adaptation potential by Bayevskiy (API) was calculated in absolute units (a.un.) [1]; HBR during HIPA trainings. For general physiological characteristic of the participants PA results were calculated every week. For comparison of days before HIPA with average monthly (without days with HIPA) results were rendered in day/night format.

Percents were calculated by formula 
\[ x = (b-a) \cdot a \cdot 100\% \]

where, \( x \) – is percentage value; \( a \) – previous indicator and \( b \) – next indicator of compared pair of numbers.

Statistical processing was fulfilled with methods of non parametrical statistics as far as results did not correspond to normal distribution. We found the following: 95% inter-quartile range (IR), median (\( Me \)). Comparison of indicators between days was fulfilled with the help of Wilcoxon’s criterion with level of confidence (\( p=0.05 \)). EXCEL and Statgraphics16 programs were applied.

**Results**

Physiological characteristic of mature men (see table 1) was based on BMI values (which was in average 27.83 kg/m²) and API (average indicator – 1.61 a.un.). Such data show normal condition of men’s cardio-vascular systems. Per one week men’s HIPA was 2.1 times with volume of 3604.71 st/week and spent time – 21.53 min. The tested average HBR during HIPA trainings was 143.31 bpm. It characterizes its high intensity.

Comparative of average and low intensity daily PA before HIPA trainings showed significant distinctions (see table 2). Quantity of steps in average intensity PA before HIPA was 3072.42 st/day. It is by 9.15% confidently less than everyday indicators (3353.50 st/day). Quantity of low intensity PA steps before training was 5960.23 st/day. It is by 10.41% confidently less than everyday quantity (6682.19 st/day). Average intensity PA time before HIPA was 30.46 min/day. It is by 11.13% confidently less than everyday indicators (33.85 min.). Day intensity of average PA had no substantial distinctions: only 1.79% with quantity of 80.87 st/min before HIPA and 82.32 st/min. everyday. On the contrary, low daily intensity before HIPA was 5.72 st/min. and everyday – 6.31 st.min. It is by 10.4% confidently less.

Comparison of consumed food products before HIPA and everyday showed significant distinctions by all indicators (see table 3). Relative weight of consumed food before HIPA was 30.65 g. It is by 6.82% more than every day (28.65 g). Relative weight of animal origin food before HIPA was 6.45 g. It is by 8.7% less than everyday consumption (7.01 g). Relative weight of vegetation origin food before HIPA was 21.25 g. It is by 10.64% more than everyday (19.53 g.). Relative weight of raw food before HIPA was 16.26 g. It is by 7.61% more than everyday consumption (15.02 g).

Rest regime was studied by indicators of day/night sleep, night sleep and their quality (see table 4). We did not find confidence differences between sleeping before

---

**Table 1. Physiological indicators of mature men, who practice healthy life style (n=26)**

<table>
<thead>
<tr>
<th>№</th>
<th>Indicators</th>
<th>Me (95%IR)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>BMI (kg/m²)</td>
<td>27.83 (25.08;30.58)</td>
</tr>
<tr>
<td></td>
<td>API (a.un.)</td>
<td>1.61 (1.53;1.69)</td>
</tr>
<tr>
<td></td>
<td>Quantity of HIPA per week (times/week)</td>
<td>2.1 (1.08;3.12)</td>
</tr>
<tr>
<td></td>
<td>HIPA (steps/week)</td>
<td>3604.71 (2816.43;4392.99)</td>
</tr>
<tr>
<td></td>
<td>HIPA time (min/week)</td>
<td>21.53 (17.34;25.72)</td>
</tr>
<tr>
<td></td>
<td>HBR during HIPA (bpm)</td>
<td>143.31 (134.28;152.34)</td>
</tr>
</tbody>
</table>
HIPA and in everyday regime. Before HIPA sleep duration was 505.24 minutes, with difference of 1.52%, comparing with everyday sleep (497.57 minutes). Sleep quality was 81.37% before HIPA and 79.07 in every day regime (difference – 2.83%). Night sleep duration was 450.78 minutes before HIPA and 457.96 everyday (difference – 1.59%). Night sleep quality before HIPA was 79.76%, and every day – 78.94% (difference – 1.02%).

Discussion
Analysis of men’s physical condition supplemented information [10, 12] about tendency to excessive weight of men and insufficient HIPA level [9, 114]. In our study BMI of men exceeds standard by 2.83 kg/m². With it, cardio-vascular system corresponds to API requirements (1.80 a.un.) [1]. The daily quantity of walked steps witnesses about mainly immobile lie style of most of urban population. The quantity of average intensity steps corresponds to standard indicators (3000 st/day) [21]. Weekly PA of high intensity is insufficient to meet the recommendations of World health protection organization and other researches [14]. This indicator is 1 minute/day.
more than average statistical [21]. The tested HBR and quantity of steps per minute during HIPA trainings prove their high intensity for this age category of men [20].

Comparative analysis of men’s PA proved for the first time that before HIPA physical activity of other intensity was confidently lower: by quantity of daily steps; by PA time; by quantity of steps per minute in zone of low intensity. Such PA reduction witnesses about accumulation of energy before HIPA. Exclusion was only quantity of steps per minute in PA of average intensity. It can be regarded as factor of men’s individuality, which does not depend on energy accumulation or consumption.

Eating is the most substantial factor of life style. For the first time we proved that consumed per day relative weight of food products in total, vegetarian raw food products was confidently higher before HIPA than in other days. Relative weight of animal origin food was confidently less. Total quantity and qualitative content of the consumed food products, prevailing carbohydrates facilitate accumulation of energy in organism before HIPA. Confident reduction of animal origin food is conditioned by reduction of energy consuming for organism kind of food [5].

Sleep is a result of life style in previous day. Sleep duration before HIPA and everyday corresponds to age standards [8]. There were no distinctions in duration and quality of sleep with confident PA reduction and increase of food consumption. It does not confirm the data of other works [10, 15] about reduction of sleep duration with increase of consumed food. Increase of consumed food is a result of lack of sleeping or food quality is under question. In our research permanence of sleep duration and quality is explained by lower PA, which compensates sleep duration’s reduction from the point of organism’s energetic balance.

General tendency of mature men life activity’s physiological components is directed to accumulation of organism’s energy reserves in day preceding HIPA. It is also explained by CVS activation the next day [3, 17], when API confidently grows. Such energy accumulation results in natural demand in HIPA.

Conclusions

The research found increase of body weight and insufficient physical activity of mature men, who have no chronic diseases. We registered certain distinctions before not planned HIPA trainings, comparing with everyday regime. General physical activity, its volume and intensity were confidently lower. Relative weight of consumed food, vegetarian food and raw vegetarian food was confidently higher. Relative weight of consumed animal origin food was confidently less. There were found no confident distinctions in duration and quality of day/night and night sleep. The determined special features of men’s life style are directed at energy accumulation in organism for its further realization in highly intensive physical activity the next day.

Conflict of interests

The author declares that there is no conflict of interests.

References

1. Baevskij RM, Berseneva AP. Donozologicheskaia enersia and quantity of steps per minute during HIPA trainings prove their high intensity for this age category of men [20].

Comparative analysis of men’s PA proved for the first time that before HIPA physical activity of other intensity was confidently lower: by quantity of daily steps; by PA time; by quantity of steps per minute in zone of low intensity. Such PA reduction witnesses about accumulation of energy before HIPA. Exclusion was only quantity of steps per minute in PA of average intensity. It can be regarded as factor of men’s individuality, which does not depend on energy accumulation or consumption.

Eating is the most substantial factor of life style. For the first time we proved that consumed per day relative weight of food products in total, vegetarian raw food products was confidently higher before HIPA than in other days. Relative weight of animal origin food was confidently less. Total quantity and qualitative content of the consumed food products, prevailing carbohydrates facilitate accumulation of energy in organism before HIPA. Confident reduction of animal origin food is conditioned by reduction of energy consuming for organism kind of food [5].

Sleep is a result of life style in previous day. Sleep duration before HIPA and everyday corresponds to age standards [8]. There were no distinctions in duration and quality of sleep with confident PA reduction and increase of food consumption. It does not confirm the data of other works [10, 15] about reduction of sleep duration with increase of consumed food. Increase of consumed food is a result of lack of sleeping or food quality is under question. In our research permanence of sleep duration and quality is explained by lower PA, which compensates sleep duration’s reduction from the point of organism’s energetic balance.

General tendency of mature men life activity’s physiological components is directed to accumulation of organism’s energy reserves in day preceding HIPA. It is also explained by CVS activation the next day [3, 17], when API confidently grows. Such energy accumulation results in natural demand in HIPA.

Conclusions

The research found increase of body weight and insufficient physical activity of mature men, who have no chronic diseases. We registered certain distinctions before not planned HIPA trainings, comparing with everyday regime. General physical activity, its volume and intensity were confidently lower. Relative weight of consumed food, vegetarian food and raw vegetarian food was confidently higher. Relative weight of consumed animal origin food was confidently less. There were found no confident distinctions in duration and quality of day/night and night sleep. The determined special features of men’s life style are directed at energy accumulation in organism for its further realization in highly intensive physical activity the next day.

Conflict of interests

The author declares that there is no conflict of interests.

References


2. Pryshva OB. Vplav stanu sercevo-sudisnoi sistem chlovinik zrilogo viku na ihknu fizichnu aktivnist' v osinnii period [Influence of mature men’s cardio-vascular system’s condition on their physical activity in Autumn]. Fizichne vikhovannia, sport i kul'tura zhorov'ia u suchasnomu suspil'stv [Physical training and sports, 2016;22(2): 352-60. (in Portugal)


Information about the author:
Pryshva O.B.; http://orcid.org/0000-0002-3727-5142; ooobc@yahoo.com; Kherson State University; Str. University, 27, Kherson, 73000, Ukraine.


The electronic version of this article is the complete one and can be found online at: http://www.sportpedagogy.org.ua/index.php/PPS/issue/archive

This is an Open Access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited (http://creativecommons.org/licenses/by/4.0/deed.en).
Impact of athletic recovery parameters of hemodynamics in disabled powerlifters with cerebral palsy

Prystypa Tatiana1, Stefaniak Tadeusz2, Rudenko Romana3

1Department of Paralympic Sport, Wroclaw University of Physical Education, Poland
2Wroclaw University of Physical Education, Poland
3Health Department, Lvov State University of Physical Culture, Ukraine

Abstract

Purpose: Sport as one of physical culture components renders extremely complex impact on various environments and is enormously popular. In Poland disabled powerlifting represents top world standards. Aim of work: aims at examination of impact of biological regeneration on blood pressure and pulse in CP class 4, 5, 6, 7, 8 disabled power-lifters with normal upper extremities function.

Material: The research material comprised twenty 18-30 years old disabled power-lifters with cerebral palsy and normal function of upper extremities who are active members of “Start-Impel” sports club in Wroclaw. The research was carried out in 2 identical cycles on the same disabled sportsmen. Cycle I comprised primary research, while Cycle II, as secondary research, was carried out 5 months later. The micro-cycles were identical as regards training and biological regeneration schedules on particular weekdays, which guaranteed optimal research conditions.

Results: Results of the research allowed formation of the following parameters of pressure and pulse dynamics: 1. Post-training systolic blood pressure shows increasing dynamics; 2. During training meso-cycle with biological regeneration in Group A systolic pressure parameters were considerably lower than during the meso-cycle without biological renovation; 3. Diastolic pressure measured before training in both groups remains at 70–80 mm Hg, while post-training pressure increases to 82–86 mm Hg; 4. Post-training pulse measures are always higher than starting measures.

Conclusions: Combination of strength training and complex biological regeneration has positive impact on dynamics of blood pressure and pulse hemodynamic parameters, which in turn boosts training effectiveness.

Keywords: hemodynamics, biological regeneration, Para-Olympic sports, powerlifting

Introduction

Sport as one of physical culture components has an extremely complex impact on various environments and enjoys enormous popularity, both as regards active participation and passive observation of sports events [1-3]. Performing sports has a positive influence on many aspects of life. People with disabilities are prone to lead sedentary lifestyles which increase the risk of various chronic diseases. Diminished activity may contribute to reduced health-related quality of life. Cerebral palsy (CP) is one of the reasons of disability which limits activity with all its consequences. For this reason health care providers implement programs of trainings and encourage people with CP to participate in sports programs. Groff and coworkers [4] conducted a survey among athletes with CP competing in the 2005 CP World Championships to examine the effect of adaptive sports participation on influence on quality of life. The results indicate that sport positively influenced their overall health (84.9%), quality of life (80.8%), quality of family life (53.4%), and quality of social life (56.1%).

The participation in sports for disabled persons continues to expand. The reasons of growing interest in sports vary from rehabilitation and recreational purposes to elite competitions such as Paralympic athletes. CP became one of the six impairment group in which athletes with disabilities may compete. Disorders occurring in cerebral palsy are not limited to the movement-related disorders. Paralympic medicine must face also such problems as communication difficulties, increased muscle tone, convulsive disorders and fatigue from intense training which may result in dehydration, thermoregulatory problems or induce seizures [5]. Therefore, not only monitoring health condition and hemodynamic parameters during exercise but also the proper recovery after training seems to be very important. Moreover, proper planning of athletic training and complex recovery treatment is a vital issue for athletes in general as well as those with disabilities [6-11].

There is still not enough data regarding the effectiveness of training in comparison to the impact on the body physiology. Scoon GS. (2006) and Dec (1979) claim that no research on bodily reactions as regards cardiac capacity of powerlifters with disability has been carried out, and use of the outcome of research on able-bodied sportsmen diminishes efficacy of their application in the training of sportsmen with disability [7,12]. This study was performed to shed more light on training athletes with CP. The aim of the work was to examine of the impact of athletic recovery treatment on blood pressure and heart rate of disabled power-lifters with CP in sport-medical classes CP 4, 5, 6, 7, 8 with normal function of the upper extremities.

Material and Methods

Subjects

The study group consisted of twenty 18-30 year old disabled athletes with CP with normal function of their...
The study was approved by the Committee of Senate for Research Ethics at University of Physical Education in Wroclaw. Written informed consent was obtained prior to the patient entering the study. The study was conducted in compliance with the ethical principles originating in or derived from the Declaration of Helsinki.

Statistics

The analyses were performed using the Statistica package software (version 9, StatSoft). The following variables were calculated: arithmetic mean, standard deviation (s), and variation coefficient (v). Assessment of statistical significance between means for two groups was performed with use of a t-Student test, and in case of bigger amount of comparable means one-way analysis of variance (ANOVA test) was applied, with comparison of least significant difference in LSD test. A p value less than 0.05 was considered statistically significant.

Results

Blood pressure and heart rate in Cycle I

Comparative analysis of hemodynamic parameters in the Cycle I encompassing training without recovery treatment proved that no significant differences observed in adaptive reactions to weight trainings between Groups A and B.

The most interesting findings are as follows. Statistically significant differences in systolic blood pressure were recorded on the 4th day of the second microcycle after training (p=0.011) and on the last day of the fourth microcycle (p=0.016), which was not significant for 40 measurements taken. Statistically significant differences in diastolic blood pressure in Groups A and B were recorded in two cases before training (on the second and fourth day of the third microcycle: p=0.023 and p=0.041 respectively) and in two cases after training (on the third day of the first microcycle p=0.017 and on the fourth day of the fourth microcycle p=0.016). Reduced systolic blood pressure was recorded after the training (136±8.06 mm Hg) as compared to pre-training measurement (140±8.31 mm Hg) only in one case (on the fourth day of the third microcycle) and was not statistically significant. Pre-training diastolic blood pressure parameters in both groups ranged from 70 to 80 mm Hg, but after training they slightly increased to 82–86 mm Hg, however the change was not statistically significant. Post-training heart rate occurred to be always higher than pre-training heart rate. Heart rate significantly differed only in two cases: on the fifth day of the third microcycle and on the fourth day of the fourth microcycle). Identical processes were observed in Group B as well, which means that in the first mesocycle no case post-training reduction of systolic
The blood pressure was recorded. It is worth pointing out that out of 20 measures of pre- and post-training systolic blood pressure taken in Group B only in 6 cases a significant increase was noted.

Comparative analysis of pre- and post-training diastolic blood pressure parameters in the first mesocycle without recovery treatment showed two patterns. Selected results of analysis of variance and post-hoc test are presented in Table 1.

After 15 trainings diastolic blood pressure rate in Group A demonstrated an increasing tendency, whereas in five cases a decreasing tendency was observed. Only in 4 cases the said changes were statistically significant. In Group B a decreasing tendency was observed in 3 cases, whereas in 17 cases diastolic blood pressure rate increased, including 7 cases in which they were statistically significant.

After 20 trainings of the first mesocycle heart rate parameters in Group A were higher than before the training cycle. Statistically significant increase in heart rate was observed in 15 cases, whereas in the remaining five cases it was statistically insignificant. In Group B during the first training mesocycle no decrease in heart rate was recorded, while in 17 cases the heart rate increase was statistically significant, and in 3 cases the changes did not qualify as statistically significant.

In the second mesocycle with recovery treatment systolic blood pressure demonstrated an increasing tendency in both groups. In Group A only one case of reduced systolic blood pressure value by the end of training was reported. On the first day of the first microcycle pre-training systolic blood pressure reading in Group A was at a level of 131.60±8.72 mm Hg, while at the end of the training it dropped to 131.30±8.71 mm Hg, hence the difference was not significant (p=0.0905). Statistically significant changes in post-training systolic blood pressure parameters in Group A were higher than before the training cycle. Statistically significant increase in heart rate was observed in 15 cases, whereas in the remaining five cases it was statistically insignificant. In Group B during the first training mesocycle no decrease in heart rate was recorded, while in 17 cases the heart rate increase was statistically significant, and in 3 cases the changes did not qualify as statistically significant.

![Figure 1. Diagram of the study schedule.](image)

---

**Table 1.** Evaluation of means of blood pressure and heart rate in selected days of training during Cycle I and II – first meso-cycle without athletic recovery – variance analysis and LSD.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Cycle I, pre-training</th>
<th>Cycle I, post-training</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood pressure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Systolic</td>
<td>F-Snedecor</td>
<td></td>
</tr>
<tr>
<td>Group</td>
<td>Cycle</td>
<td>1 day, 1 mesocycle</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>5W14</td>
</tr>
<tr>
<td>A</td>
<td>4.07</td>
<td>0.000</td>
</tr>
<tr>
<td>B</td>
<td>3.12</td>
<td>0.001</td>
</tr>
<tr>
<td>A</td>
<td>3.75</td>
<td>0.000</td>
</tr>
<tr>
<td>B</td>
<td>6.75</td>
<td>0.000</td>
</tr>
<tr>
<td>A</td>
<td>2.22</td>
<td>0.019</td>
</tr>
<tr>
<td>B</td>
<td>3.42</td>
<td>0.000</td>
</tr>
<tr>
<td>A</td>
<td>2.70</td>
<td>0.000</td>
</tr>
<tr>
<td>B</td>
<td>4.58</td>
<td>0.000</td>
</tr>
<tr>
<td>A</td>
<td>15.11</td>
<td>0.000</td>
</tr>
<tr>
<td>B</td>
<td>3.56</td>
<td>0.000</td>
</tr>
<tr>
<td>A</td>
<td>4.58</td>
<td>0.000</td>
</tr>
<tr>
<td>B</td>
<td>7.92</td>
<td>0.000</td>
</tr>
<tr>
<td>A</td>
<td>15.99</td>
<td>0.000</td>
</tr>
</tbody>
</table>

* F-Snedecor – F-distribution; F – test function value; p - probability values less than 0.05 denote statistically significant - marked in bold; LSD - least significant difference; symbols indicating the day of the study are designed as follows (e.g. 5W14): first number indicates micro-cycle day, second capital letter indicates type of measurement (W-pre-training; K-post-training); third number indicates mesocycle (1-first; 2-second); fourth number indicates microcycle number (from 1 to 4).
blood pressure were reported in 7 cases. In group B only one case of reduced systolic blood pressure was recorded for 20 measurements taken. On the first day of the fourth microcycle pre-training average value of systolic blood pressure was 134.20±11.61 mm Hg, and before the end of the training it demonstrated insignificant decrease dropping to 131.80±7.42 mm Hg (p=0.463). Out of all 20 measurements taken six were statistically significant, which means that normotonic hemodynamic adaptive reactions to high-intensity weight training dominated.

Comparative analysis of the dynamics of post-training diastolic blood pressure values in Group A in the second mesocycle showed an increase in fifteen cases, and a decrease in five, where in 4 cases the change was statistically significant. While in Group B, in the same time in 17 cases diastolic blood pressure increased but only in 3 cases it decreased. In 7 cases the change was statistically significant. Statistical analysis of pre- and post-training heart rate parameters in Group A during the mesocycle with recovery treatment showed increase in all cases, but in 13 cases the change was statistically significant. Whereas in Group B, 19 cases of post-training increased heart rate were recorded, 8 of which qualify as statistically significant.

In the Group A, after massage treatment a constantly decreasing values of systolic blood pressure was observed. Reduction in systolic blood pressure after delivery of local massage treatment was recorded in all 20 cases, 14 of which were statistically significant. Similar changes were observed in systolic blood pressure behavior in the Group B. The decrease in systolic blood pressure after delivery of local massage treatment was recorded in all 20 cases, 13 of which were statistically significant. Analysis of parameters of diastolic blood pressure after delivery of local massage treatment in Group A showed an increase in 14 cases, while in six a decreasing tendency was observed. In 6 out of 20 cases changes in diastolic blood pressure dynamics after delivery of local massage were statistically significant. In Group B there were 18 cases of reduced diastolic blood pressure values and two cases of increased diastolic blood pressure values after delivery of local massage treatment. In 6 out of 20 cases changes in diastolic blood pressure after delivery of local massage were statistically significant.

Heart rate dynamics after delivery of local massage treatment in Group A proved that the restoration mechanism in all 20 cases contributed to a decreasing tendency. Statistic analysis of post-massage heart rate showed that in 13 cases it significantly decreased, while in 7 cases the decrease was statistically insignificant. Heart rate dynamics in Group B followed a similar pattern. In Group B in 19 cases post-massage heart rate dropped and only in one a significantly insignificant increase in heart rate from 79.40±1.48 beats/min. to 79.80±1.48 beats/min. was observed. Statistical analysis showed that in 12 cases heart rate reduction after local massage treatment was statistically significant. Heart rate parameters measured after the treatment in Groups A and B fluctuated about the pre-training heart rate range. In the Group A, pre-training and after-massage heart rate varied from 75 to 85 beats per minute. The tendency in Group B was similar.

Comparative analysis of systolic blood pressure parameters measured after massage and hydrotherapy treatments showed an increase in all cases. In the Group

<p>| Table 2. Evaluation of means of blood pressure and heart rate in selected days of training during Cycle I and II – second mesocycle pre-training measurements – variance analysis and LSD. |</p>
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Cycle</th>
<th>Group</th>
<th>1 day 1 micro-cycle</th>
<th>5 day 4 micro-cycle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood pressure</td>
<td>Cycle</td>
<td>Group</td>
<td>1 day 1 micro-cycle</td>
<td>5 day 4 micro-cycle</td>
</tr>
<tr>
<td>Systolic</td>
<td>I</td>
<td>A</td>
<td>0.706</td>
<td>0.918</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>0.262</td>
<td>0.605</td>
<td><strong>0.044</strong></td>
</tr>
<tr>
<td>Diastolic</td>
<td>I</td>
<td>A</td>
<td>0.390</td>
<td>0.390</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td><strong>0.039</strong></td>
<td><strong>0.002</strong></td>
<td>0.000</td>
</tr>
<tr>
<td>Heart rate</td>
<td>I</td>
<td>A</td>
<td>0.087</td>
<td>0.325</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td><strong>0.086</strong></td>
<td><strong>0.006</strong></td>
<td><strong>0.000</strong></td>
</tr>
<tr>
<td>Diastolic</td>
<td>I</td>
<td>A</td>
<td>0.496</td>
<td>0.043</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td><strong>0.201</strong></td>
<td><strong>0.002</strong></td>
<td><strong>0.000</strong></td>
</tr>
<tr>
<td></td>
<td>I</td>
<td>A</td>
<td>0.064</td>
<td>0.098</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>0.725</td>
<td>0.063</td>
<td>1.000</td>
</tr>
<tr>
<td></td>
<td>II</td>
<td>A</td>
<td>0.935</td>
<td><strong>0.001</strong></td>
</tr>
<tr>
<td></td>
<td>B</td>
<td><strong>0.308</strong></td>
<td><strong>0.000</strong></td>
<td><strong>0.000</strong></td>
</tr>
</tbody>
</table>

*Probability values less than 0.05 denote statistically significant - marked in bold; LSD - least significant difference; symbols indicating the day of the study are designed as follows (e.g. 5W24): first number indicates micro-cycle day, second capital letter indicates type of measurement (W-pre-training; K-post-training; M-after massage; D-after athlete recovery); third number indicates mesocycle (1-first; 2-second); fourth number indicates microcycle number (from 1 to 4).
A, in 14 cases systolic blood pressure significantly increased after the treatments. The adaptive responses to hydrotherapy treatment were similar in the Group B. After hydrotherapy treatment, in 10 out of 20 cases an increase in systolic blood pressure was statistically significant, while in the remaining 10 cases the increase was statistically insignificant. It was also noted that systolic blood pressure parameters had a tendency to increase after delivery of hydrotherapy treatment. Comparative analysis of diastolic blood pressure dynamics after delivery of hydrotherapy treatments in the Group A showed that in 17 out of 20 cases it increased, and in 3 cases decreased. In 9 chases the change was statistically significant. In the Group B an increase in diastolic blood pressure after hydrotherapy treatments was reported in 19 cases, and only in one case diastolic blood pressure rate was reduced. 10 out of 20 changes were statistically significant.

Comparative analysis of diastolic blood pressure dynamics after delivery of local massage and hydrotherapy treatments showed idiosyncratic characteristics. For instance, in Group A after delivery of local massage treatment diastolic blood pressure parameters decreased in 14 cases out of 20, while in 6 cases were reduced. After delivery of hydrotherapy treatment only in 3 cases diastolic blood pressure decreased, while in as many as in 17 cases it increased. Similar tendency was observed in the Group B, where in 18 cases diastolic blood pressure decreased after delivery of local massage treatment, and in 2 cases it increased, whereas after delivery of hydrotherapy treatments diastolic blood pressure increased in as many as 19 cases out of 20.

Comparative analysis of heart rate dynamics after delivery of hydrotherapy treatment in the Group A showed that heart rate parameters in 19 cases were higher than parameters recorded after local massage. In 9 cases the change was statistically significant. In the Group B after hydrotherapy treatments heart rate in all cases was higher as compared to the rate recorded after local massage. Only in 4 cases the change was statistically insignificant. The results of analysis of variance and post-hoc test of measurements performed during second mesocycle before training are presented in Table 2.

The results of measurement performed after training and recovery treatment are presented in Table 3.

**Analysis of blood pressure and heart rate dynamics in Cycle II**

Comparative analysis of blood pressure and heart rate parameters in Cycle II in both groups confirms most characteristics observed in Cycle I.

**Discussion**

The increased interest in sports among disabled pose several challenges as regards intensive seeking for training support measures. One of the most vital methodological aspects of competitive sports is necessity to include complex recovery treatment in training and contest program [2-3] Complex athletic recovery treatment incorporated into trainings and competitions cycle is recommended in contemporary studies as an indispensable element of the entire preparation system [10,15-16] Analysis of hemodynamic parameters aimed at diagnosing athletes condition, their adaptability and form find a broad application in competitive sports [17-21]

The present study included athletes with CP. The

**Table 3.** Evaluation of means of blood pressure and heart rate in selected days of training during Cycle I and II – second meso-cycle pre-training measurements – variance analysis and LSD.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Cycle</th>
<th>Group</th>
<th>I day</th>
<th>1 micro-cycle</th>
<th>II meso-cycle post-training</th>
<th>5 day, 4 micro-cycle</th>
<th>II meso-cycle post massage</th>
<th>1 day</th>
<th>1 micro-cycle</th>
<th>II meso-cycle post recovery</th>
<th>5 day</th>
<th>4 micro</th>
<th>1 day</th>
<th>1 micro.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood pressure</td>
<td>I</td>
<td>A</td>
<td>0.273</td>
<td>0.000</td>
<td>0.151 , 0.161</td>
<td>0.259</td>
<td>0.012</td>
<td>0.973</td>
<td>0.016</td>
<td>0.015</td>
<td>0.000</td>
<td>0.011</td>
<td>0.012</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>B</td>
<td>0.131</td>
<td>0.363</td>
<td>0.123</td>
<td>0.976</td>
<td>0.627</td>
<td>0.003</td>
<td>0.303</td>
<td>0.524</td>
<td>0.347</td>
<td>0.164</td>
<td>0.044</td>
<td>0.649</td>
</tr>
<tr>
<td></td>
<td>II</td>
<td>A</td>
<td>0.042</td>
<td>0.413</td>
<td>0.236</td>
<td>0.051</td>
<td>0.006</td>
<td>0.390</td>
<td>0.437</td>
<td>0.047</td>
<td>0.006</td>
<td>0.000</td>
<td>0.103</td>
<td>0.390</td>
</tr>
<tr>
<td></td>
<td></td>
<td>B</td>
<td>0.022</td>
<td>0.016</td>
<td>0.750</td>
<td>0.318</td>
<td>0.104</td>
<td>0.010</td>
<td>0.496</td>
<td>0.035</td>
<td>0.148</td>
<td>0.000</td>
<td>0.053</td>
<td>0.010</td>
</tr>
<tr>
<td>Systolic</td>
<td>I</td>
<td>A</td>
<td>0.902</td>
<td>0.198</td>
<td>0.099</td>
<td>0.902</td>
<td>0.758</td>
<td>0.076</td>
<td>0.666</td>
<td>0.712</td>
<td>0.243</td>
<td>0.325</td>
<td>0.177</td>
<td>0.853</td>
</tr>
<tr>
<td></td>
<td></td>
<td>B</td>
<td>0.320</td>
<td>0.637</td>
<td>0.192</td>
<td>0.374</td>
<td>0.564</td>
<td>0.023</td>
<td>0.675</td>
<td>0.402</td>
<td>0.175</td>
<td>0.296</td>
<td>0.061</td>
<td>0.753</td>
</tr>
<tr>
<td></td>
<td>II</td>
<td>A</td>
<td>0.127</td>
<td>0.003</td>
<td>0.551</td>
<td>0.203</td>
<td>0.012</td>
<td>0.035</td>
<td>0.307</td>
<td>0.019</td>
<td>0.000</td>
<td>0.000</td>
<td>0.002</td>
<td>0.203</td>
</tr>
<tr>
<td></td>
<td></td>
<td>B</td>
<td>0.281</td>
<td>0.052</td>
<td>0.787</td>
<td>0.038</td>
<td>0.014</td>
<td>0.179</td>
<td>0.158</td>
<td>0.093</td>
<td>0.000</td>
<td>0.000</td>
<td>0.007</td>
<td>0.685</td>
</tr>
<tr>
<td>Diastolic</td>
<td>I</td>
<td>A</td>
<td>0.228</td>
<td>0.006</td>
<td>0.057</td>
<td>0.480</td>
<td>0.175</td>
<td>0.480</td>
<td>0.880</td>
<td>0.392</td>
<td>0.041</td>
<td>0.160</td>
<td>0.579</td>
<td>0.512</td>
</tr>
<tr>
<td></td>
<td></td>
<td>B</td>
<td>0.063</td>
<td>0.001</td>
<td>0.000</td>
<td>1.000</td>
<td>0.558</td>
<td>0.007</td>
<td>0.199</td>
<td>0.199</td>
<td>0.001</td>
<td>0.007</td>
<td>0.000</td>
<td>0.558</td>
</tr>
<tr>
<td>Heart rate</td>
<td>I</td>
<td>A</td>
<td>0.567</td>
<td>0.052</td>
<td>0.289</td>
<td>0.935</td>
<td>0.019</td>
<td>0.104</td>
<td>0.074</td>
<td>0.369</td>
<td>0.043</td>
<td>0.000</td>
<td>0.001</td>
<td>0.024</td>
</tr>
<tr>
<td></td>
<td></td>
<td>B</td>
<td>0.428</td>
<td>0.000</td>
<td>0.000</td>
<td>0.910</td>
<td>0.650</td>
<td>0.000</td>
<td>0.214</td>
<td>0.365</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.734</td>
</tr>
</tbody>
</table>

* probability values less than 0.05 denote statistically significant - marked in bold; LSD - least significant difference; symbols indicating the day of the study are designed as follows (e.g. 5W24): first number indicates microcycle day, second capital letter indicates type of measurement (K-post-training; M-after massage; D-after athlete recovery); third number indicates mesocycle (1-first; 2-second); fourth number indicates micro-cycle number (from 1 to 4).
two identical research cycles were conducted twice on the same athletes (Groups A and B) at a 5-month interval, since it was impossible to match a control group characterized by similar parameters to those study groups. However, a 5-month interval can satisfy the conditions for obtaining reliable research results. The obtained results allow to come to conclusion that characteristics of selected functions of the cardiovascular system in the Cycle II do not differ substantially from outcomes observed in the Cycle I. Therefore, those observations on selected hemodynamic functions confirm a positive impact of athletic recovery treatment on the increase of training efficacy in power-lifters with CP that was drawn in Cycle I.

The overall changes in systolic and diastolic blood pressure as well as in heart rate observed in the Cycle I in the Groups A and B proved that hemodynamic adaptive responses to high-intensity training without recovery were in both Groups A and B identical. The research outcomes allowed for drawing up the characteristics of the blood pressure and heart rate dynamics in power-lifters with CP.

In majority of the cases a stable increasing dynamics in post-training systolic blood pressure readings was observed. Similar findings were reported also by other researchers [19,22,23]. Pre-training diastolic blood pressure parameters in both groups increased slightly after the training, however the change is not statistically significant. Many researchers underline the multifactorial relations among hemodynamics components [14-27].

The detailed analysis of systolic blood pressure showed some characteristic behaviors. During training micro-cycles systolic blood pressure demonstrated a tendency to regular fluctuations within normotonic limits, while post-training it showed an increasing dynamics. In the Group A its values were considerably lower during the training mesocycle with athletic recovery treatment than without. During the training mesocycle followed by athletic recovery treatment in the Group B the input systolic pressure parameters were within the limits typical for the mesocycle without athletic recovery treatment, however the limits were wider. Comparative analysis of the changes in the systolic blood pressure values obtained in the Cycle I to the specialist literature allows for a conclusion that systolic blood pressure adaptive responses to high-intensity weight training in Groups A and B follow the pattern of normotonic changes [24,28-30]. The observed finding result from a multi-factor impact on athletes hemodynamics [22, 26-27, 31].

Local massage was delivered to muscles that were most loaded during training. After delivery of this treatment during the second training mesocycle, a tendency to substantial decrease in systolic blood pressure was observed as compared to relevant post-training parameters. Similar finding were presented in other studies [28, 32]. After delivery of hydrotherapy treatments systolic blood pressure parameters in both groups were considerably higher as compared to relevant parameters recorded after delivery of local massage treatment and they were within the range of post-training parameters, which was also observed by Strack [28]. Local massage treatment had a recovering effect on diastolic blood pressure lowering it to pre-training rates. The data obtained in the study prove that local massage treatment had a definitely greater normalizing effect on systolic than on diastolic blood pressure values. Local massage treatment in all cases had an effect on heart rate lowering it to pre-training rates and the results were statistically significant. However, the findings regarding influence of local massage on haemodynamics are interesting, the topic require further research.

The results of the study indicate that systolic blood pressure parameters had a tendency to increase after delivery of hydrotherapy treatment, which means that the hydrotherapy treatments have a significant impact on athletes’ hemodynamics. The research proved that hydrotherapy treatments are the source of significant load and therefore the methods of its application, especially after high-intensity weight training require further research. In the present study hydrotherapy treatments resulted in adaptive changes in diastolic blood pressure that are typical for post-training parameters. Therefore, it can be assumed that diastolic blood pressure dynamics is multidirectional in nature, as opposed to systolic blood pressure dynamics, where a stable increasing tendency was observed. As reported in the study and by other researchers, hydrotherapy treatments increase heart rate to the post-training parameters [25,33-34]. Small heart rate dynamics prove that the cardiovascular system is healthy and well regulated [33-34]. Hydrotherapy treatments and local massage delivered after high-intensity training have statistically significant impact on athletes heart rate and blood pressure and significantly boost hemodynamic processes.

**Conclusions:**
1. Combination of strength training with complex athletic recovery treatment has positive impact on dynamics of blood pressure and heart rate hemodynamic parameters, which in turn boosts training effectiveness in disabled powerlifters with CP.
2. The research proved that hydrotherapy treatment is a source of significant load and therefore the methods of its application, especially after intensive weight training require thorough research.

**Acknowledgments:** This work was supported by the Department of Physical Culture and Disable Sports at the University of Physical Education in Wroclaw.

**Conflict of interests**
The authors declare that there is no conflict of interests.
Information about the authors:

Prystupa Tetiana; http://orcid.org/0000-0002-0219-8845; tetyanaprystupa@gmail.com; Department of Paralympic Sport, The University of Physical Education; al. I. J. Paderewskiego 35, 51 – 612 Wroclaw, Poland.

Stefaniak Tadeusz; http://orcid.org/0000-0001-8306-9692; dziekanat.sportu@awf.wroc.pl; The University of Physical Education; al. I. J. Paderewskiego 35, 51 – 612 Wroclaw, Poland.

Rudenko Romanna; http://orcid.org/0000-0002-1994-228X; office@ldufk.edu.ua; Lviv State University of Physical Culture; 11 Kostiushka Str., Lviv, Ukraine.

Cite this article as: Prystypa T., Stefaniak T., Rudenko R. Impact of athletic recovery parameters of hemodynamics in disabled powerlifters with cerebral palsy. Pedagogics, psychology, medical-biological problems of physical training and sports, 2017;21(3):131–138. doi:10.15561/18189172.2017.0306

This is an Open Access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited (http://creativecommons.org/licenses/by/4.0/deed.en).

Received: 04.02.2017
Accepted: 25.02.2017; Published: 30.04.2017
Special aspects of Paralympic athletes’ sport activity in the process of self-education
Shuba V.V.
Dnipropetrovs’k State Institute of Physical Culture and Sport

Abstract

**Purpose:**
to determine and substantiate influence of self-education components of Paralympic athletes' sport activity.

**Material:**
in the research 46 Paralympic athletes form three teams of game kinds of sports participated: combined football, basketball and volleyball teams of Ukraine. The program of self-education process's organization was designed for 9 months and consisted of three stages. Pedagogic program consisted of 9 classes. Optimal time of one training session was 45 minutes a day (in total – 9 days).

**Results:**
we determined the need in consideration of athletes' individual-personality features in organization the self-education process. We also substantiated and experimentally tested correlations, which facilitate: adequate organization of athletes' self-education process; mastering of sport knowledge and skills of behavior in different extreme situations; realization of own potentials in sport and social life.

**Conclusions:**
the structure of athletes' self-education is presented by combination of interconnected components: motivation-personal (motives, demands, settings, moral-will qualities and individual personal features); cognitive (system of knowledge about oneself and sport functioning); activity (formation of skills in self-cognition, self-organization and self-control).

**Keywords:** Paralympic athletes, self-education, sport activity, football, volleyball, basketball.

Introduction

Modern sport is the natural result of human cognitive activity. Achievements of sport sciences, methodic of elite athletes’ training, application of it results in other branches are a combination of sports' spiritual values [20, 25, 29, 31].

Involvement of disabled people in sport activity is of great importance for such people and society in general. Adaptive sports facilitate disabled people’s integration in social life. Adaptive sports facilitate full opening of potentials for comprehensive development of physical abilities and motor skills. Such activity permits to feel happiness, completeness of life, control over body and overcoming life difficulties as well as to expand social contacts [15, 17, 23, 32].

In sports disabled people have opportunity to self-realize and self-perfect. Participation in sports movement facilitates activation of all organism’s systems, motor correction and formation of a number of required motor compensations. It is an important factor of disabled people’s physical and social rehabilitation [21, 22, 26, 30].

Psychological-pedagogic aspect of Paralympic trainings on all stages requires special attention. Success depends to large extent on Paralympic athlete him/herself: his/her abilities to self-control at competitions, ability to independently cognize own potentials and resources, to plan own activity and distribute reasonably forces and time [14, 17, 19, 28].

It should be noted that personality’s education in sports and ordinary life was paid attention to by the following scientists: I. Bekh – education of personality and influence of medium on its formation [2]; V. Voronova – psychology of sports and development of personality under influence of elite sports factors [5]; V. Shuba – psychological-pedagogic aspects of work with disabled people [12]; Y. Bhambhni – influence of physical training on emotional state of disabled athletes [13].

Searching of means for raising effectiveness of Paralympic athletes' self-education process’s organization is presented in the following works: Yu. Briskin – studies in the sphere of adaptive physical culture, which facilitates maximal development of vitality and effective self-realization in society [3, 4]; V. Zhylenkova – formation and development of physical culture and sports for disabled people with muscular skeletal apparatus disorders [6]; R. Chudnaya – aspects of physical education of people, having different heavy disorders of vitally important organism’s functions and restricted physical potentials, resulted from diseases or traumas [10]; V. Shuba – special aspects of psychological-pedagogic organization of Paralympic athletes’ (with muscular skeletal apparatus disorders) training process [11]; M. Braycich – influence of different level competitions on athletes’ psychological individual features [15]; G.R. Coudeville et al. – application of specific strategy of overcoming personal anxiety before competitions [18]; P. Laursen – special aspects of trainings with different intensity levels [27].

That is why, one of new approaches to solution the problem of Paralympic athletes’ potentials realization can be analysis of self-education process and its interconnection with different components.

**The purpose of the research:** is to determine and substantiate influence of self-education components of Paralympic athletes’ sport activity.

**Material and methods**

**Participants:** in the research 46 Paralympic athletes form three teams of game kinds of sports participated (control group n=24 and experimental group – n=24): combined football, basketball and volleyball teams of...
Ukraine.

Organization of the research: control group was trained according to traditional training schedule. Trainings on organization of self-education process, considering pedagogic conditions, were not conducted in this group.

For experimental group we worked out and offered the program of organization of Paralympic athletes’ self-education. The main purpose of this program was to facilitate athlete’s psychological adaptation in training activity and society; ability to open own potentials at competitions of different level.

The program of self-education process’s organization was designed for 9 months and consisted of three stages. Every participant was given approximately equal time and opportunity to participate in training process.

Pedagogic program consisted of 9 classes. Optimal time of one training session was 45 minutes a day (in total – 9 days). The program was implemented in training camp period.

Every training consisted of three parts. It complied with the structure of athletes’ training process.

Preparatory part took 10-20 % – introduction, warming up, passing to group work. This part was intended at athletes’ motivation and organization; their familiarization with topic and preparation to main part. Besides, it facilitated discipline, which ensures safety measures’ observation at trainings.

Main part took 70-80% of training session: work in group, topical role-exercises, discussion of results. It depends on aims and tasks of training. The tasks can be of different orientation. The most purposeful it is to plan the trainings in definite sequence. The sequence and differentiation depend on the purpose of correction work and stage of self-education process’s organization.

Final part takes 10-20% – summarizing of training results, setting tasks for the next training, relaxation or activation of athletes’ state, depending on the targets of correction program and assessment of group work or each athlete separately. Final part was conducted under musical accompaniment.

At first training session rules of group work are announced; they, further, positively influence on correction work and mutual trust. All exercises were strictly regulated by time.

Every stage of program had its own dynamic. It depended on the purpose and tasks of every stage.

The first training session of the first stage is devoted to familiarization, organizational questions and explanations of expectations. At 2-8 trainings dynamic and active self-cognition work was practiced.

The first training of the 2nd stage was devoted to analysis of diaries and its re-structuring. At 2nd-4th trainings athletes overcame critical life situations. At 5th training exercise “Tree of resources” was practiced. At 6th-8th trainings athletes overcame critical life situations (this training was devoted to summarizing).

At 3rd stage athletes worked more independently and their work was directed at creation of optimal psychological-pedagogic conditions of self-education’s organization in life activity. This work was fulfilled at 1st-8th trainings. 9th training of the 3rd stage was devoted to summarizing of all program of athletes’ self-education process’s organization.

For assessment of self-education organization with the help of innovative program effectiveness and self-report diary we formed a block of methods for psycho-emotional state diagnostic.

Athletes’ psycho-emotional state; self-education’s organization and self control were checked by psychological tests and questionnaires. It permitted to find psycho-emotional state development, functioning and correction in pre-competition and competition periods:

1. Method of modeling (consisted of three stages). The first stage: careful study of self-education and self-perfection experience of Paralympic athletes; analysis and generalization of this experience and formation of hypothesis which became the basis of innovative program of self education process’s organization, considering pedagogic conditions [1, 8].

The second stage: formation of research program; organization of practical activity in compliance with the worked out innovative program of self-education process’s organization; inserting of corrections to the program; specifying of initial hypothesis, taken as the base of model.

The third stage: formation of final variant of model of innovative program of self-education process’s organization for Paralympic athletes.

2. Diagnostic talks: as the basis of these talks we took five-step model of psychological interview: making contacts with athletes; collection of information on the problem; formulation of the desired result; working out of alternative solutions; generalization [7].

3. Questionnaire for anxiety level was with closed questions. I.e. answers were restricted by previously determined quantity of answers’ variants. We used standard questionnaire for athletes’ anxiety determination [1, 9, 12].

4. Socio-metric study implied the following: first we determined main criteria for assessment of one or another side of interpersonal interaction. For this purpose we formulated the questions, relating to real situation [7].

5. Questionnaire of Spilberger-Khanin was used for assessment of reactive and personal anxiety [1, 9].

6. Scale of competition anxiety was used for quantitative measuring of athlete’s bent to emotionally react by different intensity anxiety to pre-competition and competition situations [1, 5, 7].

7. Questionnaire of Izank was used for diagnostic of neurotism, extraversion/introversion and psychotism. This questionnaire is a realization of psychological approach to personality’s study [8, 9].

Psycho-emotional state of athletes was studied in dynamic as well: in trainings during all stages.

Statistical analysis: we calculated the following: mean arithmetic; mean square deviation; variation coefficient; standard error of mean arithmetic; correlation coefficient. The receive data were processed with the help of Microsoft Excel program.

Results of the research
Paralympic athletes with muscular skeletal apparatus problems relate to the most dynamic branch of Paralympic movement. It is witnessed by: increase of competitions’ quantity, strengthening of contest, emersion of new kinds of sports [3, 16, 34]. At present stage of Paralympic movement’s development Paralympic athletes’ activity is regarded at the level of “healthy” athletes’ participation [24, 33]. During year Paralympic athlete can participate in a number of competitions of different level. Their quantity determines dynamic of training process.

In the course of our study of Paralympic athletes we receive significant correlations between different parameters: sport age and sport category; sport category and social status in group; Sport age and social status in group; sport category and the type of temper personal anxiety and situational anxiety; personal anxiety and competition anxiety; communication with other people and planning future activity; communication with other people and professional progress.

Analysis of the received data showed the following:
1. The received significant correlations between “sport age” and “sport degree” witness about increase of sportsmanship in compliance with sport experience (see table 1).

This natural regularity is characteristic both for women and men. The accumulated in the process of many years’ sports practicing experience brings its qualitative result.

2. The following received correlation between “sport category” and “socio-metry” can also be considered quite logical. Direct correlation points at positive influence of sportsmanship on socio-metric indicators of athlete (see table 2).

For many years athlete gains higher results that causes respect from less experienced athletes and higher quantity of choices by results of socio-metry.

Table 1. Correlation between sport age and sport category of Paralympic athletes

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Sport Category</th>
<th>Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correlation coefficient</td>
<td>1.000</td>
<td>.674**</td>
</tr>
<tr>
<td>Bilateral value</td>
<td>.674**</td>
<td>1.000</td>
</tr>
<tr>
<td>N</td>
<td>24</td>
<td>24</td>
</tr>
</tbody>
</table>

**Correlation is significant at 0.01 (bilateral)

Table 2. Correlation between sport category and social status in Paralympic athletes’ group

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Sport category</th>
<th>Socio-metry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correlation coefficient</td>
<td>1.000</td>
<td>.674**</td>
</tr>
<tr>
<td>Bilateral value</td>
<td>.674**</td>
<td>1.000</td>
</tr>
<tr>
<td>N</td>
<td>24</td>
<td>24</td>
</tr>
</tbody>
</table>

**Correlation is significant at 0.01 (bilateral)

Table 3. Correlation between sport age and social status in group of Paralympic athletes

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Sport age</th>
<th>Socio-metry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correlation coefficient</td>
<td>1.000</td>
<td>.725**</td>
</tr>
<tr>
<td>Bilateral value</td>
<td>.725**</td>
<td>1.000</td>
</tr>
<tr>
<td>N</td>
<td>24</td>
<td>24</td>
</tr>
</tbody>
</table>

**Correlation is significant at 0.01 (bilateral)
3. Similar picture was received for parameters “sport age” and “socio-metry”. The higher is sport experience the oftener a person receives advantage in choices by socio-metry (see table 3).

The data witness that sport results and sport age characterize the athlete’s experience. It causes respects to such athletes and points at higher quantity of choices by socio-metry.

4. Attention should also be paid to significant correlation between “sport category” and “type of temper”. Reverse correlation points, that with increasing of sportsmanship melancholic temper is rather rare, while sanguine temper if more frequently met (see table 4).

The received data point that:

A) High sport results shall not be expected from Paralympic athletes with melancholic type of temper, especially in game kinds of sports. It means that at the beginning of sport career correct sport selection can save a lot of time and finances.

B) Athletes with sanguine type of temper are the most promising for achievement of high sport results, especially in game kinds of sports. Such athletes are characterized by natural friendliness, will power and openness. All these facilitate team spirit, group dynamic and team will for victory.

5. We received significant correlation between “personal anxiety” and “situational anxiety”. Direct correlation points that with increasing of personal anxiety situational anxiety also increases (see table 5).

This correlation points that athletes with high personal anxiety will have high situational anxiety in extreme situations. It can become an obstacle in achievement of high sport results.

6. We received significant correlation between “personal anxiety” and “competition anxiety”. Its direct character points that with increasing of personal anxiety, “competition anxiety” also increases (see table 6). In competitions such anxiety can be an obstacle in achievement of high sport results.

7. We also obtained highly significant correlation between “discussing of interesting problems with other people to know their point of view” and “planning of future activity (physical loads and so on)” (see table 7).

This correlation means the following: a) for Paralympic athletes initial pronouncing of own future actions can be sufficiently critical point in making plan

### Table 4. Correlation between sport category and type of temper of Paralympic athletes

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Sport category</th>
<th>Type of temper</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Correlation coefficient</td>
<td>1.000</td>
</tr>
<tr>
<td></td>
<td>Bilateral value</td>
<td>-.011</td>
</tr>
<tr>
<td>By Spearman</td>
<td>N</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>Correlation coefficient</td>
<td>-.637*</td>
</tr>
<tr>
<td></td>
<td>Bilateral value</td>
<td>.011</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>24</td>
</tr>
</tbody>
</table>

*Correlation is significant at 0.05 (bilateral)

### Table 5. Correlation between personal anxiety and situational anxiety of Paralympic athletes

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Personal anxiety</th>
<th>Situational anxiety</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Correlation coefficient</td>
<td>1.000</td>
</tr>
<tr>
<td></td>
<td>Bilateral value</td>
<td>.030</td>
</tr>
<tr>
<td>By Spearman</td>
<td>N</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>Correlation coefficient</td>
<td>.559*</td>
</tr>
<tr>
<td></td>
<td>Bilateral value</td>
<td>.030</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>24</td>
</tr>
</tbody>
</table>

*Correlation is significant at 0.05 (bilateral)

### Table 6. Correlation between personal anxiety and competition anxiety of Paralympic athletes

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Personal anxiety</th>
<th>Competition anxiety</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Correlation coefficient</td>
<td>1.000</td>
</tr>
<tr>
<td></td>
<td>Bilateral value</td>
<td>.003</td>
</tr>
<tr>
<td>By Spearman</td>
<td>N</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>Correlation coefficient</td>
<td>.707**</td>
</tr>
<tr>
<td></td>
<td>Bilateral value</td>
<td>.003</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>24</td>
</tr>
</tbody>
</table>

**Correlation is significant at 0.01 (bilateral)
of future activity; b) pronouncing permits to plan future activity and insert necessary corrections, when receiving significant feedback in due time; c) it’s quite probable that initial pronunciation of the most important issues will play key role in development of self-organization of Paralympic athletes’ personalities.

8. We received significant correlation between parameter “I used to discuss important for me questions with other people, to know their opinion” and parameter “Control over own professional progress to obtain positive results” (see table 8).

This correlation shows that Paralympic athletes require constant assistance during trainings from pedagogues, psychologists and coaches.

Discussion

To large extent, success in sports depends on athlete’s individual features [3, 13]. Athlete’s psychic qualities are the most significant factors, which condition the level of sport achievements [2]. The results, received in our experiment revealed similar connection. As per these parameters it is of no importance in which sport movement (Olympic or Paralympic) athlete participates. Intensive physical and psychic loads are characteristic for all sports. Such loads facilitate development of psychic features. They ensure weakening of psychic load by rationalizing behavior (anxiety in particular).

A number of authors [1, 2, 9] noted kinds of anxiety on the base of situations, connected with training process: training anxiety; with picture of oneself – self-assessment anxiety; with communication – interpersonal anxiety. Our researches confirm the results of other studies. Specificity of the chosen category of athletes permitted for us to open wider these results. Thus we can affirm the following:
- Training process: for maximal realization of this direction it is necessary (especially in game kinds of sports) to select athletes with sanguine type of temper (see table 4);
- Picture of oneself: the received results show that Paralympic athletes with high personal anxiety can build imaginative obstacles. It influences negatively on achievement of high sport results and communication in team in extreme situation and everyday trainings (see tables 5, 6);
- Communication is the element, closely connected with previous kind of anxiety. It is necessary to remember that we deal with disabled people (see tables 7, 8).

Some authors [1, 13, 18] say that anxiety state complicates athlete’s activity and reduces his/her achievements in competitions. Other specialists [6, 15, 33] present the data that anxiety state is connected with feeling “comfort of psychological functioning”. The mentioned problem of conscious localization of anxiety control only has started to be worked out in sport psychology.

In the received by us results we attract attention to the data of correlations. They witness about demand in constant assistance of pedagogues, psychologists and coaches in trainings of Paralympic athletes. It is also confirmed by other authors [9, 10, 16]. Such assistance will positively influence on emotional state that will facilitate realization of Paralympic athlete’s maximal potentials and bring victory in competitions.

Table 7. Correlation between communication with other people and planning of future activity

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Consideration of other people’s point of view</th>
<th>Planning of future activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>By Spearman</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consideration of other</td>
<td>Correlation coefficient 1.000</td>
<td>.853**</td>
</tr>
<tr>
<td>people’s point of view</td>
<td>Bilateral value</td>
<td>.000</td>
</tr>
<tr>
<td>N</td>
<td>24</td>
<td>24</td>
</tr>
<tr>
<td>Planning of future activity</td>
<td>Correlation coefficient .853**</td>
<td>1.000</td>
</tr>
<tr>
<td>Bilateral value</td>
<td>.000</td>
<td>-</td>
</tr>
<tr>
<td>N</td>
<td>24</td>
<td>24</td>
</tr>
</tbody>
</table>

**Correlation is significant at 0.01 (bilateral)

Table 8. Correlation between communicating with other people and professional progress of Paralympic athletes

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Consideration of other people’s point of view</th>
<th>Control over own progress</th>
</tr>
</thead>
<tbody>
<tr>
<td>By Spearman</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consideration of other</td>
<td>Correlation coefficient 1.000</td>
<td>-.580*</td>
</tr>
<tr>
<td>people’s point of view</td>
<td>Bilateral value</td>
<td>.023</td>
</tr>
<tr>
<td>N</td>
<td>24</td>
<td>24</td>
</tr>
<tr>
<td>Control over own</td>
<td>Correlation coefficient -.580*</td>
<td>1.000</td>
</tr>
<tr>
<td>progress</td>
<td>Bilateral value</td>
<td>.023</td>
</tr>
<tr>
<td>N</td>
<td>24</td>
<td>24</td>
</tr>
</tbody>
</table>

*Correlation is significant at 0.05 (bilateral)
Conclusions

Organization of athletes’ self-education process has been defined as targeted, conscious, systemic and planned process. At the beginning athletes require assistance. Then, independent, personally desired and important personality’s work with him/herself is started. The purpose of such work is: rising of sportsmanship, perfection of moral-will qualities, regulation of psycho-emotional state, self-perfection and self-realization in sport activity.

We have substantiated sequential stages of self-education process of Paralympic athletes in conditions of sport activity: involvement of Paralympic athletes in self-cognition process; mastering of skills in self-education; athlete’s self-organization and self control over own sport and social self-perfection.

The structure of athletes’ self-education is presented by combination of interconnected components: motivational-personal (motives, demands, settings, moral-will qualities and individual-personal features); cognitive (system of knowledge about oneself and sport activity); activity (formation of skills in self-cognition, self-organization and self-control).

The prospects of further researches imply further scientific solution of the following problems: training of coaches for Paralympic teams in different kinds of sports, consideration of special aspects of Paralympic athletes’ self-education process’s organization in different kinds of sports during trainings and at different level competitions.

Conflict of interests

The author declares that there is no conflict of interests.

References


**Information about the author:**

Shuba V.V.; https://orcid.org/0000-0001-5042-3106; viktoria-shuba79@yandex.ru; Dnipropetrov’sk State Institute of Physical Culture and Sport; street Embankment of Victory, 10, Dnipropetrov’sk, 49094, Ukraine.

**Cite this article as:** Shuba VV. Special aspects of Paralympic athletes’ sport activity in the process of self-education. *Pedagogics, psychology, medical-biological problems of physical training and sports*, 2017;21(3):139–145. doi:10.15561/18189172.2017.0307

The electronic version of this article is the complete one and can be found online at: http://www.sportpedagogy.org.ua/index.php/PPS/issue/archive

This is an Open Access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited (http://creativecommons.org/licenses/by/4.0/deed.en).

Received: 02.02.2017
Accepted: 25.02.2017; Published: 30.04.2017
Dynamic of bio-geometric profile indicators of children’s with functionally one ventricle posture at stage of physical rehabilitation

Vitomskiy V.V., Lazarijeva O.B., Imas E.V., Zhovnir V.A., Emets I.N.

1Scientific-Practical Medical Center of Pediatric Cardiology and Cardiac Surgery of the MH of Ukraine
2National University of Physical Education and Sport of Ukraine

Abstract

Purpose: to assess dynamic of bio-geometric profile quantitative indicators in children with functionally one ventricle at stages of physical rehabilitation.

Material: 35 patients were examined during hospital stay and when leaving hospital. Indicators were registered with the help of photo metering and program Ergotherapy.

Results: in children we registered great number of posture disorders in frontal (94.3%) and sagittal planes (97.1%). In frontal plane the angles, pointing at significant asymmetry of upper limbs in respect to horizontal plane, were increased. In sagittal plane we received angles, which pointed at presence of thoracic kyphosis and lumbar lordosis. After surgery and stationary stage of rehabilitation static changes were registered in insignificant quantity of the studied angles. After post-clinical physical rehabilitation stage we registered reduction of angles’ values and their approaching to norm.

Conclusions: physical rehabilitation at stationary and port clinical stages with the help of correcting exercises positively influence on restoration of posture after surgery and its improvement in the future.

Keywords: congenital heart disease, circulation of Fontane, posture, static stereotype.

Introduction

To day in Ukraine all known in the world cardio-surgeries in cases of the heaviest congenital heart diseases (CHD) are practiced [5]. Abnormalities with functionally one ventricle (FOV) are considered to be the heaviest; for them mixing of arterial and venous blood is characteristic. That is why, study of different physical health aspects of patients and influence of surgery and physical loads on it is very relevant.

Scientists note that patients with FOV lag in physical development [3] have reduced functional potentials of respiratory system [9, 12, 19, 22] and tolerance to physical loads [11, 14, 24, 30]. As on to day the problems of physical rehabilitation of children with CHD are paid insufficient attention to. In the past century fundamental works on rehabilitation of children with CHD are practiced [5]. Abnormalities with functionally one ventricle at stages of physical rehabilitation.

Today in Ukraine all known in the world cardio-surgeries in cases of the heaviest congenital heart diseases (CHD) are practiced [5]. Abnormalities with functionally one ventricle (FOV) are considered to be the heaviest; for them mixing of arterial and venous blood is characteristic. That is why, study of different physical health aspects of patients and influence of surgery and physical loads on it is very relevant.

Scientists note that patients with FOV lag in physical development [3] have reduced functional potentials of respiratory system [9, 12, 19, 22] and tolerance to physical loads [11, 14, 24, 30]. As on to day the problems of physical rehabilitation of children with CHD are paid insufficient attention to. In the past century fundamental works on these problems were fulfilled by O.I. Yankelevich [7] and L.V. Petrunina [6]. In English scientific sources the quantity of works on physical health, motor functioning and sports problems in persons with CHD is much greater. Such works deepened knowledge at the account of researches of patients with different diseases, age and creation of appropriate recommendations.

The most wide-scale studies of physical loads’ influence in cardio-rehabilitation programs for persons with CHD were made by J. Rhodes [26-28] – increase of peak VO₂ and maximal load for long period; P. E. Longmuir [20, 21] – long term improvement of physical fitness indicators; L. M. Bradley [10] – improvement of peak VO₂ and endurance; I. C. Balfour [8] - improvement of peak VO₂; B. Goldberg [16] – improvement of maximal power and workability, influence on peak VO₂ was absent; H. D. Ruttenberg [29], P. M. Fredriksen [13] – improvement of endurance, influence on peak VO₂ was absent.

Study of bio-geometric profile of posture permits to find the following:
- Parameters of children’s postures for working out post-surgery rehabilitation program [25];
- Parameters of static balance, which characterize the level of deviation in development children’s [23] and adults [18] physical qualities;
- Correction of cardio-rehabilitation program for adults [15, 17].

But influence of physical loads on children’s with CHD posture has not been studied yet. Other authors received results of dynamic of respiratory system’s functional state in physical rehabilitation process [1], indicators of life quality and quantitative assessment of posture [4].

The purpose of the research: to assess dynamic of bio-geometric profile quantitative indicators in children with functionally one ventricular at stages of physical rehabilitation.

Material and methods

Participants: in the research 35 patients with CHD participated: 23 boys and 12 girls (age from 6 to 14 years). The children were hospitalized for surgery (haemodynamic correction) in “Scientific-practical medical center of pediatric cardiology and cardio-surgery MHP of Ukraine”. After rehabilitation course 31 patients were examined (those, who fulfilled rehabilitation completely). The parents gave consent for their children’s participation in the research.

Organization of the research: we used quantitative assessment of posture bio-geometric profile (photo metering with program «Ergotherapy»). It was fulfilled trice: in the day of hospitalizing, after clinical stage of rehabilitation (in day of leaving hospital) and after post-clinical stage of physical rehabilitation. Norms of angles
values were 0°, distances L₁ and L₂ shall be equal.

Statistical analysis: the materials of the research were processed in program of statistical analysis IBM SPSS 21. Mathematical processing of numerical data was fulfilled with the help of variation statistic. Analysis of quantitative indicators distribution’s correspondence to the law of normal distribution was checked by Shapiro-Wilk test (W). For quantitative indicators with normal distribution we found mean value (X̄) and mean square deviation (S).

For quantitative indicators with distribution, differing from normal we found median (Me) and upper/lower quartiles (25%; 75%). For assessment of difference’s significance (providing normal distribution of the results of the research) we used Student’s t-test (for independent or dependent groups). For indicators with distribution, differing from normal we used Wilcoxon’s criterion (for dependent groups).

Results

Among the tested patients 33 children had posture disorder in frontal plane and 34 children – in sagittal plane. According to the received average statistic results, as on the moment of hospitalizing of children with CHD angle β₁ was 1.34±0.70°; Me was (25%; 75%) 1.29 (0.67; 1.84)°. Angle β₄ (formed by line of horizon and line between acromions) was 3.10±1.60°; Me (25%; 75%) – 2.79 (2.00; 4.26)°. Angle β₃ (formed by horizon line and segment, connecting points of shoulder blades’ lower angles) was 4.65±2.33°; Me (25%; 75%) – 4.32 (3.04; 5.96)°. Angle β₂ (formed by line of horizon and segment, connecting head mass center and point between legs’ sphirions) was 0.63±0.26° with Me (25%; 75%) – 0.60 (0.44; 0.83)°.

We did not find confident difference between L₁ and L₂ (p>0.05), that points at absence of confidence prevalence by quantity of curvatures to one of sides. But there was present statistically confident difference between indicators L₁₀ (distance between radial point and center of ilium crest at the side of budge) and L₁₂ (distance between radial point and center of ilium crest at the side of concavity) (p<0.001), that is a result of scoliotic changes in posture.

In sagittal plane (at the beginning of hospital stay period) we also received angle values, differing from norm. Mean statistic value of angle α₂ (formed by vertical line and segment between head mass center and acromion) exceeded norm and was 5.86±3.55° with Me (25%; 75%) at levels 5.30 (3.65; 8.24)°. Angle α₃ (formed by vertical line’s crossing the segment between head of ilium crest and trochanterica) was 7.38±4.51°. Indicators Me (25%; 75%) were at level 7.32 (3.81; 11.06)°. Output values of other angles of sagittal planes also differed from normal.

It should be noted that application of physical rehabilitation technology started before surgery and continued after it and after leaving hospital. More detail description of physical rehabilitation is given in scientific literature [2].

Analysis of experimental data showed that bio-geometric profile indicators in frontal plane (see table 1) changed at different stages of the research.

By our results (see fig. 1) we can conclude that be the moment of hospital leaving only angles β₁ (p<0.05) and β₄ (p<0.01) statistically confidently increase. Thus, mean value of angle β₂ increased by 0.40° (12.9% to 3.58°). Angle β₃ increased by 0.17° (30.0% to 0.80°). It should also be noted that reduction of angle β₁ is not statistically confident. But the value of this angle shows the possibility of certain improvement of posture under influence of physical rehabilitation. It should be considered that surgery causes traumas of chest in children.

After some period of time we registered statistically confident improvement of all angles in frontal plane (p<0.01) Comparing with initial data. In particular, angle β₁ reduced by 0.40° (to 0.94°). Angle β₄ decreased by 1.14° (to1.96°). Angle β₂ reduced by 2.21° (to 2.44°); angle β₃ – by 0.19° (to 0.44°). It is interesting that the greatest changes were in angle β₁ – it reduced by 47.5%. Alongside with it, angle β₂ reduced by 29.9% and angle β₃ – by 36.8%. Angle β₄ reduced by 30.2%. Statistical; indicators Me (25%; 75%) were 1.87 (1.39; 2.37)° for angle β₁ and 2.31 (1.52; 3.37)° for angle β₄.

Reduction of angles in frontal plane statistically significantly reflected only in increasing of L₁₂ to 5.84 cm (p<0.01). Thus, L₁₂ (module of difference between L₁ and L₂) confidently reduced by 0.82 cm to 0.52 cm (p<0.01).

In the process of physical rehabilitation changes of angles took place also in sagittal plane (see table 2). It was found that in period of stationary stage and at leaving hospital only angles α₂ (p<0.05) and α₃ (p<0.01) changed statistically confidently. Thus, mean value of angle α₂ increased by 1.14° (3.8% to 9.41°). Angle α₃ reduced by 1.62° (22.0% to 0.80°).

In post-stationary period we registered statistically confident improvement of all angles in sagittal plane (p<0.01). In particular, angle α₂ reduced by 2.82°(to 3.04°). Angle α₃ decreased by 2.83° (to 5.44°). Angle α₄ decreased by 1.47° (to 4.59°) and angle α₆ – by 0.58° (to 6.80°). Angle α₄ reduced by 0.59° (to 3.76°) and angle α₆ – by 0.88° (to 2.97°). Angle α₆ reduced by 1.01° (to 2.09°).

It should be noted that angle α₃ changed most of all – it reduced by 48.1%, while angle α₄ – by 34.2%, angle α₆ – by 24.3%, angle α₃ – by 7.8%, angle α₄ – by 13.6%, angle α₆ – by 22.9% and angle α₃ – by 32.6%. Statistically significant indicators Me (25%; 75%) were 5.73 (2.88; 7.78)° for angle α₃ and 6.45 (3.23; 10.22)° for angle α₄.

Discussion

Demand in some reviewing of methodological approaches to patients’ with heavy heart diseases health
### Table 1. Mean statistic indicators of bio-geometric profile of children with functionally one ventricular in frontal plane at different stages of the research

<table>
<thead>
<tr>
<th>Bio-geometric profile indicators of posture</th>
<th>In hospital (n=35)</th>
<th>When leaving hospital (n=35)</th>
<th>In post clinical period (n=31)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(\bar{\mu})</td>
<td>S</td>
<td>(\bar{\mu})</td>
</tr>
<tr>
<td>(\beta_1, ^\circ)</td>
<td>1.34</td>
<td>0.70</td>
<td>1.38</td>
</tr>
<tr>
<td>(\beta_2, ^\circ)</td>
<td>3.10</td>
<td>1.60</td>
<td>3.58'</td>
</tr>
<tr>
<td>(\beta_3, ^\circ)</td>
<td>4.65</td>
<td>2.33</td>
<td>4.33</td>
</tr>
<tr>
<td>(\beta_4, ^\circ)</td>
<td>0.63</td>
<td>0.26</td>
<td>080''</td>
</tr>
<tr>
<td>(L_1), cm</td>
<td>6.24</td>
<td>1.89</td>
<td>6.47</td>
</tr>
<tr>
<td>(L_2), cm</td>
<td>5.76</td>
<td>1.65</td>
<td>5.89</td>
</tr>
<tr>
<td>(L_3), cm</td>
<td>6.76</td>
<td>1.74</td>
<td>6.93</td>
</tr>
<tr>
<td>(L_{conc}), cm</td>
<td>5.33</td>
<td>1.55</td>
<td>5.43</td>
</tr>
<tr>
<td>(L_{\Delta}), cm</td>
<td>1.34</td>
<td>1.15</td>
<td>1.50</td>
</tr>
</tbody>
</table>

Notes: \(\beta_1\), ° – angle, formed by vertical line and segment between head MC and vertebra C7; \(\beta_2\), ° – angle formed by horizontal line and segments between acromions; \(\beta_3\), ° – angle formed by horizontal line and segments between bottom angles of shoulder blades; \(\beta_4\), ° – angle formed by vertical line and segment between vertebra C7 and point between spirhions; \(L_1\) – distance between left radial point and center of left ilium crest; \(L_2\) – the same to the right; \(L_3\) – distance between radial point and center of ilium crest on bulge side; \(L_{conc}\) – distance between radial point and center of ilium crest on concave side; \(L_{\Delta}\) – module of \(L_1\) and \(L_2\) difference; * – difference between indicators is statistically significant, comparing with indicators at hospital stay period at \(p<0.05\); ** – \(p<0.01\).

### Table 2. Mean statistic indicators of bio-geometric profile of children with functionally one ventricular in sagittal plane at different stages of the research

<table>
<thead>
<tr>
<th>Bio-geometric profile indicators of posture</th>
<th>In hospital (n=35)</th>
<th>When leaving hospital (n=35)</th>
<th>In post clinical period (n=31)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(\bar{\mu})</td>
<td>S</td>
<td>(\bar{\mu})</td>
</tr>
<tr>
<td>(\alpha_1, ^\circ)</td>
<td>5.86</td>
<td>3.55</td>
<td>5.79</td>
</tr>
<tr>
<td>(\alpha_2, ^\circ)</td>
<td>8.27</td>
<td>4.31</td>
<td>9.41'</td>
</tr>
<tr>
<td>(\alpha_3, ^\circ)</td>
<td>6.06</td>
<td>3.64</td>
<td>6.46</td>
</tr>
<tr>
<td>(\alpha_4, ^\circ)</td>
<td>7.38</td>
<td>4.51</td>
<td>5.76''</td>
</tr>
<tr>
<td>(\alpha_5, ^\circ)</td>
<td>4.35</td>
<td>2.39</td>
<td>4.44</td>
</tr>
<tr>
<td>(\alpha_6, ^\circ)</td>
<td>3.85</td>
<td>1.82</td>
<td>4.17</td>
</tr>
<tr>
<td>(\alpha_7, ^\circ)</td>
<td>3.10</td>
<td>1.94</td>
<td>3.33</td>
</tr>
</tbody>
</table>

Notes: \(\alpha_1\), ° – angle, formed by vertical line and segment between head mass center (MC) and acromion; \(\alpha_2\), ° – angle, formed by vertical line and segment between acromion and infra-thoracic point; \(\alpha_3\), ° – angle, formed by vertical line and segment between infra-thoracic point and center of ilium crest; \(\alpha_4\), ° – angle, formed by vertical line and segment between center of ilium crest and trochanterica; \(\alpha_5\), ° – angle, formed by vertical line and segment between trochanterica and tibiala point; \(\alpha_6\), ° – angle, formed by vertical line and segment between tibiala point and Spirhion; \(\alpha_7\), ° – angle, formed by vertical line and segment between acromion and trochanterica; * – difference is statistically significant, comparing with indicators in stationary clinical period at \(p<0.05\); ** – \(p<0.01\).
protection and improvement has been recognized long before. Recent decade application of physical exercises and physical training in case of congenital heart diseases have been recognized as necessary and important therapy. Posture is one of the most important sides of patients’ physical health.

The received indicators of posture bio-geometric profile point at significant prevalence of posture disorders in children with functionally one ventricular in frontal (94.3%) and sagittal (97.1%) planes.

In period of leaving hospital we registered statistically confident worsening of angles $\beta_2$, $\beta_4$, $\alpha$. It permits to say that stationary clinical period of physical rehabilitation was rather effective. During this period a number of negative factors influenced: sternotomy; long lasted drainages; pain and stiffness; sparing regime for arm with venous catheter. All these cause worsening of posture.

Results of all physical rehabilitation course witness about reduction of backbone curvatures and improvement of posture bio-geometric profile.

The received results prove statistical data about significant prevalence of posture disorders among children with CHD. In the work of O.I. Yankelevich [12] it is noted that posture disorders were found in more than 50% of examined before hospitalizing children with CHD: scoliotic posture; slouch; scoliosis of 1st, 2nd and 3rd category. In the research of O.I. Yankelevich [12] it is noted that posture disorders were found in more than 50% of examined before hospitalizing children with CHD: scoliotic posture; slouch; scoliosis of 1st, 2nd and 3rd category. In the research of L.V. Petrunina [7] percentage of children with posture disorders was 54.7%. It resulted from congenital defect of muscular skeletal apparatus of backbone thoracic section, which usually accompanies congenital heart diseases. The author notes that scoliotic posture was detected in 36.8% of children with defect of atrial membrane, in 38.0% of children with defect of inter-ventricular membrane and in 33.4% of children with tetralogy of Fallot. Slouch was registered in 52.75%, 47.5% and 37.4% according to the mentioned groups of children.

Thus, study and consideration of posture condition, when building individual rehabilitation programs for children with CHD, is a substantiated and necessary pre-condition.

Conclusions

Among children with FOV there are many disorders of static stereotype. In the studied group of children there were disorders in frontal plane 94.3% and in sagittal – 97.1%. It is a combined result of low physical condition, a number of surgeries with sternotomy and congenital defect of muscular skeletal apparatus. Such facts condition need in application of physical rehabilitation program with special exercises, oriented on posture correction.

The received results of dynamic of posture bio-geometric profile’s indicators point that application of correcting physical exercises, general and breathing exercises facilitates restoration of muscular strength and static stereotype at stationary clinical rehabilitation stage. At post clinical stage is facilitates their improvement.

Acknowledgements

The work has been fulfilled in compliance with “Combined plan of SRW in sphere of physical culture and sports for 2011-2015” by topic 4.4. “Improvement of organizational and methodic principles of physical rehabilitation processes’ programming in cases of dysfunctional disorders in different systems of human organism”. State registration number: 0111U001737.

Conflict of interests

The authors declare that there is no conflict of interests.

References

2. Vitomskiy V. Metodichni osnovi pobudov programi iz fizichnoi reabilitacii dla ditej shkil’nogo viku z funktsional’no iedinim shlunochkom sercja [Medical principles of building physical rehabilitation program for school age children with functionally one ventricular]. Mododizhnij naukovij visnik, 2015;18:111–116. (in Ukrainian)
4. Vitomskiy V, Lazariieva O. Pokazniki biogeometrichnogo profili postavi ta iakosti zhittia u ditej z funktsional’no iedinim shlunochkom sercja [Indicators of posture bio-geometrical indicators and life quality of children with functionally one ventricular]. Fizichne vikhovannia, sport i kul’ura zdorov’ia u suchasnomu suspil’stvi, 2015;4(55):156–160. (in Ukrainian)
5. Iemec’ IM, Rudenko NM, Vorobjova GM. Transpoziciia magistral’nikh sudin [Transposition of main vessels], Ternopil: Ternopil State Medical University; 2012. (in Ukrainian)
6. Petrunina LV. Osobennosti metodiki lechebnoi gymnastiki u bol’nykh s vrozhdennymi porokami sereda, operirovannykh v usloviakh iskusstvennogo krovoobrazchenii. Kand. Diss. [Special aspects of therapeutic gymnastic’s methodic in patients with congenital heart diseases, who were operated on in
conditions of cardiopulmonary bypass. Cand. Diss.], Moscow; 1972. (in Russian)
22. Matthews IL, Fredriksen PM, Bjørnstad PG, Thaulow E, Gronn M. Reduced pulmonary function in children with the Fontan circulation affects their exercise capacity. Cardiology in the Young. 2006;16(3):261–267. doi:10.1017/S1047951106000345
Information about the authors:
Vitomskiy V.V.; http://orcid.org/0000-0002-4582-6004; vitomskiyvova@rambler.ru; Scientific-Practical Medical Center of Pediatric Cardiology and Cardiac Surgery of the MH of Ukraine; 24 Melnikov St, Kyiv, 04050, Ukraine; National University of Physical Education and Sport of Ukraine; 1 Phizkultury Street, Kiev, 03680, Ukraine.

Lazarieva O.B.; http://orcid.org/0000-0002-7435-2127; helenka_l@mail.ru; National University of Physical Education and Sport of Ukraine; 1 Phizkultury Street, Kiev, 03680, Ukraine.

Imas E.V.; http://orcid.org/0000-0001-5261-6868; rectorat@uni-sport.edu.ua; National University of Physical Education and Sport of Ukraine; 1 Phizkultury Street, Kiev, 03680, Ukraine.

Zhovnir V.A.; http://orcid.org/0000-0003-1186-7585; info@uccc.com.ua; Scientific-Practical Medical Center of Pediatric Cardiology and Cardiac Surgery of the MH of Ukraine; 24 Melnikov St, Kyiv, 04050, Ukraine.

Emets I.N.; http://orcid.org/0000-0002-5411-1246; info@uccc.com.ua; Scientific-Practical Medical Center of Pediatric Cardiology and Cardiac Surgery of the MH of Ukraine; 24 Melnikov St, Kyiv, 04050, Ukraine.

Cite this article as: Vitomskiy VV, Lazarieva OB, Imas EV, Zhovnir VA, Emets IN. Dynamic of bio-geometric profile indicators of children’s with functionally one ventricle posture at stage of physical rehabilitation. Pedagogics, psychology, medical-biological problems of physical training and sports, 2017;21(3):146–151. doi:10.15561/18189172.2017.0308

The electronic version of this article is the complete one and can be found online at: http://www.sportpedagogy.org.ua/index.php/PPS/issue/archive
This is an Open Access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited (http://creativecommons.org/licenses/by/4.0/deed.en).
Received: 02.02.2017
Accepted: 25.02.2017; Published: 30.04.2017
SUBMISSION OF MANUSCRIPTS

(For more detailed information see http://www.sportpedagogy.org.ua/index.php/PPS/pages/view/trebovaniya-e)

Structure of article:
- title of an article;
- surname, full first name and patronymic;
- full name of organization (place of work or study);
- annotation in three language (Russian, Ukrainian, English). The scope of the annotation is to be 800-1000 symbols.

Annotation must contain translate of surname, full first name and patronymic of authors, in Ukrainian (Russian) and English. Structure of annotation: Purpose, Material, Results, Conclusions. For authors from Russia, the translation in the Ukrainian language makes editorial board.

Key words for the three languages: (4-6 words).

Introduction
Hypothesis, Purpose

Material and methods
Participants.
Research Design.
Statistical Analysis

Results
Discussion
Conclusions

Conflict of interests

References (more than 20) should be making up according to standard form.

REVIEW PROCEDURE FOR MANUSCRIPTS (For more detailed information see http://www.sportpedagogy.org.ua/html/recenzirovaniye-e.html)

All manuscripts submitted for publication must go through the review process.

TREATMENT OF MANUSCRIPTS (For more detailed information see http://www.sportpedagogy.org.ua/html/rassmotreniye-e.html)

Manuscripts are assessed by the Editorial Board within 1 month.
The Journal will acknowledge receipt of a manuscript within 2 days.

EDITORIAL ETHICS (For more detailed information see http://www.sportpedagogy.org.ua/html/ethics-e.html)

The journal is committed to a high standard of editorial ethics.
The Editorial board is used the principles of ethics of scientific publications upon recommendations of International Committee of Medical Journal Editors.
Conflicts of interests of persons who have direct or indirect relation to the publication of an article or any information that the article consist are settled according to the law of Ukraine in the field of intellectual property.

CONTACT INFORMATION
box 11135, Kharkov-68, 61068, Ukraine
phone. 38-099-430-69-22
http://www.sportpedagogy.org.ua
e-mail: sportart@gmail.com

Information Sponsors, Partners, Sponsorship:
- Olympic Academy of Ukraine
- Ukrainian Academy of Sciences.

SCIENTIFIC EDITION (journal)
Pedagogics, Psychology, Medical-Biological Problems of Physical Training and Sports. 2017;3:54

designer – lermakov S.S.
editing – Yermakova T.
designer cover – Bogoslavets A.
administrator of sites – lermakov S.S.

passed for printing 30.04.2017
Format A4.
Red Banner str., 8, Kharkov, 61002, Ukraine.
PRINOTHUSE (BOZ № 248 750, 13.09.2007).
61002, Kharkov, Girshman, 16a.