ISSN 2308-7269

PEDAGOGICS
PSYCHOLOGY

Medical-Biological
Problems of Physical
Training and Sports
№04/2016

PEDAGOGICS, PSYCHOLOGY, MEDICAL-BIOLOGICAL PROBLEMS OF PHYSICAL TRAINING AND SPORTS

2016
04

Key title: Pedagogika, psihologia ta mediko-biologicni problemi fizicnogo vihovanna i sportu

Abbreviated key title: Pedagog. psihol. med.-biol. probl. fiz. vihov. sportu

ISSN 1818-9172 (Russian ed. Print)

ISSN 1818-9210 (Russian ed. online)

Certificate to registration: KB 20683-10483PR. 31.03.2014.

Founders:

Kharkov National Pedagogical University.

Journal is ratified:

Ministry of Education and Science of Ukraine

6.11.2014, N1279 (pedagogical sciences);

06.03.2015, N261 (physical education and sport).

Frequency – 6 numbers in a year.

http://www.sportpedagogy.org.ua

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)

Address of editorial office:

Box 11135, Kharkov-68, 61068, Ukraine,

Tel. 38 099 430 69 22

e-mail: sportart@gmail.com

Address of editorial office (Europe):

Sport str. 2, of.209, 85-064 Bydgoszcz, Poland

Deputy Editor: Mirosława Cieślicka,

e-mail: cudaki@op.pl

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
   IndexCopernicus http://journals.indexcopernicus.com
   РІНЦ – 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

CONTENTS

ASSESSMENT OF OFFICIAL COMBAT MISSION'S FULFILLMENT BY HIGHER EDUCATIONAL ESTABLISHMENT'S CADETS (on example of militarized cross)

Anatskyi R.V.[1], Kolomiitseva O.E.[2]
[1]The National Academy of the National Guard of Ukraine
[2]Yaroslav the Wise National Law University

Abstract. *Purpose:* to analyze results of official combat mission's fulfillment (militarized cross with shooting and throwing of grenades) by military educational establishment's cadets. *Material:* in the research 80 2nd year cadets of different specialties participated. The cadets fulfilled exercise in full military equipment. They started and finished by military units and total time, registered by indicators of the last team member, was considered. The distance was 6 km and included: run on even surface; overcoming of obstacle course; two firing lines with shooting in lying and standing position at human height target; throwing of training grenade (F 1) for distance of not less than 35 m. For every slip in shooting 10 seconds of penalty time was accounted; for failure in throwing grenade – 40 seconds of penalty time. *Results:* the conducted study permitted to assess different sides of cadets' profile training, i.e. physical, fire and tactic. All units finished in full strength, i.e. coordination of actions was good. The best total time of cross fulfillment was demonstrated by cadets of "special purpose units" specialty. The best shooting results were in cadets of "automobile transport" specialty – 90%, who also were the best in throwing grenade – 40%. Not very high indicator of this speed-power exercise says about inability to overcome general fatigue and fulfill combat task at the utmost. *Conclusions:* Complex technology of trainings with their combining with profile disciplines (physical, tactic and fire) first of all train cadets to act coordinately; to be responsible for each other; it will facilitate development and perfection of basic physical qualities, formation of main physical skills; increase percentage of sharpshooting in conditions of significant physical loads.

Key words: cadets, military unit, militarized cross, sharpshooting, throwing of grenade.

Introduction

As on to day, in military higher educational establishments there exists rather complex situation with cadets' physical fitness level. The reasons of physical loads' weak positive influence on professional fitness are: absence of typical programs on special physical training, absence or neglect of sport training bases, low physical level of most of applicants. Of not less importance is also unjustified reduction of practical hours' quantity, assigned for military officers' physical training [2, 16].

As it is noted in order of Commander of National Guard of Ukraine "On organization of physical training and sport-mass work in National Guard of Ukraine in 2016", № 708 dt. 27.11.2015 "results of control inspections of military parts and units for 2015 academic year witness that physical fitness level of most of military officers … does not correspond to existing requirements. Especially low level was registered in exercises for endurance…".

General endurance influences, to certain extent, on human workability. Besides, general endurance plays important role in optimization of life functioning; is an important component of person's physical health. Endurance is determined by functional potentials of organism's vegetative functions – cardio-vascular and respiratory. Examples of aerobic endurance are run and swimming at long distances, triathlon, ski and bicycle racings, academic rowing and etc. [12]. Means of training of military officers' endurance [10] are 1 km and 3 km run, run-marches at 5 and 10 km. Besides, in regulations for "Competitions of National Guard of Ukraine in military applied kinds of sports" one of program items is military course with shooting and throwing of grenade. These competitions combine results of many links of cadets' training: first of all coordination of actions in unit; psychological stability, moral-combat qualities of every cadet; personal physical fitness, sufficient aerobic endurance and shooting skillfulness.

Seeking of new technologies of military officers' physical and professional fitness improvement is constantly important and urgent. It attracts attention of leading domestic [2, 8, 9] and foreign specialists [19-22]. For example, a number of authors deal with different sides of organization of cadets' special physical training [13, 14, and 18]. Some authors [1, 4, and 7] point at paying attention to cultivation of applied physical qualities for effective fulfillment of combat techniques. Other works are devoted to "overcoming of obstacle course" [3, 11, and 14]. Alongside with it,

doi:10.15561/18189172.2016.0401

fulfillment of militarized cross with shooting and throwing of grenade requires from cadets to be able to resist to significant tiredness for fulfillment of the task. Such exercise is absolute new and complex element of personnel staff training in modern army. That is why we did not find such information in modern domestic scientific-methodic literature. It proves the relevance of our work.

Purpose: to analyze results of official combat mission's fulfillment (militarized cross with shooting and throwing of grenades) by military educational establishment's cadets.

Material and methods

Participants: in the research 80 2nd year cadets of different specialties of National Academy of National Guard of Ukraine participated:

- military management, hereinafter group 1;
- special purpose units, hereinafter group 2;
- weaponry and military equipment, hereinafter group 3;
- automobile transport, hereinafter group 4.

Organization of the research: the cadets fulfilled exercise "militarized cross with shooting and throwing of grenade", which was realized by competition method, in field uniform, high ankle boots and baldric. The weight of military equipments (bulletproof vest "Corsair MZS", helmet, SMG AK-74, belt kit with two magazines and gas mask) was nearly 10 kg.

Distance was 6 km on medium rugged terrain. On this distance it was necessary to overcome natural and artificial obstacles as well as shoot at two fire lines (sic shots at each) and throw grenade for distance. Start and finish were in one and the same place (see fig.1). The cadets started and finished together: by units; total time, registered by indicators of the last team member, was considered. At finish lagging if one cadet should not exceed 50 meters.

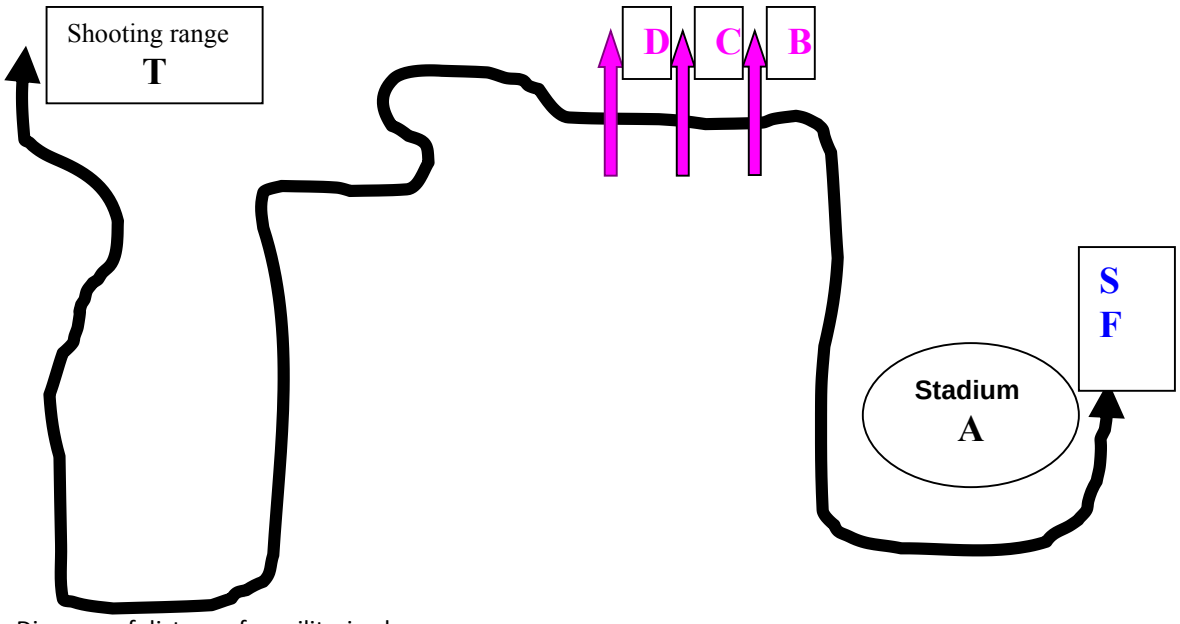

Fig.1. Diagram of distance for militarized cross

Notes: S, F – Star, finish; A – place for throwing of grenade; B – first obstacle (blockage of logs); C – second obstacle ("snake"); D – third obstacle (gap in wall); T – shooting range.

First 3.5 km of distance included:

- Run on even surface;
- Overcoming of "obstacle course" elements (blockage of logs, "snake", "gap in wall");
- Run on even surface to first fire line, at which shooting from lying position (three shots) at 100 meter' distance (target No.4 – human height) was fulfilled;

– Run on even surface to second fire line, at which shooting from standing position, in the same conditions was fulfilled;

The rest 2.4 km included run on even surface to place of throwing of training anti-personnel grenade for distance. Throw distance of not less than 35 meters was registered.

For every slip in shooting 10 seconds of penalty time was accounted; for failure in throwing grenade – 40 seconds of penalty time. During run help or mutual help without weapon or equipment's handing over of was permitted.

Statistical analysis: calculation of experimental results was conducted with the help of Excel program.

Results of the research

Study of endurance level, shooting and grenade throw efficiency permits to receive material, which can explain the reasons of low level of official combat missions' fulfillment in conditions of actual combat. The obtained data can serve as the base for creation of technologies for different modifications' militarized crosses and working out of assessment standards for them.

It should be noted that in the course of cross no unit lost any participant and finished at full strength. So, one of tasks was fulfilled: support, help and finishing in complete unit. It permits to say about coordination of actions in military unit and psychological resistance to physical loads; moral-morale in conditions of official combat functioning.

Analysis of militarized cross results by time indicators (see fig. 2) witnessed that the best total time was demonstrated by group 2 cadets (special purpose units). Much worse results were in groups 1, 3 and 4 with lagging behind nearly by 8, 11 and 10 minutes accordingly.

Complete analysis of cross fulfillment (as assessment of general endurance, shooting skillfulness and speed-power abilities in grenade throwing in conditions of high general fatigue) permits to understand that not all cadets groups coped with their tasks (see fig.3).

Rather high run endurance and shooting skillfulness was demonstrated by 70% cadets (at least one hit from six shots). Cross winners (2nd group cadets) could not cope with grenade throwing and only 20% fulfilled this task. Thus, for shooting slips and bad grenade throwing they were accounted 12 minutes and 3 seconds of penalty time.

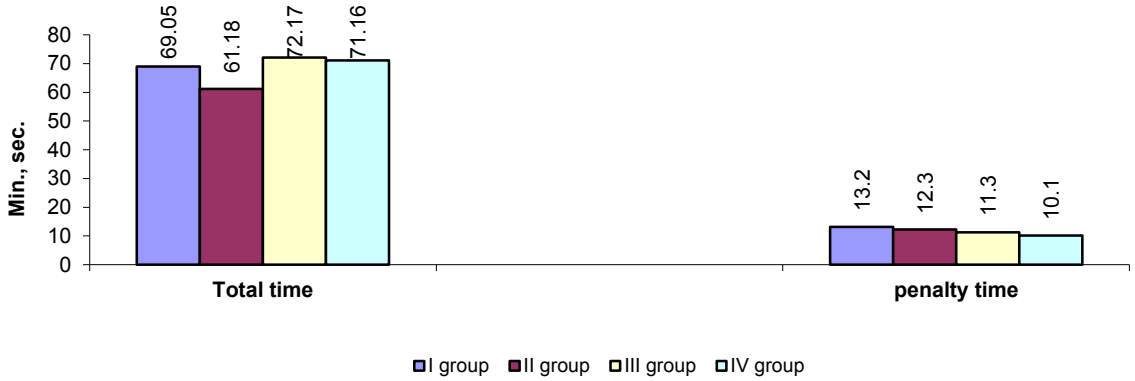

Fig. 2. Time indicators of sharpshooting and grenade throwing, demonstrated by cadets of different specialties, %

Much worse picture was in group 1: lagging behind from cross leaders was 8 minutes. The fulfilled 87.5% hits and 12.5% successful grenade throwing. Thus, for shooting slips and unsuccessful grenade throwing they were accounted 13 minutes and 2 seconds of penalty time.

Cadets of group 3 wasted much more total time, comparing with leader: they had the least penalty time. 90% of this unit hit in target and only 20% threw grenade at distance more than 35 meters. So for failures in grenade throwing they were accounted 11min. and 3sec. of penalty time.

Rather high results (shooting - 90% and grenade throwing – 40%) were demonstrated by group 4 cadets. It permitted for them to get the least quantity of penalty time.

Thus, grenade throwing was nearly failed by cadets in conditions of significant general fatigue. Indeed, they fulfilled throwing nearly at the end of distance. With it, they already covered 5600 meters' distance with obstacle

course (“logs’ blockage”, “snake”, “gap in wall”) and two fire lines. It should be noted that grenade throwing at distance of 35 meters in physical training of higher educational cadets [10] corresponds to mark “satisfactory”.

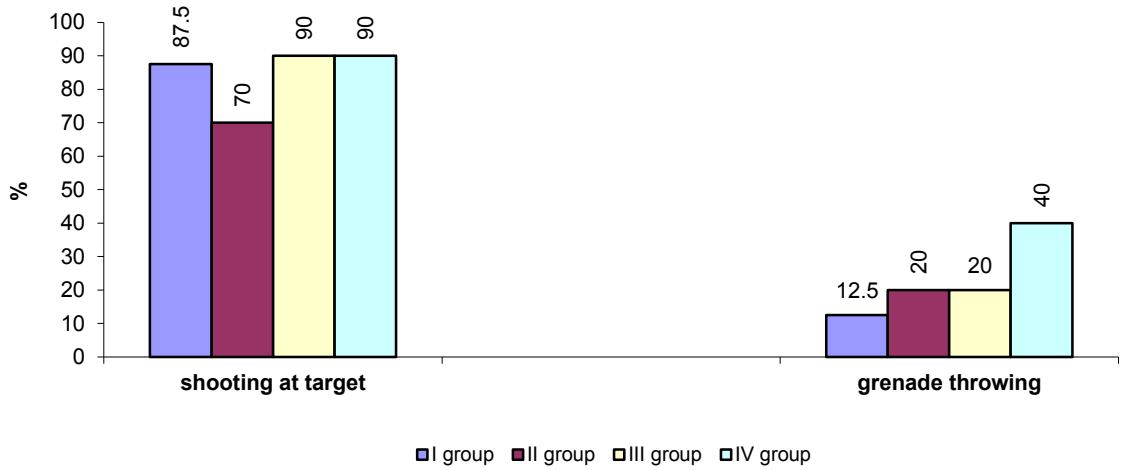

Fig.3. Time indicators of sharpshooting and grenade throwing, demonstrated by cadets of different specialties, %

As far as obstacle course elements are at the beginning of distance, fulfillment of this exercise was in fresh state. That is why cadets fulfilled it successfully, without instructor’s remarks.

More specific analysis of shooting results showed the following. First shooting was from lying position (after 3 km distance course) and , naturally, it was more successful than shooting from standing position (after running 500 meters more) (see table 1). The best results in shooting from lying position were in groups 3 and 4 and the worst results – in group 2. Results of shooting from standing position were also better in group 4 and the worst – in group 1.

Table 1. Results of shooting at target No.4 (human height) from different positions, %

Cadets groups	Quantity of hits from three shots			
	3 hits	2 hits	1 hit	No hits
	From lying position, %			
I group	27.5	30	25	17.5
II group	20	20	30	30
III group	50	20	10	10
IV group	55	30	5	10
	From standing position, %			
I group			5	95
II group		10	20	70
III group			20	80
IV group	5	20	5	70

Discussion

Analysis of researches showed that in present conditions professional functioning has specific features and puts forward high requirements to physical and psychological fitness of military officers [5, 17]. Basing on analysis and generalization of different sources’ data we supplemented the works of different authors [2, 16] devoted to physical and psychic loads, endured by cadets during fulfillment of official combat missions.

The data, received by us, prove first importance of physical fitness level in ensuring of individual combat readiness and its influence on professional functioning. We also supplemented the data about importance of cadets’ physical training factor just during their study at MHEE as far as in the future it will be difficult to ensure proper

physical fitness level [6, 17]. We also confirmed the data of [3, 5] about positive influence of physical exercises for endurance, for general physical fitness, morale of military officers.

As on to day competitions in militarized cross with shooting and throwing of grenade are a new approach to cadets' training in Ukrainian military higher educational establishments. Results of cadets' fulfillment of official combat mission in conditions of significant physical loads prove the presence of problem situation. Fulfillment of every exercise separately (long distance run, obstacle course, shooting, grenade throwing) are not difficult for cadets and do not cause any remarks of instructors [2, 3, 10]. However, combining of these elements in official combat situation (with need to act coordinately in unit, in military equipment of 10 kg weight)

In our opinion all mentioned above underlines the urgency of our research as well as witness about demand in working out of new training technologies and their implementation in educational space of modern military educational establishments. It is possible to use experience and methods of triathlon, modern pentathlon of military forces of other countries. Complex technology of trainings implies combination of profile disciplines: physical, tactic and fire. It permits to train cadets to act coordinately, to be responsible for each other as well as facilitate development and perfection of basic physical qualities, formation of main physical skills. Besides it trains to realize sharpshooting under physical and psychological loads in conditions, approached to combat.

Conclusions:

1. Analysis of scientific methodic literature and official documents showed unsatisfactory state of military higher educational cadets' physical fitness. It makes impossible successful fulfillment of official combat missions.

2. Analysis of militarized cross with shooting and grenade throwing results witnesses that in conditions of significant physical and moral loads cadets demonstrate low level of shooting at target of human height, as well as grenade throwing at distance of more than 35 meters is not feasible for all cadets.

3. The fulfilled research outlines a number of problems and puts new tasks for officers, instructors, cadets in respect of application of new approaches to improvement of MHEE cadets' physical and combat readiness for professional functioning.

The prospects of future researches imply working out technology of application of complex trainings for increase the level of profile disciplines' mastering by cadets and determination of its effectiveness.

Conflict of interests

The authors declare that there is no conflict of interests.

References:

1. Alekseev NA, Kutergin NB, Kulinichev AN, Gorbatenko AV. Integrated method development of general and special students stamina involved in the fight. *Physical Education of Students*, 2014;3:3-8. doi:10.6084/m9.figshare.974476
2. Anac'kij RV, Kolomijceva OE. Pokazniki vikonannia zagal'nokontrol'noi vpravi na iedinij smuzi pereshkod kursantami pid chas prokhodzhennia pervinnoi pidgotovki [Indicators of fulfillment of general control exercise on single obstacle course by cadets in their primary preparation]. *Slobozhans'kij naukovo-sportivnij visnik,* 2014;6:7-10. (in Ukrainian)
3. Anokhin IeD, Ier'omin SA, Desiatka OA, Loginov DO, Mikhajlov VV. *Podolannia pereshkod* [Overcoming of obstacles], Lviv; 2006. (in Ukrainian)
4. Ashkinazi SM, Kochergin AN. Analiz effektivnosti razlichnykh takticheskikh variantov vedeniia rukopashnogo boia [Analysis of effectiveness of different hand to hand combat tactic variants]. *Uchenye zapiski universiteta im. P.F. Lesgafta,* 2008;3:10-13. (in Russian)
5. Vandenko VV. Fizichna pidgotovka v umovakh antiteroristichnoi operacii [Physical training in conditions of anti-terrorists mission]. *Naukovo-metodichna konferenciia 26–28 listopada 2014 r., m.Kiiv "Fizichna pidgotovka osobovogo skladu Zbrojnikh sil, inshikh vijs'kovikh formuvan' ta pravookhoronnikh organiv Ukraini"* [Scientific-methodic conference "Physical training of Armed forces', other military formations and law enforcement personnel staff of Ukraine", dt. November 26-28, 2014. Kyiv]. Kiev: MOU; 2014. (in Ukrainian)
6. Hlazunov SI. Peculiarities of military officers' physical perfection during troops' being in conditions of positional defense. *Pedagogics, psychology, medical-biological problems of physical training and sports,* 2016;1:13-18. doi:10.15561/18189172.2016.0102

7. Danylchenko VA, Khabinets TA. Typical mistakes, made by the cadets, mastering the submission locks, of the higher educational establishments of the Ministry of Internal Affairs of Ukraine. *Physical Education of Students*, 2014;4:20-25. doi:10.6084/m9.figshare.974478
8. Zakorko IP. *Special'na fizichna pidgotovka u vishchikh navchal'nikh zakladakh MVS Ukraini z urakhuvanniam individual'nikh osoblivostej motoriki kursantiv. Cand. Diss.* [Special physical training in higher educational establishments of MAF of Ukraine, considering individual features of cadets' motor abilities. Cand. Diss.], Kiev; 2001. (in Ukrainian)
9. Kamaev OI, Pilipec AV, Beloshenko UK. Conditions and ways of improvement of training methods of cadets in the Academy of Interior Troops of the MIA of Ukraine. *Physical education of students*, 2011;2:47-49.
10. Leshchenia SV, Panchenko VF, Mal'cev OO, Osipchuk MV. *Kerivnictvo z fizichnoi pidgotovki i sportu vnutrishnikh vijs'k MVS Ukraini* [Instruction on physical training and sports for internal troops of MAF of Ukraine], Kyiv: Ukraine IVTS BB MIA: 2011. (in Ukrainian)
11. Mykhaylov VV, Mykhaylov VV, Popovich O.I. Running and tactical skill assessing in obstacle course run of Military Sports Complex's athletes. *Pedagogics, psychology, medical-biological problems of physical training and sports*, 2010;2:89-92.
12. Romanenko VA. *Diagnostika dvigatel'nykh sposobnostej* [Diagnostic of motor abilities], Donetsk: DNU Publ.; 2005. (in Russian)
13. Romanchuk SV. *Fizichna pidgotovka kursantiv vijs'kovikh navchal'nikh zakladiv Sukhoputnikh vijs'k Zbrojnikh sil Ukraini* [Physical training of military higher educational establishments' cadets of Land forces of Armed forces of Ukraine], Lviv: ASV; 2012. (in Ukrainian)
14. Starchuk O. O. *Metodika formuvannia fizichnoi gotovnosti majbutnix oficeriv do vijs'kovo-profesijnoi diial'nosti. Cand. Diss*. [Methodic of physical readiness formation for future military professional functioning of future military officers. Cand. Diss.], Khmelnytskyi; 2011. (in Ukrainian)
15. Kharabouga SG, Klymovitch BV, Loyko OM, Liudovyk TV. Informative factors of cadets physical fitness in the military institute (as an example "crossing and obstacle course"). *Pedagogics, psychology, medical-biological problems of physical training and sports*, 2008;10: 122-124.
16. Shlyamar IL, Yaworsky AI, Romanchuk SV, Petruk AP, Dzyama VV, Romaniv IV, Vorontsov AS. Characteristics of physical loads endured by military officers of mechanized troops during field maneuvres. *Pedagogics, psychology, medical-biological problems of physical training and sports*, 2015;9:57-63. doi: 10.15561/18189172.2015.0909
17. Yavorskyy AI. Study of author's applied physical training program for military officers-graduates of reserve officers' departments. *Pedagogics, psychology, medical-biological problems of physical training and sports*, 2016;20(2):72-77. doi:10.15561/18189172.2016.0211
18. Yareschenko OA. Justification of effective program of special physical preparation of cadets of higher educational institutions of the law-enforcement profile. *Pedagogics, psychology, medical-biological problems of physical training and sports,* 2008;7:164-167.
19. Baños Sánchez-Matamoros J. Management accounting and rationalisation in the Army: The case of Spanish Military Hospitals in the 18th century. *Revista de Contabilidad*. 2014;17(1):71–77.
20. Barclay K, Myrskylä M. Birth order and physical fitness in early adulthood: Evidence from Swedish military conscription data. *Social Science & Medicine*. 2014;123:141–148.
21. Fedak S. Physical examination performed by the international military operations in mountainous terrain. *Pedagogics, Psychology, Medical-Biological Problems of Physical Training and Sports*. 2014;5:67–73.
22. Walker D, Neighbors C, Walton T, Pierce A, Mbilinyi L, Kaysen D, et al. Spicing up the military: Use and effects of synthetic cannabis in substance abusing army personnel. *Addictive Behaviors*. 2014;39(7):1139–1144.

Information about the authors:

Anatskyi R.V.; http://orcid.org/0000-0002-5662-9903; ruslan.anackii@mail.ru; The National Academy of the National Guard of Ukraine; Povstannya Square 3, Kharkov, 61001, Ukraine.

Kolomiytseva O.E.; http://orcid.org/0000-0003-4463-5027; olga86-76@mail.ru; Yaroslav the Wise National Law University; Dynamo street, 4, Kharkov, 61023, Ukraine.

Cite this article as: Anatskyi R.V., Kolomiitseva O.E. Assessment of official combat mission's fulfillment by higher educational. *Pedagogics, psychology, medical-biological problems of physical training and sports*, 2016;4:4–10. doi:10.15561/18189172.2016.0401

The electronic version of this article is the complete one and can be found online at: http://www.sportpedagogy.org.ua/html/arhive-e.html

Received: 16.06.2016
Accepted: 26.06.2016; Published: 30.08.2016

TESTS AND STANDARDS FOR EXPRESS-CONTROL OF PHYSICAL FITNESS AND HEALTH OF MIDDLE SCHOOL AGE PUPILS

Bodnar I.R., Andres A.S.
[1]Lviv State University of Physical Culture
[2]Lviv Polytechnic National University

Abstract. *Introduction:* to day, physical fitness testing often causes negative emotions in pupils. It results in sharp loss of pupils' wish to fulfill physical exercises in free time and worsens their health. Possibility to assess health level is an important motivation factor for pupils' passing physical tests. Objective testing system will form positive motivation for physical exercises' practicing and will facilitate increase of pupils' motor functioning. It will also facilitate optimization of their physical condition, improvement of physical fitness and strengthening of health. *Material:* we tested physical fitness level and made diagnosis of pupils' functional state (10-15 years' age; n=85) with the help of tool methodic. We also used regressive analysis. *Results:* the system of tests and standards for express-control over physical fitness and health of middle school age pupils has been worked out and substantiated. The system of tests envisages fulfillment of 4 exercises: back pressing ups on bench during 20 seconds; throwing and catching of ball with two hands from wall during 30 seconds; side bending; torso rising from lying position into sitting during 30 seconds. Integral indicator of pupils' physical fitness and health correlates with functional state of organism's leading systems. We worked out 5 levels' scale for express-control over physical fitness and health of middle school age pupils. The system stipulates calculation of integrative indicator with the help of regression equation by results of 4 test exercises and calculation of one index. *Conclusions:* The system of tests and standards permits the following: to divide pupils into relatively uniform groups even at the beginning of academic year for successful reasonable physical load. The system also permits to determine standard and find what shall be strived for by a pupil in order to achieve optimal physical fitness and somatic state; to motivate relatively weakly trained pupils for testing and further their physical self-perfection.
Key words: control, assessment, pupils, indices, physical education.

Introduction

In Ukraine, recent time parents and physical culture (PC) teachers have had cautious attitude to physical fitness (PF) testing at PC lessons in secondary schools. The relevance of this problem is also proved by the fact that testing often causes negative emotions in pupils (especially those, who have low or middle PF levels). Negative emotions at PC lessons result in sharp weakening of pupils' wish to fulfill physical exercises in free time that, in its turn, worsens their health.

Health strengthening or its preservation at proper level is one of main purposes of PC lessons. Possibility to assess health level is an important motivation factor for many pupils' passing physical tests (61.5%). That is why it is important that application of pedagogic methods would permit for PC teacher, pupils and their parents to have information about children's PF and their health, deviations in their somatic state (for example bent to disorder of carriage). It would help to select proper individual correcting means.

For increase of motivation for PC tests' passing by all pupils (especially pupils with little deviations in health) it is necessary to individualize approaches to pupils' testing.

In scientific sources there is a contradiction in respect to directions of control at physical culture lessons. Many authors say that control shall be oriented on assessment of dynamic of pupils' physical fitness [1, 2, 3, and 4]. Other specialists [5, 6, 7] think that control shall be a measure of PC lessons' effectiveness, meaning improvement of organs' and systems' functional state. Some authors offer integral approach when assessing effectiveness of pupils [8] and students [9] physical education process. Such control shall be conducted by a number of indicators of organism's most important systems' functional state and by indicators of strength, endurance and coordination. Some authors [9] substantiate integral assessment, which is based on consideration of mentioned above and other groups of indicators: morbidity and way of life.

doi:10.15561/18189172.2016.0402

Among teachers there is no single opinion about orientation of pupils testing. Though, the quantity of teachers, who wish to receive information only about physical fitness level (17.24%) or rates of its increment (12.78%) is confidently ($p<0.05$) less than quantity of those, who want to receive complex information about somatic health and physical fitness of pupils (51.10%) [10]. That is why, among existing as on to day tests, suitable for application in school PC, it is necessary to choose, first of all, those, which are connected with health indicators.

The known methods of physical fitness assessment (Patent of RF for invention № 2109486, published on 4.27.1998, Bulletine №10; Patent of Ukraine for useful model № 61369, published on 25.07.2011, Bulletine №14) contain complex in calculation, heavy or not feasible for mass application in field conditions, methodic. Such methodic envisages presence of computer hardware and proper software; they do not give information about pupils' health level; they are standard and not interesting for children; they do not differentiate requirements depending on children's individual features.

In publications there is substantiation [10] and description [11] of tests system for PF determination of middle school age pupils. Though application of offered 9 tests system requires much time, deficit of which is always exists at PC lessons. That is why we took decision to for system for express control of pupils' PF, which whould include the most informative exercises. Results of such exercises' fulfillment are connected with indicators of children's health.

Hypothesis: express-control system shall determine objective level of PF and health; form positive motivation of pupils for regular physical trainings. It will increase their motor functioning, facilitate optimization of physical condition; improvement of physical fitness and health.

Purpose: to improve system of express control over middle school age pupils' physical fitness and health.

Material and methods

Participants: in experiment 85 pupils (42 boys and 43 girls of 10-15 years' age) participated. Their parents gave written consent for children's participation in experiment.

Procedure: we carried out testing of physical fitness level and made diagnosis of pupils' functional state. Physical fitness level was determined by worked out and substantiated by us at previous stages [13, 14] test exercises (and indices). Pupils' functional state was diagnosed with the help of program-apparatus complex "Omega-M", produced by "Scientific-research laboratory "*Dinamika Technologies*"" (Saint-Petersburg) [12]. On the base of systemic analysis of functional and biological reserves, assessment of pupils' psycho-physical and psycho-emotional state we derived integral indicator of health functional state (*health*), subjected to analysis. Diagnosis was conducted in conditions of ordinary academic day of academic year (3rd semester) after standard warming up before main part of PC lesson. We made 5 minutes' cardiogram recording in sitting position. Electrodes were applied on limbs by common methodic in 1st standard position.

Statistical analysis: we calculated indicators' mean values and their mean square deviations. We also fulfilled regression analysis of results of pupils' passing 9 worked out by us tests and indices [10, 11] with integral indicator of functional state (*health).* Value of *(health),* found with the help of program-apparatus complex "Omega-M", was a dependent variable.

Limits of physical fitness and health (see table 1) were found, considering standard deviation from mean value. Average level was in the range of $X\pm1.0\sigma$, higher or lower than average– in the range from $X\pm1.0\sigma$ to $X\pm2.0\sigma$, high and low – accordingly higher and lower than $X\pm2.0\sigma$.

Results of the research

Results of regression analysis permitted to say that pupils' functional state is substantially influenced by 4 indicators, which statistically confidently ($p<0.05$) positively impact on value of physical fitness and health index (IPFH in formula 1). So, we recommend finding the level of pupils' physical fitness and health, by calculation of physical fitness and health index (IPFH) by the following formula:

$$IPFH = 0.11 + 0.007X_1 + 0.006X_2 + 0.025X_3 + 0.004X_4, \quad (1)$$

Where IPFH – index of physical fitness and health;

X_1 – power endurance of arms (results of back pressing ups on bench during 20 sec.), Quantity of times;

X_2 – dexterity (results of exercise "throwing and catching of ball by two hands, from wall during 30 seconds), quantity of times;

X_3 – index of backbone mobility (to be determined by formula 2), conv. un.;
X_4 – power endurance of abdomen muscles (results of torso rising from lying position in sitting, during 30 seconds), quantity of times;

Conditions of exercises' fulfillment

Back pressing ups on bench during 20 sec. Only complete pressing ups were registered. This exercise permits to assess arms power endurance.

Throwing and catching of ball by two hands, from wall during 30 seconds. Distance to wall was 2 meters. Hitting the ball with hands was prohibited – only catching was registered. Two attempts with 2 minutes interval were fulfilled and the best result was registered. For complex assessment of different dexterity forms we recommend to draw "target" on wall, of 1x1 m size with center at eye level of a pupil (distance from floor to lower edge of target – 1 m). Slip throws were not registered. This exercise is recommended for assessment of pupils' dexterity.

Bending to the right (to the left)

When pupil is in standing position, with hands pressed to thighs, we mark the point of middle finger's distal phalanx contact with thigh by chalk. Pupil fulfills bent to the right and makes 2-3 seconds' pause. The second mark is made. The distance between two marks is measured (with accuracy of 1 mm). To avoid forward deviation this exercise shall be fulfilled by the wall with pupil blades' contact with the wall.

Index of backbone mobility (IBM) is calculated by formula:

$$IBM = \frac{(L_1 - L_2) \times 0{,}5 - (L_2 + L_1)}{L_3}, \quad (2)$$

Where IBM – index of backbone mobility;
L_1 – (lower) result of bending to one side, mm;
L_2 – (higher) result of bending to other side, mm;
L_3 – body length, cm.

Torso rising in sitting position during 30 seconds, from initial lying on back position with legs, bent under angle of 90° and fixed feet; arms – crossed on chest. The exercise is for assessment of abdomen muscles' endurance.

The value of calculated IPFH is compared with data of table 1. Using the data of this table we find the level of physical fitness and health of individual pupil.

Table 1. Graduation of pupils' physical fitness and health levels

Physical fitness and health levels	Physical fitness and health index
high (5)	>0.64
Above average (4)	0.58–0.64
Average (3)	0.44–0.57
Below average (2)	0.37–0.43
Low (1)	<0.37

Application in practice of worked out by us express testing system resulted in increase of self control skills for determination of physical fitness in 45% pupils; increase of motivation for passing tests in 87% ; motivation for further physical fitness improvement in 66% . 37 talented children were selected to sports circles. That is why the worked out system of pupils' physical fitness control can be recognized to be effective.

Discussion

The worked out by us approaches to assessment of pupils' physical fitness level confirm results of other authors [7, 9] in respect to their orientation on children's health. The offered system of tests eliminates contradictions, described in works of domestic [1, 3, 6] and foreign [13-16, 22, 23] authors. We expanded the data of Sazhneva E.V. [8] and Pal'chuk M. [6] about demand in consideration of functional state indicators in control of pupils' health level.

When building the tests we considered recommendations of Peleshenko I.M. [20]. The author offers to fulfill tests in the following sequence: for quickness and coordination; for speed-power qualities and flexibility; for endurance. Besides, it is offered to observe the following sequence: from two (September, May) to four times (September, December, February, and May) in year. Besides, we considered recommendations of Kovalenko Y.O., and Boloban V.N. [19], Juha Habib et al. [17] and Tereshchenko I.A. et al. [24] about demand in paying attention to pupils' carriage, when they fulfill the tests; Pop C.L. [21] and Kashuba V.O. et al. [18] about health related orientation of physical education lessons.

The received results are the supplement of our previous researches [10, 11] in the context of substantiation of tests and standards of pupils' physical fitness and health current control.

Positive element of our research is the fact that for determination of pupils' PF and health it is enough to know the results only of few (four) easy, safe and feasible physical exercises. It is proved by correlation coefficient between physical fitness and health index and level of functional state (r=0.54), that was found with the help of program-apparatus complex "Omega-M". Correlation coefficient witnesses that derived by us equation of multiple regressions, with higher than average accuracy degree, permits to assess pupils' health level. Integrative assessment of pupils' health level, combined with determination of physical fitness meets expectations of PC teachers.

The selected exercises are safe as far as they do no harm for health. Such exercises prevent from diseases, which are frequent in school age (as far as fulfillment of these exercises, considering symmetric development of muscles, facilitates reduction of carriage disorders in frontal plane). These test exercises are feasible as far as they are not technically and moderate by load. Thus, the worked out by us system of express assessment has no main disadvantages, which are intrinsic to many modern testing methodic. Besides, test exercise "bending to the right (to the left)" permits to assess harmony of a pupil's physical condition, which is one of health indicators; individualization of requirements (consideration of body length) raises objectiveness of test exercises and does not weaken pupils' wish to pass tests.

Physical fitness and health levels are recommended to be used as criterion of pupils' distribution into relatively uniform groups at the beginning of academic year for choosing proper physical load. Results of express-control can be used for determination of "weak links" in pupils' PF and selection of exercises for further physical self-perfection.

Conclusions

We have worked out and substantiated safe, feasible, individualized, economic system of express-assessment of pupils' physical fitness and health, which envisages 4 test exercises: back pressing ups on bench during 20 seconds; throws and catching of ball from the wall during 30 seconds; side bending; torso rising from lying position into sitting one during 30 seconds. Integral indicator of pupils' physical fitness and health correlated with functional state of organism's most important systems' functional state. We also worked out 5-levels' scale for express-control of middle school age children's physical fitness and health.

The system of tests and standards permits the following: to distribute pupils in relatively uniform groups at the beginning of academic year for choosing proper physical load; to determine standard and find what a pupil shall strive for in order to achieve optimal state of physical fitness and somatic health; to motivate relatively weak pupils for PF testing and their further physical self-perfection.

Results of the worked out control system's implementation in physical education practice proved its effectiveness.

References

1. Bileckaia VV. Kharakteristika podkhodov k ocenke fizicheskoj podgotovlennosti shkol'nikov [Characteristic of approaches to pupils' physical fitness assessment], *Slobozhans'kij naukovo-sportivnij visnik,* 2010;1: 9-12. (in Russian)
2. Vas'kov IuV. Problema vprovadzhennia rukhovikh testiv na urokakh fizichnoi kul'turi [Implementation of motor tests in physical culture lessons]. *Pedagogics, psychology, medical-biological problems of physical training and sports,* 2012;8: 9-13. (in Ukrainian)
3. Krucevich TIu. Ekspres-kontrol' fizichnoi pidgotovlenosti ditej ta pidlitkiv v umovakh fizkul'turno-ozdorovchikh zaniat' [Express-control of children's and adolescents' physical fitness in conditions of health

related physical culture trainings]. *Teoriia i metodika fizichnogo vikhovannia i sportu*, 2007;1: 64-69. (in Ukrainian)

4. Peleshenko IM. Ociniuvannia rukhovikh zdibnostej uchniv za dopomogoiu kompleksnogo testuvannia v zagal'noosvitnikh navchal'nikh zakladakh [Assessment of pupils' motor abilities with the help of complex testing in comprehensive educational establishments]. *Slobozhans'kij naukovo-sportivnij visnik*, 2010;2: 35-38. (in Ukrainian)
5. Malakhova ZhV. Kontrol' i korrekciia fizicheskogo sostoianiia studentov special'noj medicinskoj gruppy v uchebnom processe medicinskogo VUZa [Control and correction of special health group students' physical condition in educational process of medical HEE]. *Pedagogics, psychology, medical-biological problems of physical training and sports*, 2009;10: 135-137.
6. Pal'chuk M. Kontrol' pokaznikiv fizichnogo rozvitku iak osnovnij faktor v sistemi upravlinnia fizichnim vikhovanniam shkoliariv [Control of physical condition indicators as main factor in system of pupils' physical education management]. *Moloda sportivna nauka Ukraini*, 2012;2:145-149. (in Ukrainian)
7. Timoshina IN. *Aktualizaciia preemstvennosti soderzhaniia i organizacii adaptivnogo fizicheskogo vospitaniia detej, podrostkov i uchashchejsia molodezhi v obrazovatel'nykh uchrezhdeniiakh. Cand. Diss.* [Actualization of continuity of content and organization of children's, adolescents' and students' adaptive physical education in educational establishments. Cand. Diss], Uljanovsk; 2007. (in Russian)
8. Sazhneva EV. *Metodika kompleksnogo pedagogicheskogo kontrolia v processe fizicheskogo vospitaniia mladshikh shkol'nikov special'noj medicinskoj gruppy. Cand. Diss*. [Methodic of complex pedagogic control in physical education of primary school pupils of special health group. Cand. Diss.], Volgograd; 2010. (in Russian)
9. Vrzhesnievs'kij II. *Ocinka fizichnikh mozhlivostej studentiv u sistemi mediko-pedagogichnogo kontroliu u procesi fizichnogo vikhovannia special'nogo viddilennia vuzu. Cand. Diss.* [Assessment of students' physical potentials in system of medical-pedagogic control in the process of physical education at HEE special department. Cand. Diss.], Kiev; 2011. (in Ukrainian)
10. Bodnar I. Obgruntuvannia testiv i normativiv sistemi potochnogo kontroliu fizichnoi pidgotovlenosti i zdorov'ia uchniv seredn'ogo shkil'nogo viku [Substantiation of tests and standards of system for current control of middle school age pupils' physical fitness and health]. *Naukovo-pedagogichni problemi fizichnoi kul'turi,* 2015;10(65): 31–35. (in Ukrainian)
11. Bodnar I, Kozhukh N. Testi j normativi dlia viznachennia rivnia fizichnoi pidgotovlenosti i zdorov'ia shkoliariv seredn'ogo shkil'nogo viku [Tests and standards for determination of middle school age pupils' physical fitness and health levels], *Sportivna nauka Ukraini*, 2015;4(68): 9-17. (in Ukrainian)
12. Chuian EN, Biriukova EA, Ravaeva MIu. Kompleksnyj pokhod k ocenke funkcional'nogo sostoianiia organizma studentov [Complex approach to assessment of student organism's functional state]. *Uchenye zapiski Tavricheskogo nacional'nogo universiteta*, 2008;21(60,1):123-139. (in Russian)
13. Alfrey L, Gard M. A crack where the light gets in: a study of Health and Physical Education teachers' perspectives on fitness testing as a context for learning about health. *Asia-Pacific Journal of Health, Sport and Physical Education,* 2014;5(1):3–18.
14. Bendiksen M, Williams CA, Hornstrup T, Clausen H, Kloppenborg J, Shumikhin D, et al. Heart rate response and fitness effects of various types of physical education for 8- to 9-year-old schoolchildren. *European Journal of Sport Science,* 2014;14(8):861–869.
15. Ceschia A, Giacomini S, Santarossa S, Rugo M, Salvadego D, Da Ponte A, et al. Deleterious effects of obesity on physical fitness in pre-pubertal children. *European Journal of Sport Science,* 2016;16(2):271–278.
16. Ingle L, Stephenson A, Sandercock GR. Physical activity profiles and selected muscular fitness variables in English schoolchildren: A north–south divide? *European Journal of Sport Science,* 2016;1:1–10.
17. Juha Habib, Yurchenko AA, Sergienko KN. Comparative analysis of foot support-spring indicators of primary school age children with weak eyesight in physical education process. *Pedagogics, psychology, medical-biological problems of physical training and sports*, 2016;20(2):59-65. doi:10.15561/18189172.2016.0209

18. Kashuba VO, Goncharova NN, Butenko HO. Effectiveness of health tourism application as the basis of health related recreational technology in primary school pupils' physical education. *Pedagogics, psychology, medical-biological problems of physical training and sports*, 2016;20(2):19-25. doi:10.15561/18189172.2016.0203
19. Kovalenko YO, Boloban VN. Structural elements of construction of individual and group exercises' competition compositions in calisthenics. *Physical Education of Students*, 2016;1:12-20. doi:10.15561/20755279.2016.0102
20. Peleshenko IN. Training-test module in the system of pedagogical control of physical fitness in lower grades. *Pedagogics, psychology, medical-biological problems of physical training and sports*, 2014;6:42-47. doi:10.6084/m9.figshare.1004093
21. Pop Cristiana Lucretia. Physical and health education facing the technology challenge. *Physical Education of Students*, 2016;20(2):45-49. doi:10.15561/20755279.2016.0207
22. Sandercock GRH, Ogunleye A, Voss C. Associations between showering behaviours following physical education, physical activity and fitness in English schoolchildren. *European Journal of Sport Science,* 2016;16(1):128–34.
23. Tambalis KD, Panagiotakos DB, Psarra G, Daskalakis S, Kavouras SA, Geladas N, et al. Physical fitness normative values for 6–18-year-old Greek boys and girls, using the empirical distribution and the lambda, mu, and sigma statistical method. *European Journal of Sport Science,* 2016;16(6):736–746.
24. Tereshchenko IA, Otsupok AP, Krupenya SV, Liauchuk TM, Boloban VN. Coordination training of sportsmen, specializing in sport kinds of gymnastic. *Physical Education of Students*, 2015;3:52-65. doi:10.15561/20755279.2015.0307

Information about the authors:

Bodnar I.R.; http://orcid.org/0000-0002-7083-6271; ivannabodnar@ukr.net; Lviv State University of Physical Culture; 11, Kostushko str., Lviv, 79007, Ukraine.

Andres A.S.; http://orcid.org/0000-0002-1472-9009; andres_a@ukr.net; Lviv Polytechnic National University; 12 Bandera street, Lviv, 79013, Ukraine.

Cite this article as: Bodnar I.R., Andres A.S. Tests and standards for express-control of physical fitness and health of middle school age pupils. *Pedagogics, psychology, medical-biological problems of physical training and sports*, 2016;4:11–16. doi:10.15561/18189172.2016.0402

The electronic version of this article is the complete one and can be found online at: http://www.sportpedagogy.org.ua/html/arhive-e.html

Received: 06.07.2016
Accepted: 26.07.2016; Published: 30.08.2016

CONNECTION OF SUPREME NERVOUS FUNCTIONING'S NEURO-DYNAMIC CHARACTERISTICS WITH SUCCESS OF JUNIOR SPORTSMEN IN SPORTS DANCES

Korobeynikov G.V.[1], Myshko V.V. [2]
[1]National University of Physical Education and Sport of Ukraine
[2]Uzhhorod National University

Abstract. *Purpose:* to find peculiar features of neuro-dynamic characteristics of 14-15 years' age sportsmen in sport dances and their influence on successfulness. *Material:* we tested 32 qualified dancers of 15-16 years' age. *Results:* it was found that high workability and reduced anxiety level of dancers with higher successfulness is accompanied by sympathetic adrenalin system's activation, resulted from mobilization of organism's adaptation resources. The presence of nervous processes' high mobility and increase of quickness of information perception and processing are the keys to success in sport dances. It was proved that success in sport dances is connected with nervous processes' balance and facilitates higher organization of psycho-motor skills. It is also conditioned by concentration on fulfillment of motor skills, accompanied by reduction of nervous processes' lability. *Conclusions:* we found connection between individual-typological characteristics of junior dancers' high nervous functioning. We also determined that high workability and reduced anxiety of sportsmen with high successfulness is accompanied by sympathetic adrenalin system's activation, resulted from mobilization of organism's adaptation resources. It follows form mobilization of organism's adaptation resources. Increase of accuracy and stability of motor skills' realization reduces the level of junior dancers' psycho-motor productivity.
Key words: neuro-dynamic, sport dances, dancers, psycho-motor, lability.

Introduction

A great number of factors influences on successfulness in sports. It especially concerns creative kinds – sport dances and other. The most influential are the factors, which are conditioned by individual typological features of supreme nervous system's functioning. Such factors are genetically determined and manifestation of these characteristics is connected with organism's functional status. Such factors are neuro-dynamic characteristics of supreme nervous system's functioning [1, 2, 3, 9].

The level of neuro-dynamic characteristics' manifestation reflects sportsmen's abilities to endure significant physical, psychological, intellectual, will and emotional loads. Such loads are conditioned by specificities of sports functioning without negative after-effects for health [4, 10, 14, 10].

In sport dances neuro-dynamic characteristics play important role. Sportsman-dancer shall be maximally concentrated and have optimal state of "combat readiness", which maximally influences on result.

Sport activity is a kind of extreme functioning, which is realized on the border of human potentials for achievement maximal result. Many scientists think that neuro-dynamic characteristics of supreme nervous functioning are and integral component of its structure and determine effective functioning of all systems of organism and psych [5, 6, 7, 12, 13]. It is undoubted that exactly the state of dancers' neuro-dynamic characteristics conditions success of sport activity.

In our previous studies we researched psycho-physiological states, which appear in conditions of sports activity. We regarded psycho-physiological peculiarities of visual perception in sports and dynamic of sportsmen's psycho-physiological and vegetative functions on different training stages. Besides, we studied sex peculiarities of neuro-dynamic functions of elite athletes. It permitted to offer approaches to regulation and correction of psycho-physiological states, which appear in conditions of sportsmen's training and competition functioning [7, 8, 19].

However, in scientific literature we could not find the data about interconnection of neuro-dynamic characteristics with success in sport dances. Just for this purpose we conducted research of individual-typological characteristics' connection with successfulness in sport dances.

Hypothesis: we assumed that the level of neuro-dynamic characteristics of supreme nervous system in sport dances manifests in different ways and is connected with effectiveness of sports activity.

doi:10.15561/18189172.2016.0403

The purpose of the research: to find peculiar features of neuro-dynamic characteristics of 14-15 years' age sportsmen in sport dances and their influence on successfulness.

Material and methods

Participants: in the research 32 qualified junior sportsmen, specializing in sport dances, participated. Their age was 15-16 years. Their qualification was: from 1st sports degree to candidate master of sports of Ukraine.

Every dancer was assessed by five criteria of successfulness (10-points scale for every criterion) for further distribution into groups of more or less successful sportsmen.

The first group – dancers with the highest successfulness, determined by special tests – 12 persons (>71points), the second group – less successful sportsmen by special tests– 20 persons (< 70 points).

Organization of the research: for determination of successfulness level we carried out testing with five special exercises, which showed technical skillfulness and choreographic fitness:

1. Temp and main rhythm ("musicality" – assessment of fulfillment's musicality in each tact). Dancing in tact means that step is completed (not before or after) but exactly at appropriate count. Following main rhythm means that step is made during proper time (for example, slowly or quickly) and correct correspondence between quick and slow steps is observed.

2. Lines of figure are correct, elegant lines of pair, which corresponds to character of stylized contest dance. Referee assesses correctness of the following: lines of arms, lines of backs, lines of shoulders and hips; (lines of legs, head and neck; left and right side lines. Marks for every line are equivalent.

3. Motion ("dynamic" is continuous fulfillment of figures; movements, which correspond to character of the dance; assessment of ascends and descends, swing, and equilibrium of the pair). Referee shall determine is movements are fulfilled in compliance with dance character, swing and balance of pair. Excessive swing justifies rising of mark only if movements are controlled and balance is kept. In dances of Latin America it is necessary to assess plasticity of torso, which is characteristic for every dance.

4. Work of feet ("technique" is exact fulfillment of figures: direction of movement in respect to body in different positions, work of feet). Referee shall assess correctness of feet work, including toe and heel, postures and movements, closeness of feet position, expressiveness of legs' movements and control over them.

5. Presentation; it is artistry, preproduction of every dance character, behavior on parquet.

For assessment of psycho-physiological state and general workability we used eight colors' Luscher test. Conception about associative connection between colors and human state, reflecting human different adaptation methods to environment, is in the base of this methodic [8].

For studying of neuro-dynamic characteristics we applied the following methods: functional mobility and balance of nervous processes; time of simple visual reaction and psycho-motor characteristics (tapping test). The tests were components of computer psycho-diagnostic system "Multi-psycho-meter -05".

Statistical analysis: processing of the received results was fulfilled with the help of MS Excel and "Statistica 6.0" applied computer programs. As far as indicators were out of law of normal distribution, for determination of significant difference between samples we used landmark criterion rank sum of Wilkinson. For demonstration of the data distribution we used inter-quartile range, which pointed at first (25% percentile) and third quartile (75%) [7, 10].

Results of the research

Determination of dancers' psychological state was fulfilled with Luscher color test, results of which are presented in table 1.

Results of the research (see table 1) show confidently lower workability values in group of less successful dancers, comparing with group of more successful./ It points at connection with psychological state and successfulness in sport dances.

More confident anxiety indicator in group of less successful dancers points at increase of stress, resulted from weakening of general workability level (see table 1).

By indicator of vegetative coefficient we see higher values in more successful dancers (see table 1). The received fact reflects higher activation of sympathetic adrenalin system in more successful group.

Thus, high workability and reduced anxiety level in more successful dancers is accompanied by activation of sympathetic adrenalin system, resulted from mobilization of organism's adaptation resources.

Table 1. Indicators of psychic state by Luscher test of dancers with different successfulness level (median of upper and lower quartiles)

Indicators	More successful dancers (n=12)	Less successful dancers (n=20)
Workability, conv. un.	12. 00 11. 00;14. 00	7. 50* 6. 50; 10. 00
Fatigue, conv. un.	1. 50 1. 00; 2. 00	3. 00 2. 00; 4. 00
Anxiety, conv. un.	0. 5 0;1. 00	2. 00* 1. 00; 4. 00
Vegetative coefficient, conv. un. .	16.00 9. 00; 17. 00	10. 50* 5. 00; 15. 00

Note: * - p<0. 05, comparing with group of more successful dancers.

In table 2 we supply mean values of indicators by test of functional mobility of dancers with different successfulness.

Table 2. Indicators of nervous processes' functional mobility of dancers with different successfulness (median, upper and lower quartiles)

Indicators	More successful dancers (n=12)	Less successful dancers (n=20)
Dynamism, conv. un.	73. 70 66. 50;79. 25	78. 30 69. 65; 83. 40
Bandwidth of visual analyzer, conv. un.	1. 75 1. 45; 1. 85	1. 80 1. 50; 1. 90
Maximal time of information processing, msec.	320. 00 290. 00; 420. 00	360. 00* 340. 00; 450. 00

Note: * - p<0. 05, comparing with group of more successful dancers.

Analysis of results (see table 2) shows absence of confident differences between dynamism and bandwidth of visual analyzer in test for quickness of complex visual motor reaction's processing. By indicator of information processing maximal time there are certain distinctions. The presence of maximal time lower values in more successful dancers points at better functional mobility of nervous processes. Thus, higher mobility of nervous processes is a key to success in sport dances.

In table 3 we present indicators of latent time of simple visual-motor reaction of dancers with different successfulness.

Table 3. Indicators of latent time of simple visual-motor reaction of dancers with different successfulness (median, upper and lower quartiles)

Indicators	More successful dancers (n=12)	Less successful dancers (n=20)
Latent time of simple visual-motor reaction, msec.	245. 80 230. 50; 340. 40	290. 60* 250. 50; 303. 00
Stability, secV	18. 15 13. 62; 18. 33	15. 45* 12. 00; 17. 00

Note: * - p<0. 05, comparing with group of more successful dancers.

According to the received results, more successful dancers have less absolute values of visual motor reaction's latent time and confidently higher values of reaction's stability (see table 3). The received fact says about higher quickness of perception and processing of visual information by successful dancers, comparing with less successful sportsmen.

Stability indicator is actually the criterion of response "compactness" in sportsman's reacting to visual irritators. Psycho-physiologically interpreted, stability of visual-motor reaction reflects degree of psycho-emotional tension [15, 16, and 17]. Thus, in successful dancers we observe reduction of psycho-emotional tension and conclude

that success in sport dances is conditioned by increase of quickness of information perception and processing as well as by reduction of psycho-emotional tension.

In table 4 we give indicators of nervous processes balance of dancers with different successfulness.

Table 4. Indicators of nervous processes balance of dancers with different successfulness (median, upper and lower quartiles)

Indicators	More successful dancers (n=12)	Less successful dancers (n=20)
Accuracy, conv. un.	2. 90 2. 50; 3. 15	2. 50 2. 00; 3. 40
Stability, conv. un.	3. 80 3. 25; 3. 90	3. 30* 2. 80; 3. 75
Excitation, msec.	0. 02 -0. 25; 0. 65	-0. 15* -0. 90; -0. 03

Note: * - p<0. 05, comparing with group of more successful dancers.

Analysis of table 4 data witnesses about presence of confidently higher values of stability among more successful dancers, when they reproduce psycho-motor act. This result points at more organized system of psycho-motor functions' realization by more successful dancers, comparing other sportsmen's group [18].

Indicator of more successful dancers' excitation has positive value, while less successful – negative (see table 4). This fact points at presence of nervous processes' balance in successful dancers. At the same time less successful dancers have prevalence of excitation processes in central nervous system. Thus, success in sport dances is connected with balance in nervous processes that facilitate higher organization of psycho-motor skills' realization.

Tapping test indicators of dancers with different successfulness are presented in table 5.

Table 5. Tapping test indicators of dancers with different successfulness (median, upper and lower quartiles)

Indicators	More successful dancers (n=12)	Less successful dancers (n=20)
Frequency of touches, quantity	6. 15 6. 00; 6. 60	6. 10 5. 60; 6. 30
Lability, conv. un.	60. 00 48. 00; 68. 60	64. 00* 56. 30; 70. 50
Signal ratio, conv. un.	2. 70 2. 45; 3. 10	2. 60 2. 40; 3. 00
Stability, sec.V	10. 50 10. 00; 14. 00	14. 00* 12. 00; 19. 50

Note: * - p<0. 05, comparing with group of more successful dancers.

The found reduced stability of successful dancers points at concentration in conditions of psycho-motor realization that is in compliance with reduction of nervous processes' lability. Thus, success in sport dancers is conditioned by concentration in motor skills' fulfillment with simultaneous reduction of nervous processes' lability [19, 20].

Discussion

It was found that neuro-dynamic functions of junior dancers influence on success of special technical skills' realization. It is known that fulfillment of complex technical elements in sport dances requires training of coordination [1, 12]. However, quality of motor skills' formation depends on individual-typological properties of supreme nervous functioning [4, 17]. At the same time high successfulness of special technical elements' realization by junior dancers is connected with mobilization of adaptation resources, resulted from activation of sympathetic adrenalin system of organism. One more important characteristic of supreme nervous system's individual-typological properties is functional mobility of nervous processes [10, 11].

We found that exactly high mobility of nervous processes and quickness of processes of information perception and processing by junior dancers are the keys to high successfulness. Thus, for optimization of junior dancers' training process it is necessary to consider individual-typological properties of supreme nervous functioning.

Further researches shall be concentrated on differentiation of training programs, considering neuro-dynamic characteristics in sport dances.

Conclusions

1. We found connection between junior dancers' individual-typological characteristics of supreme nervous functioning. We also determined that successful junior sportsmen's high workability and weakened anxiety is accompanied by activation of sympathetic adrenalin system, resulted from mobilization of organism's adaptation resources.
2. High mobility of nervous processes is the key to success in sport dances. It is reflected in increase of quickness of information perception and processing as well as in weakening of psycho-emotional tension in sport dancers with higher successfulness.
3. Success in sport dances is connected with balance of nervous processes, concentration and reduction of nervous processes' lability. All these facilitate higher organization of psycho-motor skills' realization; reduces junior dancers' psycho-motor productivity.

Conflict of interests

The authors declare that there is no conflict of interests.

References

1. Bachynska NV, Fedoryka AV. Osoblivosti planuvannia trenuval'nogo procesu v zmagal'nomu periodi dlia sportsmeniv 13-15 rokiv, iaki zajmaiut'sia bal'nimi sportivnimi tanciami [Peculiarities of training process planning in competition period for 13-15 years' age sportsmen, specializing in ballroom sport dances]. *Pedagogics, psychology, medical-biological problems of physical training and sports,* 2010;2:13-17. (in Ukrainian)
2. Iermakov SS. Psikhologicheskie testy v seti Internet i perspektivy ikh primeneniia v sportivnoj praktike [Psychological tests in Internet and the prospects of their application in sports practice]. *Fizicheskoe vospitanie studentov tvorcheskikh special'nostej,* 2004; 3: 8-24. (in Russian)
3. Ermolaeva YS. Level of anxiety as one of the criteria of efficiency of emotional stability in sport dancing. *Pedagogics, psychology, medical-biological problems of physical training and sports*, 2015;2:22-25. doi:10.15561/18189172.2015.0204
4. Il'in EP. *Psikhofiziologiia sostoianij cheloveka* [Psycho-physiology of human states], Sankt Petersburg: Peter; 2005. (in Russian)
5. Il'in EP. *Psikhologiia sporta* [Psychology of sports], Sankt Petersburg: Peter; 2012. (in Russian)
6. Kozina ZhL, Prusik Krzysztof, Prusik Katarzyna. The concept of individual approach in sport. *Pedagogics, psychology, medical-biological problems of physical training and sports*, 2015;3:28-37. doi:10.15561/18189172.2015.0305
7. Korobeynikov G, Pristupa E, Korobeynikova L, Briskin U. *Ociniuvannia psikhofiziologichnikh staniv u sporti* [Assessment of psycho-physiological states in sports], Lviv: LSUPC; 2013. (in Ukrainian)
8. Korobeinikov G V, Korobeinikova L G, Richok T M. Statevi osoblivosti nejrodinamichnikh funkcij u elitnikh atletiv [Sex peculiarities of elite athletes' neuro-dynamic functions]. *Visnik Cherkas'kogo universitetu*, 2015;2(335):55-59. (in Ukrainian)
9. Lee Bo. Sovershenstvovanie aerobnykh vozmozhnostej sportsmenov v sportivnykh tancakh [Perfection of sportsmen's aerobic potentials in sport dances]. *Physical Education of Students*, 2011;2:64-66.
10. Makarenko NV, Lizogub V, Bezkopil'niy A. Formirovanie svojstv nejrodinamicheskikh funkcij u sportsmenov [Formation of neuro-dynamic functions' properties in sportsmen]. *Nauka v olimpijskom sporte*, 2005;2:80-86. (in Russian)
11. Makarenko MV. *Ontogenez psikhofiziologichnikh funkcij liudini* [Ontogeny of human psycho-physiological functions], Cherkassy: Vertikal; 2011. (in Ukrainian)
12. Omelyanenko VI. Complex integrated method of improvement of sports ballroom dance performance. *Physical Education of Students*, 2014;6:49-53. doi:10.15561/20755279.2014.0610

13. Soronovich IM, Chaikovsky EV, Pilevskaya V. Features of functional support of competitive activity in sports dance given the differences prepared by partners. *Physical Education of Students*, 2013;6:78-87. doi:10.6084/m9.figshare.840556
14. Shutova SV, Murav'eva IV. Sensomotornye reakcii kak kharakteristika funkcional'nogo sostoianiia CNS [Sensor-motor reactions as characteristic of CNS functional state]. *Vestnik Tambovskogo universiteta*, 2013;18(5-3):2831-2840. (in Russian)
15. Bria S, Bianco M, Galvani C. Physiological characteristics of elite sport-dancers. *The journal of sports medicine and physical fitness*. 2011; 51(2):194-203.
16. Drozdovski AK. The connection between typological complexes of properties of the nervous system, temperaments, and personality types in the professions and sports. *Open access journal of sports medicine*. 2015;6:161-166.
17. Janelle C M, Hatfield B D. Visual attention and brain processes that underlie expert performance: Implications for sport and military psychology. *Military Psychology*. 2008;20(1): 39-45.
18. Khudolii OM, Iermakov SS, Ananchenko KV. Factorial model of motor fitness of junior forms' boys. *Journal of Physical Education and Sport*. 2015;15(3):585-591.
19. Korobeynikov G, Mazmanian K, Korobeynikova L, Jagiello W. Diagnostics of psychophysiological states and motivation in elite athletes. *Bratislava Medical Journal*. 2011; 112(11): 637-643.
20. Năstase VD. The roll of sensations, perceptions and representations in learning dance sport. *Procedia-Social and Behavioral Sciences*. 2012;51: 957-960.

Information about the authors:

Korobeynikov G.V.; http://orcid.org/0000-0001-5588-4825; george.65@mail.ru; National University of Physical Education and Sport of Ukraine; Fizkulture str. 1, Kiev, 03680, Ukraine.

Myshko V.V.; http://orcid.org/0000-0003-0518-7751**;** Nikamyshko@gmail.com**;** Uzhhorod National University; Str. Podgornaya 46, Uzhgorod, 454080, Ukraine.

Cite this article as: Korobeynikov G.V., Myshko V.V. Connection of supreme nervous functioning's neuro-dynamic characteristics with success of junior sportsmen in sports dances. *Pedagogics, psychology, medical-biological problems of physical training and sports*, 2016;4:17–22. doi:10.15561/18189172.2016.0403

The electronic version of this article is the complete one and can be found online at: http://www.sportpedagogy.org.ua/html/arhive-e.html

Received: 22.07.2016
Accepted: 26.07.2016; Published: 30.08.2016

MASTERING OF MUSICAL RHYTHM BY PRE-SCHOOL AGE CHILDREN WITH SPEECH DISORDERS WITH THE HELP OF DANCE-CORRECTION PROGRAM TRAININGS

Petrenko N.B.
National University of Physical Education and Sport of Ukraine

Abstract. *Introduction:* It is known that regular listening to specially selected music develops children's cognitive abilities. Musical influence optimizes many important functions of brain: increases mental workability; accelerates processing of information; improves short term memory. Besides, sensitivity of visual and hearing analyzers strengthens, as well as regulation of arbitrary movements; indicators of verbal and non verbal intellect improve. *Purpose:* to determine peculiarities of musical rhythm's mastering by pre-school age children with speech disorders with the help of dance-correction program trainings. *Material:* the categories of the tested children: children of age – 4-5 and 5-6 years with speech disorders and healthy pre-school age children. Children of 4-5 years' age composed: main group (n=12), control group (n=16); group of healthy children (n=24). For assessment of verbal thinking and rhythm-motor (or dance) abilities we used complex of tests of constantly increasing difficulty. *Results:* we found that under influence of dance-correcting exercises activation of rhythm-motor abilities and development of cognitive functions happened in children. We also found main functional peculiarities of musical rhythm's mastering by pre-school age children. It was determined that by the end of pedagogic experiment, main groups of children approached to groups of healthy peers by all tested characteristics. *Conclusions:* it is recommended to include correcting components (fit ball – dance gymnastic, tales-therapy, logo-rhythm trainings, and game fitness) in trainings by choreographic program.

Key words: pre-school children, speech disorders, cognitive, musical rhythm, motor abilities.

Introduction

Great number of scientific works proves that different kinds of musical activity influence positively on children's mental functioning. Musical classes improve psychic processes of perception, attention, memorizing [7]. People's rhythmic musical activity has been known since ancient time. To this activity we can relate drumming and play other musical instruments, dances, and singing [13, 15, 19]. Musical sounds cause spontaneous body reactions – motion in tact, rhythmic tapping, clapping [16, 17, 22]. It is also known that newborns imitate faces and gestures of adults [18], synchronize movements of their bodies with adults' speech [14]. 3-4 months' babies demonstrate limbs' movements under rhythmic music [16]. In the age of one year babies can fulfill more rhythmic movements, show emotions, listening to music [24]. Rather often adults' drumming causes spontaneous reaction of senior pre-school age children: they also start drumming [17]. Thus, music's influence on child's brain with specially selected program is a structuralizing mean and optimizes brain's functioning in period of its formation. That is why it is important that since birth (and even before birth) child has had opportunity to listen to beautiful music.

As it is shown in scientific researches, regular listening by children to specially selected music improves short-term memory, increase indicators of verbal and non verbal intellect. With it, sensitivity of visual and hearing analyzers improves; brain functions optimize; regulation of arbitrary movements becomes better; processing of information accelerates. All these, in the whole, positively influence on mental workability [12]. It is known that located in frontal part of brain area is called in honor of French neurologist of 19th century Brock. It is of great importance for fulfillment of sequential physical movements, for recognition of musical rhythms, for transformation of thought in pronounced words. Scientists assume that the processes in Brock's area take part in perception of musical temp, speech and motion [21]. It is very important to consider this fact in period of organism's growth; it can influence on organization of teaching processes [20].

As far as perception of music is realized by both brain hemispheres, in cortex appears complex functional system of focuses of inter-connected activity in sensor (hearing) and frontal lobe areas of cortex [11].

Musical-rhythmic motor activity is a synthetic kind of functioning. It is a natural combination of two arts: music and dance, creating new quality – single and aesthetic wholeness. For children with speech disorders it is of

doi:10.15561/18189172.2016.0404

special importance. Motor exercises under musical accompaniment train motor memory, ensuring mobility of nervous processes [1, 2].

Organization of movements develops children's attention, memory, concentration; it facilitates formation of purposeful activity. It is connected with the fact that characteristic for them peculiarities of motor and psychic spheres are easily corrected. Form of trainings with the help of musical rhythm develops memory, attention, thinking, imagination; it awakens interest to creative activity [3, 4, 5, and 8].

In connection with absence of social-economic stability, in modern society exist difficulties, connected with formation of children's emotional-adaptation processes. As a result they have speech functions' disorders.

In practice, the presented below dance-correction program facilitates correction of children's speech functions by development of nervous structures, activation of analyzers; improvement of psycho-physiological properties and cognitive functions. In this context important task is to teach children to move under music, expressing its temp, dynamic and metric-rhythmic features.

The main means of this program are: fit ball – dance gymnastic, tales therapy, logo-rhythmic, game fitness and some other correction methodic. All these means are combined in complexes of definite sequence.

The purpose of the work is to determine specificities of pre school age children's with speech disorders mastering musical rhythm with the help of dance-correction program.

Material and methods

Participants: categories of the tested: children of 4-5 and 5-6 years' age with speech disorders and healthy peers. Children of 4-5 years age composed: main group (n=12), control group (n=16); group of healthy children (n=24).

The researches were conducted with observation of moral-ethic norms and voluntary consent of parents. The parents gave individual written consents for participation of children in pedagogic experiment (control of children's physical condition).

The procedure: assessment of cognitive functions and rhythm-motor (or dance) abilities of 4-5 and 5-6 years' age children with speech disorders was fulfilled at the beginning and at the end of academic year. We used a complex of tests of gradually increased complexity. The tests permitted to assess functional mobility of nervous processes, verbal thinking, visual and hearing memory, attention, workability, dance abilities and some other functions [6]. Accounting of points was in the following procedure: high level - 9-10 points; above average - 7-8, average – 5-6, below average– 3-4 and low — 1-2 points. I.e. it was analogous to assessment of cognitive functions, where accounting of points was in the same way [4].

Assessment of verbal thinking was carried out by methodic of Ya. Yerasyk [6, pg.137-140]. Its basis was formulated by a child answers to the questions put to him/her.

Determination of rhythm-motor (dance) abilities was carried out on the base of analysis of how child combines several movements and coordinates them with musical accompaniment. With the help of special assessment scale we determined: musicality, creative bents, coordination of dance movements, plasticity (flexibility).

Statistical analysis was fulfilled with the help of «StatSoft STATISTICA 10.0» programs. The tested sample was not suitable for normal distribution by the tested indicators. That is why we applied the methods of non parametrical statistic. For demonstration of the data we used median (Me) and interactive scale with noting lower (l.q.-.-25%) and upper quartiles (up.q.-75%). For testing of differences between two dependent samples of pair measurements we used T-criterion of Wilkokson. The criterion serves for comparing of indicators, measured in two different conditions in one and the same sample. It permits to determine orientation of changes and their expressiveness. With this criterion it is possible to determine if shift of indicators in one direction is more intensive than in other. Differences were confident at $p < 0.05$ [23].

Results

Basing on the received data we found multiple confident differences of cognitive functions and rhythm-motor (dance) abilities in 4-6 years' age children with speech disorders and healthy children (see table 1).

In main group of 4-5 years' age children with speech disorders we observed confident cognitive functions' improvement in average by 20.3% (by results of tests). Such noticeable result is connected with the fact that this group was not uniform [4]. At the same time, in this group rhythm-motor abilities confidently improved in average only by 11.5% (see table 2).

Table 1. Change of cognitive functions and dance abilities in 4-6 years' age children with speech disorders and in healthy children 1.

I	Main group, 4-5 years, n=12						Control group, 4-5 years, n=18						Healthy children,4-5 yearsn=13					
	Before			After			Before			After			Before			After		
	Me	l.q.	Up.q.	Me	l.q.	Up.q.	Me	l.q.	Up.q.	Me	l.q.	Up.q.	Me	l.q.	Up.q.	Me	l.q.	Up.q.
CF	6.4*	5.2	6.6	7.7*	6.4	8.1	4.1*	2.0	5.2	4.2*	3.2	6.2	9.0	7.2	9.0	9.0	8.0	9.0
DA	6.5*	5.5	6.8	7.3*	6.7	8.0	5.2*	3.5	6.3	5.5*	3.8	6.5	8.5*	7.5	9.0	9.0*	8.5	9.0
	Main group, 5-6 years, n=14						Control group, 5-6 years, n=16						Healthy children,5-6 years, n=24					
	Before			After			Before			After			Before			After		
	Me	l.q.	Up.q.	Me	l.q.	Up.q.	Me	l.q.	Up.q.	Me	l.q.	Up.q.	Me	l.q.	Up.q.	Me	l.q.	Up.q.
CF	6.2*	5.5	6.8	7.2*	6.8	8.0	6.9*	4.7	7.5	7.0*	6.2	7.6	8.4	7.0	9.0	9.0	7.8	9.0
DF	7.1*	6.0	8.0	7.7*	6.5	8.0	6.3*	5.6	7.1	6.7*	6.0	7.3	8.3	6.8	9.0	8.7	8.0	9.0

Notes: I – indicators; CF – cognitive functions; DA – dance abilities; l.q. – low quartile; (25%), up.q. – upper quartile (75%).

* – $p < 0.05$ confident differences between groups before and after application of dance-correction program.

Significant indicator of cognitive functions' percentage was registered only in main group children. Such picture was both in 4-5 and 5-6 years' age children. Confidently less percentage of cognitive functions was observed in 5-6 years' age children, in average by 16.1% (see table 2) and rhythm-motor abilities – by 8.5%. Indicator of 8.5% witnessed that these children approached to group of their healthy children.

Table 2. Results of confident cognitive functions' and dance abilities' changes in 4-6 years' age children at the end of academic year

Children's groups		Cognitive functions, %	Dance abilities, %
4-5 years	Main group	20.3	11.5
	Control group	2.4	6.8
	Group of healthy children	0	5.9
5-6 years	Main group	16.1	8.5
	Control group	1.4	6.4
	Group of healthy children	0	0

In the process of trainings with application of dance-correction program we found multiple functional changes. Under influence of dance-correction exercises children's rhythm-motor abilities activated and cognitive functions developed, being interconnected.

On the one hand dance-correction exercises implied involvement of short-term and long-term memory (cognitive elements) for memorizing and reproduction of dance figures. On the other hand these exercises actively influenced on cortex motor-neurons, developing motor centers. At the same time, constant changes of combinations and rhythms in a dance stimulated brain neurons to re-switch, thus, developing mobility of nervous processes.

This thesis is proved by the fact that main group children could conduct graduation concert by themselves. That is, they were presenters; they showed concert program's items, song, read poetry and danced that witness about positive influence of the worked out means on correction of speech disorders.

In control group of 4-5 years' age children with speech disorders the character of changes was a little different. Cognitive functions' percentage increased, in average, by 2.4%, and rhythm-motor abilities – by 6.8%. Nevertheless, in percents it was less than in main group. In 5-6 years' age children we found confident improvement of cognitive functions – by 1.4%, and rhythm-motor abilities – by 6.4%.

In control group of 4-5 and 5-6 years' age children we found confident improvement of cognitive functions and rhythm-motor abilities. They were less than in main groups.

The received result is connected with the fact that these children were trained by traditional (standard) choreographic program without correcting elements (fit ball – dance gymnastic, tales therapy, logo-rhythmic, game fitness). New correcting components were used only in main groups. Accordingly, this standard program was rather effective. But it was less effective than dance-correction program.

In group of healthy 4-5 years' age children we registered confident improvement of rhythm-motor abilities by 5.9% but no changes of cognitive functions.

In group of 5-6 years' age healthy children we registered no confident changes of cognitive functions and rhythm-dance abilities. It is explained by the fact that this category of children had no speech disorders and fulfilled standard choreographic program.

We determined that main groups of 4-5 and 5-6 years' age children with speech disorders significantly improved their indicators. Development of main group children's memory permitted for them to move more rhythmically and musically. In motion children song, counted spoke and stomped different tale-dance storylines. Thus, the worked out program showed progress of such cognitive functions as memory, attention, thinking, imagination, functional mobility of nervous processes in children. Besides, it helped to involve children in creative process and awakened their interest to activity. The main achievement is the fact that children became speak better, to actively contact with other people and feel musical rhythm.

Discussion

The received results supplement the data of researches in the field of music influence on children's mental functioning and brain functions [7].

It has been shown that regular children's listening to specially selected music improves short-term memory and verbal and non-verbal intellect. As a result of musical influence sensitivity of hearing and visual analyzers improves; brain functions optimize; regulation of arbitrary movements improves; information's processing accelerates and mental workability increases [12].

The received data supplement awareness of different authors [8, 9, 14, 15, 16, 17, 21] about peculiarities of musical rhythm's, temp, speech and motion's mastering.

In period of organism's growth, under influence of dance-correction exercises activation of rhythm-motor abilities and development of cognitive functions take place in children. These functions are interconnected and can influence on organization of further teaching [20]. Dance-correcting exercises imply involvement of short term and long term memory (cognitive elements) for memorizing and reproduction of dance figures. These exercises actively influence on cortex motor-neurons, thus, developing motor centers. Constant changes of combinations and rhythms in dance stimulate brain neurons to re-switch, thus, developing functional mobility of nervous processes.

Results of the research also substantially supplement ideas about mastering of musical rhythm by pre-school age children with speech disorders [5, 15, 19, 20, and 24]. We proved results of a number of authors about demand in complex and rational application of correcting methods in pre-school education. Such approach results in increase of effectiveness of cognitive functions' and rhythm-motor abilities' development in children with speech disorders [7, 8].

Conclusions

1. Peculiarities of musical rhythm's mastering by pre-school age children with speech disorders with the help of dance-correction program have been found.

2. In process of choreographic classes with pre-school children of 4-6 years' age with speech disorders we applied the worked out by us dance-correction program.

3. Changes of cognitive functions of 4-6 years' age children under influence of choreographic classes with application of dance-correction program were registered; their significance in correction of speech disorders has been shown. We found confident improvements of cognitive functions and rhythm-motor abilities in 4-5 and 5-6 years' age children with speech disorders. It has been shown that by all tested parameters main groups of 4-5 and 5-6 years' age children with speech disorders are very close to group of healthy peers. Positive dynamic of cognitive functions' and rhythm-motor abilities' progress in children with speech disorders witness about effectiveness of this methodic.

Conflict of interests

The author declares that there is no conflict of interests.

References:

1. Bernshtejn NA. *Ocherki po fiziologii dvizhenij i fiziologii aktivnosti* [Outlines of physiology of movements and physiology of activity]. Moscow: Medicine; 1966. (in Russian)
2. Pavlov IP. *Polnoe sobranie sochinenij* [Complete works], Moscow: USSR Academy of Sciences; 1954. (in Russian)
3. Petrenko NB. Osobennosti fizicheskikh kachestv i kognitivnykh funkcij u detej doshkol'nogo vozrasta s rechevymi otkloneniiami [Specific features of physical qualities and cognitive functions in pre-school age

children with speech disorders], *Naukovo-pedagogichni problemi fizichnoi kul'turi*, 2015;15(57):257-260. (in Russian)
4. Petrenko NB. The methodical approach to determining the heterogeneity of cognitive function in preschool children requiring correction of speech impediments. *Pedagogics, psychology, medical-biological problems of physical training and sports*, 2016;20(2):40-45. doi:10.15561/18189172.2016.0206 (in Russian)
5. Povaliaeva MA. *Muzykoterapiia v korrekcionnoj pedagogike* [Musical therapy in correction pedagogic], Rostov on Don; 2002. (in Russian)
6. Golovej LA, Rybalko EF. *Praktikum po vozrastnoj psikhologii* [Practicum on age psychology], Sankt Petersburg: Speech; 2002. (in Russian)
7. Samburskaia AA. *Muzyka intellekta* [Music of intellect]. Available at: http://alicepush.ucoz.ru/index/0-5 (accessed 22.06.2016) (in Russian)
8. Filatova IuO, Beliakova LI. Pedagogicheskaia model' korrekcii rechevogo i motornogo ritmov u detej s narusheniiami rechi [Pedagogic model of speech and motor rhythms' correction in children with speech disorders]. *Nauka i shkola,* 2015;3:114-123 (in Russian)
9. Filippov MM, Cirul'nikov VA. *Fiziologiia liudini* [Physiology of man], Kiev: Staff; 2013. (in Ukrainian)
10. Filippov MM. *Psikhofiziologiia funkcional'nykh sostoianij* [Psycho-physiology of functional states], Kiev: MAUP; 2006. (in Russian)
11. Khrizman TP. *Emocii, rech' i aktivnost' mozga rebenka* [Emotions, speech and brain activity of a child]. Moscow: Pedagogy; 1991. (in Russian)
12. Bengtsson SL. Listening to rhythms activates motor and premotor cortices. *Cortex*, 2009;45(1):62-71.
13. Janata P, Tillmann B, Bharucha JJ. Listening to polyphonic music recruits domain-general attention and working memory circuits. *Cognitive, Affective, & Behavioral Neuroscience*. 2002;2(2):121-140.
14. Conard NJ, Malina M, Münzel SC. New flutes document the earliest musical tradition in southwestern Germany. *Nature,* 2009;460(7256):737-740.
15. Condon WS, Sander LW. Neonate movement is synchronized with adult speech: Interactional participation and language acquisition. *Science*. 1974;183(4120):99-101.
16. Fitch WT. The biology and evolution of music: A comparative perspective. *Cognition*. 2006;100(1):173-215.
17. Fujii S. Precursors of dancing and singing to music in three-to four-months-old infants. *PloSone*. 2014;9(5):976-980.
18. Kirschner S, Tomasello M. Joint drumming: social context facilitates synchronization in preschool children. *Journal of experimental child psychology*. 2009;102(3):299-314.
19. Meltzoff AN. Imitation of facial and manual gestures by human neonates. *Science*. 1977;198(4312):75-78.
20. Mithen S. *The singing Neanderthals: The origin of language, music, mind and body*. London: Weidenfeld and Nicolson; 2005.
21. Pascual-Leone A. The brain that plays music and is changed by it. *Annals of the New York Academy of Sciences*. 2001;930(1):315-329.
22. Schlaug G. Music, musicians, and brain plasticity. In: Hallam S, Cross I, Thaut M. (ed.). *The Oxford handbook of music psychology*. Oxford University Press; 2016. pp. 220-225.
23. Sevdalis V, Keller PE. Cues for self-recognition in point-light displays of actions performed in synchrony with music. *Consciousness and cognition*. 2010;19(2):617-626.
24. Vincent WJ. *Statistics in kinesiology*. Champaign: Human Kinetics; 2005.
25. Zentner M, Eerola T. Rhythmic engagement with music in infancy. *Proceedings of the National Academy of Sciences.* 2010;107(13):5768-5773.

Information about the author:

Petrenko N.B.; http://orcid.org/0000-0001-9574-8211; petrenko_natasha@ukr.net; National University of Physical Education and Sport of Ukraine; Fizkultury str. 1, Kiev, 03680, Ukraine.

Cite this article as: Petrenko N.B. Mastering of musical rhythm by pre-school age children with speech disorders with the help of dance-correction program trainings. *Pedagogics, psychology, medical-biological problems of physical training and sports*, 2016;4:23–28. doi:10.15561/18189172.2016.0404

The electronic version of this article is the complete one and can be found online at: http://www.sportpedagogy.org.ua/html/arhive-e.html

Received: 05.07.2016
Accepted: 26.07.2016; Published: 30.08.2016

ASSESSMENT OF NERVOUS-MUSCULAR SYSTEM'S POTENTIALS OF CYCLIC KINDS OF SPORTS SPORTSMEN

Skladanivska IV.
State Research Institute of Physical Culture and Sports

Abstract. *Purpose:* to work out and substantiate methodic of assessment of nervous-muscular system's potentials of elite sportsmen, representatives of cyclic kinds of sports. *Material:* in the research sportsmen of cyclic kinds of sports (n = 28) participated. Testing was conducted with the help of ergometer of bicycle type. *Results:* we present methodic of assessment of nervous-muscular system's potentials of elite sportsmen with the help of surface electromyography. It was found that sportsmen with high aerobic potentials reach second electromyography threshold with power of work, corresponding, in average, 80.5% VO_2 max. We also found confident correlation ($r=0.59$, $p\leq0.05$) between maximal concentration of blood lactate and maximal amplitude of electromyogram. *Conclusions:* application of our approaches permits to assess reserve potential by type of muscle fibers, which influence on sportsman's bent to certain kind of motor functioning. The worked out assessment system permits to determine contribution of different motor units' types in achievement of required parameters of work.

Key words: muscle fibers, electromyography, threshold of anaerobic metabolism, anaerobic.

Introduction

Functional potentials of sportsmen's nervous-muscular system (NMS) are one of the most important factors, which influence on of sports' functioning results. In spite of sufficient quantity of scientific data [1, 2, 5, 12, 18] the problem of control and assessment of NMS functional potentials as main component of sportsman's motion functional system has not been studied properly.

As on to day in sports practice, for assessment of NMS such methods as dynamometry and electro-neuro-myography are used [1 – 3, 17]. However, such approach is insufficient for complex assessment of this system's functional potentials. Development of methods and approaches to assessment of NMS reserves is an important problem of sports science. As per modern ideas "functional reserves" are regarded as potentials of organ or system to strengthen appropriate functioning with maximal mobilization (i.e. in conditions of maximal shifts in homeostasis) [4]. Accordingly, functional potentials of sportsman's NMS reflect maximal range of this system's shifts for achievement of certain result of muscular functioning.

We have analyzed potentials of electromyography (EMG) (as method of NMS assessment), based on registration and analysis of muscles' or nervous electric activity [2]. In modern sports practice the method of surface electromyography (SEMG) is widely used and it permits to simultaneously register total electric activity of different muscular groups. So, with the help of different SEMG parameters inter-muscular and in-muscular coordination are assessed; muscular fatigue and activation of different motor units' types are differentiated and etc. [1, 5, 11, 17].

Analysis of recent data [13, 14, 16] and our own researches [8, 9] permitted to determine purposefulness of SEMG application for assessment of NMS functional potentials in cyclic kinds of sports sportsmen.

Hypothesis: application of surface electromyography under increasing load permits to find threshold changes of electromyogram, which are conditioned by recruiting of different types of muscle fibers. Appearing of second electromyography threshold reflects switching in of glycolitic muscle fibers in total effort and, therefore, it is connected with prevalence of anaerobic energy supply mechanism. By values of power and oxygen consumption at level of electromyography thresholds it is possible to assess reserve potentials of different muscle fibers' types: oxidative, transitive and glycolitic.

The purpose of the research is to work out and experimentally prove methodic of assessment of nervous-muscular system's potentials of elite sportsmen, representatives of cyclic kinds of sports.

Material and methods

Participants: the research was fulfilled on the base of State Research Institute of Physical Culture and Sports and 28 elite sportsmen of cyclic kinds of sports (academic rowing - n=18, triathlon - n=4, light athletic – n=6) participated. The sportsmen's age was 23.4 (4.8), height – 194.7 (6.8) and weight – 93.0 (7.5)

doi:10.15561/18189172.2016.0405

Procedure: testing was fulfilled with ergometer of bicycle type Monark Ergomedic 894 and stipulated work under constant increasing load: duration of every step was 3 minutes (by Machado F. A. 2013). The work was fulfilled up to reaching of oxygen maximal consumption (VO_2 max). Ergometric testing envisaged keeping of constant rotations' value – 80 r.p.m., initial power was 78 W; further it increased by 23.6 W.

Registration of external breathing and gas metabolism parameters was realized with gas analyzer "Oxycon Mobile" (Jeager, Germany). We carried out analysis of the following indicators: oxygen consumption VO_2, $ml \cdot min^{-1} \cdot kg^{-1}$;% VO_2max; ventilation equivalent by oxygen $VEVO_2$. Lactate concentration in mixed capillary blood was measured at the end of every load step with the help of bio-chemical analyzer "Dr. Lange" (Germany).

Under testing load we registered electric activity of the most engaged in work muscular groups with the help of portable electromyography device "MegaWin ME6000" (Mega Electronics Ltd, Finland) according to recommendations of V.N. Komantsev (2006).

In the article we present analysis of amplitude mean values, root mean square of eloctromyogram (rmsEMG) m. Vastus Lateralis with discreteness of 10 seconds. We studied threshold changes of electromyogram (EMG) – first and second electromyography thresholds ($EMGT_1$ and $EMGT_2$). In detail methodic of electromyography study is given in our previous publications [8, 9].

Threshold of anaerobic metabolism (TAM) was differentiated by appearing of ventilation (VT) and lactate thresholds (LT) [6].

Statistical analysis of data was carried out with the help of Excel 2007 and Statistica 6 programs. The samples of the data were checked for normality of distribution. For determination of confidence and significance of correlations between two parameters we used Spearman's correlation analysis. For determination of confidence of differences between two connected samples we used non parametrical criterion of Wilkinson. Determination of confidence of differences between two groups was fulfilled by criterion of Kholmogorov- Smirnov.

The research procedure was fulfilled in compliance with principles of all medical researches, mentioned in Helsinki Declaration, 2008.

Results of the researches

In our present research we compared the values of load power (W) and oxygen consumption (VO_2, $ml \cdot min^{-1} \cdot kg^{-1}$) at level of maximal oxygen consumption (VO_2max) and at reaching $EMGT_2$ by elite sportsmen with different aerobic potentials: first group included sportsmen with high aerobic potentials and the second included the rest of sportsmen (see table 1). Distribution of sportsmen by groups was fulfilled in compliance with such indicators as W and VO_2 at level of TAM. By modern opinions [6, 7] such indicators reflect sportsmen's aerobic potentials.

Table1. Power and oxygen consumption at TAM levels, $EMGT_2$ and VO_2max in sportsmen with different aerobic potentials (X±δ, n = 28)

Parameters		**1 group (n = 8)**	**2group (n = 20)**
Wmax, W		366. 6 ± 29.4	339.6 ± 38.1
VO_2max, $ml \cdot min^{-1} \cdot kg^{-1}$		47.2 ± 5.7	48.3 ± 8.4
TAM	W, W	284 ± 33.9	209 ± 57.1*
	VO_2, $ml \cdot min^{-1} \cdot kg^{-1}$	41.5 ± 5.0	32.7 ± 7.45*
$EMGT_2$	W (W)	294.1± 20.4	241.2 ± 36.0*
	W,%	80.5 ± 4.3	70.8 ± 6.5*
	VO_2, $ml \cdot min^{-1} \cdot kg^{-1}$	38.4 ± 7.4	34.8 ± 6.7*
	VO_2,%	80.9 ± 9.5	72.2± 8.4*

*differences are confident at $p \leq 0.05$

As we can see in table 1 in first group sportsmen VO_2 and W at level of $EMGT_2$ are confidently higher. As it is known [7], maximal potential of oxidative muscle fibers (1st type) manifests exactly at reaching TAM. Thus, values VO_2 and W of load at $EMGT_2$ level reflect aerobic ability of muscles. Therefore, by indicators of load power and oxygen consumption at reaching $EMGT_2$ we can assess reserve potentials of oxidative muscle fibers. By results of

this research we worked out scale of muscles' aerobic potentials' scale, depending on VO_2 and W when reaching $EMGT_2$ (see table 2).

Table2. Integral assessment of muscles' aerobic potentials of elite sportsmen, considering power and oxygen consumption at $EMGT_2$

Level of muscles' aerobic potentials	VO_2,%	W,%
High	≥ 80.7	≥ 81.0
Above average	73.4 – 80.6	74.3 – 80.9
Average	66.1 – 73.3	67.7 – 74.2
Below average	≤ 66.0	≤ 74.1

In order to work out methodic of assessment of glycolitic muscular fibers' functional potentials we analyzed changes of EMG amplitude after reaching $EMGT_2$.

We analyzed correlation between maximal concentration of lactate in blood and changes of electromyography amplitude. In modern opinions level of sportsman's anaerobic potentials is characterized just by value of maximal concentration of lactate in blood [12].

With the help of correlation analysis we found confident ($p \leq 0.05$) correlation between maximal concentration of lactate in blood and increase of EMG amplitude EMG (%) after reaching $EMGT_2$ ($r = 0.50$) [as well as EMG maximal amplitude (mcV)] ($r = 0.59$).

We compared two groups of sportsmen, depending on maximal concentration of lactate in blood. First group included sportsmen with high anaerobic potentials (maximal lactate concentration in blood - 14.0 ± 2.5 $mmol.l^{-1}$); second group included the rest of sportsmen. Using Kholmogorov-Smirnov's criterion, we compared EMG amplitude in both groups after reaching $EMGT_2$ (see table 3).

Table 3. Values VO_2, W, EMG amplitudes (Amax) and EMG amplitudes' increment after reaching $EMGT_2$ (ΔA) in sportsmen with different anaerobic potentials (n = 18, X±δ)

Parameters		1 group(n =10)	2 group (n =8)
La, $mmol \cdot l^{-1}$		14.0 ± 2.5	8.8 ± 1.3*
Wmax, W		332. 5 ± 29.1	349.0 ± 38.7
VO_2max, $ml \cdot min^{-1} \cdot kg^{-1}$		51.1 ± 10.7	48.7 ± 4.8
Amax, mcV		654.6 ± 164.4	452.5 ± 97.0*
Δ A	A, mcV	371.6 ± 127.2	213.5 ± 99.7*
	A,%	54.9 ± 6.1	43.4 ± 5.3*

*differences are confident at $p \leq 0.05$

As we can see in table 3 two groups confidently ($p \leq 0.05$) differ by a number of parameters. So, for sportsmen with better anaerobic potentials higher values of maximal EMG amplitude (mcV), ENG amplitudes' increment (ΔA, %) after reaching of $EMGT_2$ is intrinsic. As it is known [5, 16, 19], increase of load power after reaching $EMGT_2$ is possible only at the account of new glycolitic muscle fibers' involvement with further synchronization of already working motor units. So, duration of sportsman's work after reaching $EMGT_2$ will depend to large extent on reserve potentials of glycolitic muscle fibers.

Therefore, reserve potentials of glycolitic muscle fibers can be assessed by the value of maximal amplitude of electromyogram and by increment of EMG amplitudes after reaching $EMGT_2$. By results of our research we worked out integral assessment of muscles' anaerobic abilities (see table 4).

Table 4. Integral assessment of muscles' anaerobic abilities, depending on EMG amplitudes' increment (ΔA, %) **after reaching**

Level of muscles' aerobic potentials	ΔA,%
High	≥ 53.5
Above average	43.7 – 53.4
Average	33.9 – 43.6
Below average	≤ 33.8

Discussion

By results of experimental researches we worked out and experimentally tested system of assessment of NMS functional potentials, which includes differentiation of anaerobic threshold; assessment of reserve potentials of oxidative and gycolitic muscle fibers.

By results of this and our previous works [8, 9], when comparing load power and oxygen consumption (VO_2) at TAM level and with reaching $EMGT_2$, we found rather high correlation between the following: VO_2 and power of load at reaching $EMGT_2$ and LT ($r = 0.72 – 0.93$, $p \leq 0.05$) and VT ($r = 0.79 – 0.93$, $p \leq 0.05$). It serves as the base for application of electromyography method for TAM differentiation at reaching $EMGT_2$. These results are in agreement with the data of Moritani T. [19], C. T. Candotti [10], Zuniga J. M. [20], who determined correlations between aerobic-anaerobic transition of energy supply by changes of muscles' electric activity.

Results of our research and the researches of A. Lucia [14], F. Hug [13] showed the presence of two electromyography thresholds ($EMGT_1$ and $EMGT_2$). The authors explain the presence of two thresholds in elite sportsmen by their ability to switch in work different types of muscle fibers (transitive and glycolitic) in response to increase of load's intensity up to definite level. The authors explain that recruiting of new motor units (especially quickly contracting: of 2nd and 3rd type) is conditioned by mechanisms of fatigue of local and general genesis. The found, as a result of researches, scientific data became a basis for working out of methodic of reserve potentials' assessment; of different by type muscle fibers with the help of surface electromyography.

Appearing of $EMGT_2$ witnesses about fatigue progressing in working motor units, which is accompanied by many quickly contracting (glycolitic) muscle fibers' involving in work for maintaining of proper effort. Thus, we chose the values of load power and oxygen consumption at $EMGT_2$ as criteria for assessment of muscles' aerobic abilities: i.e, functionaly potentials of oxidative muscle fibers.

Results of C. J. De Luca [11], S. Green [12], J. Maestu [16] witness that the higher is the quantity of active quickly contracting (2nd and 3rd type – glycolitic) muscle fibers are, the quicker EMG amplitude increases. It conditions increase of anaerobic energy supply contribution. Therefore, significant increment of EMG amplitude after reaching $EMGT_2$ is conditioned by ability of nervous muscular system to switch in work great number of quickly contracting muscle fibers as well as synchronization of motor units and high reserve potentials of quickly contracting muscle fibers. So we chose value of EMG increment after reaching $EMGT_2$ as criterion for assessment of functional potentials of glycolitic muscle fibers and their anaerobic abilities.

Basing on results of previous works of modern authors [10, 13, 14, and 18] and our own researches we, for the first time, worked out the methodic of NMS assessment with the help of surface electromyography data, taken under loads of increasing power in elite sportsmen. Application of our approaches permits to assess reserve potential of different by type muscle fibers. Sportsman's bent to definite kind of motor functioning depends on it. The main advantage of the worked out assessment system is possibility to determine contribution of different motor nits' types in achievement of desired working parameters.

In our research the question about other possible factors' (except recruiting of different types of muscle fibers and fatigue progressing) influence on surface electromyogram changes under maximal loads remains unsolved. It requires further study and can be used in perfection of already worked out methodic of sportsmen's NMS assessment.

Conclusions

The research resulted in working out and experimental testing of NMS functional potentials' assessment, which includes: determination of anaerobic threshold by appearing of $EMGT_2$; assessment of reserve potentials of oxidative muscle fibers by power level of work and oxygen consumption at $EMGT_2$; assessment of reserve potentials of glycolitic muscle fibers – by EMG amplitudes' increment after reaching $EMGT_2$.

This methodic of NMS functional potentials' assessment is recommended to implement in stage-by stage and current control of functional state of cyclic kinds of sports sportsmen.

The prospects of further scientific researches imply study of factors, influencing on changes of surface electromyography in different muscle groups under maximal load of special orientation.

Acknowledgements

The research has been fulfilled in the frames of scientific topic 2015-3 "Perfection of system of sportsmen's reserve potentials' assessment" (State registration number № 0115U000904).

Conflict of interests

The author declares that there is no conflict of interests.

References

1. Gorodnichev RM. *Sportivnaia elektronejromiografiia* [Sports electroneuromyography], Great Luke: 2005. (in Russian)
2. Kapilevich LV, Davlet'iarova KV, Koshel'skaia EV, Bredikhina IuP, Andreev LV. *Fiziologicheskie metody kontrolia v sporte* [Physiological methods of control in sports], Tomsk: Tomsk Polytechnic University Publ.; 2009. (in Russian)
3. Komancev VN. *Metodicheskie osnovy klinicheskoj elektronejromiografii* [Methodic principles of clinic electroneuromyography], St. Petersburg; 2006. (in Russian)
4. Mozzhukhin AC. Sistema fiziologicheskikh rezervov sportsmena [System of sportsman's physiological reserves]. *XVI Vsesoiuznaia konferenciia* [16th All-Union conference], Moscow; 1982, p. 124. (in Russian)
5. Monogarov VD. *Utomlenie v sporte* [Fatigue in sports], Kiev: Health; 1986. (in Russian)
6. Polishchuk DA. *Laktatnyj porog i ego ispol'zovanie dlia upravleniia trenirovochnym processom* [Lactate threshold and its usage for training process monitoring], Kiev: Abris; 1997. (in Russian)
7. Seluianov VN. *Podgotovka beguna na srednie distancii* [Training of middle distances runner], Moscow: SportAcademPress; 2001. (in Russian)
8. Skladanivska IV. Vikoristannia metodu poverkhnevoi elektromiografii dlia viznachennia anaerobnogo porogu u kvalifikovanikh sportsmeniv [Application of surface electromyography method for determination of elite sportsmen's anaerobic threshold]. *Moloda sportivna nauka Ukraini*, 2015; 19(3): 164 – 168. (in Ukrainian)
9. Skladanivska IV. Ocinka aerobnikh mozhlivostej m'iaziv iz vikoristanniam metodu poverkhnevoi elektromiografii [Assessment of muscles' aerobic potentials eith the help of surface electromyography]. *Aktual'ni problemi fizichnoi kul'turi ta sportu,* 2014; 32(4): 42–45. (in Ukrainian)
10. Candotti TC, Loss JF, Melo MO, Torre ML, Pasini M, Dutra LA. Comparing the lactate and EMG thresholds of recreational cyclists during incremental pedaling exercise. *Can. J. Physiol. Pharmacol*. 2008; 86: 272–278.
11. De Luca CJ. Myoelectrical manifestations of localized muscular fatigue in humans. *Critical Reviews in Biomedical Engineering*, 1984; 14(11): 251–259.
12. Green S, Dawson B. Measurement of anaerobic capacities in humans. Definitions, limitations and unsolved problems. *Sports Med.* 1993; 15(5): 312 –327.
13. Hug F, Laplaud D, Savin B, Grelot L. Occurrence of electromyographic and ventilatory thresholds in professional road cyclists. *Eur J Appl Physiol*. 2003; 90: 643 – 646.
14. Lucia A, Sonchez A, Carvajal A, Chicharro J. Analysis of the aerobic-anaerobic transition in elite cyclists during incremental exercise with the use of electromyography. *Br J Sports Med*. 1999; 33: 178 – 185.
15. Machado FA, Kravchychyn AC, Peserico CS, da Silva DF., Mezzaroba PV. Effect of stage duration on maximal heart rate and post-exercise blood lactate concentration during incremental treadmill tests. *J Sci Med Sport*. 2013; 16(3): 276 –280.
16. Maestu J, Chiccella A, Purge P, Ruosi S. Electromyographic and neuromuscular fatigue thresholds as concepts of fatigue. *Journal of Strength and Conditioning research*. 2006; 20(4): 824 –828.
17. McComas AJ. *Skeletal muscle: form and function*. McMaster University; 2001.
18. Mello RG, Oliveira LF, Nadal J. Detection of anaerobic threshold by surface electromyography. *Proceedings of the 28th IEEE EMBS Annual International Conference.* 2006 Aug 30-Sept 3. New York City: USA; 2006. p. 6189 –6192.

19. Moritani T, Takashi T, Matsumoto T. Determination of maximal power output at neuromuscular fatigue threshold. *J Appl Physiol*. 1993; 74: 1729 –1734.
20. Zuniga JM, Bubak MP, Fisher BE, Neighbors DE. Electromyographic and gas exchange fatigue thresholds during incremental treadmill running. *Journal of Athletic Medicine*. 2013; 2(1): 99 – 109.

Information about the author:
Skladanivska I.V.; http://orcid.org/0000-0001-9011-8237; Skladankain1@rambler.ru**;** State Research Institute of Physical Culture and Sports; Str. Physical Education 1, Bldg. 2, Kiev, 03680, Ukraine.

Cite this article as: Skladanivska I.V. Assessment of nervous-muscular system's potentials of cyclic kinds of sports sportsmen. *Pedagogics, psychology, medical-biological problems of physical training and sports*, 2016;4:29–34. doi:10.15561/18189172.2016.0405

The electronic version of this article is the complete one and can be found online at: http://www.sportpedagogy.org.ua/html/arhive-e.html

Received: 04.07.2016
Accepted: 26.07.2016; Published: 30.08.2016

ON PROGRAM OF EXTRACURRICULAR MINI-FOOTBALL TRAINING PROGRAM FOR UNIVERSITY GIRL STUDENTS

Tamozhanskaya A. V. [1], Shkola O. M. [2]
[1]Kharkov State Academy of Physical Culture
[2]Kharkiv Humanitarian Pedagogical Academy

Abstract. The research is aimed at working out of efficient program for first year girl students' health improvement, which is based on mini-football means' application in extra-curricular activities. *Purpose:* to substantiate the program of one year mini-football trainings for girl students. *Material:* one year experiment envisaged participation of 18-20 years' age 56 first year girl students (two groups, 28 people each). The girl students of every group endured different physical loads: group 1 - 70% of specific means and 30% of non-specific; group 2 - 65% of specific means and 35% of non specific. *Results:* we worked one year efficient program for girl students' health improvement, which was based on application of mini-football specific and non specific means' optimal correlation in extracurricular trainings. We found that optimal correlation of specific and non-specific training loads was 70:30 (%). Practically equal level of workability in both groups was ensured by the following: in group 1 – at the account of special endurance; in group 2 – by means of general physical training. *Conclusions:* we recommend the program of one-year mini-football trainings, which ensures improvement of physical and technical fitness, rising of girl students organism's and health indicators.
Key words: health, program, mini-football, girl students, training loads.

Introduction

Analysis of leading scientists' and higher school specialists' materials shows low level of university girl students' health, physical and functional fitness [4, 6, 15]. It was found that one of directions of such unsatisfactory state recovering is practicing of different kinds of sports' extracurricular trainings [4, 14]. As it is known, the most attractive for youth kind of sports is football. Recent years mini-football has been acquiring popularity. For men there are experimentally grounded main principles of mini-football training process. For girls such principles are in the beginning of substantiation process [1, 2, 6, 12]. The authors found that physical qualities' level of modern girls is very low. They can not fulfill elementary exercises of applied character. That is why, searching of new methodic, program and exercises, which would permit for this contingent to quicker adapt to studying in higher educational establishment and be ready for future maternity, is rather relevant.

In other works it was determined that one of basic principles of training process is content of annual training cycle [3, 5]. This content is especially important for girl students, who do not practice sports and only start training after entering university. Importance of girl students' physiological characteristics in mini football training process consideration was noted in works of Clemente F. M. & Nikolaidis P. [18]. Soares B. M. et al. Found that anthropometrical indicators and sportswomen's body weight are of certain significance in preparation for mini football competitions [30]. Among other researches devoted to problems of girls' mini football trainings we can mark out the following: usage of trainings for prophylaxis of carriage disorders [24, 27], increase of sportswomen's workability at the account of optimization of aerobic and anaerobic loads' correlation [16, 28], Determination of fatigue index according to specific psychological profile of sportswomen [17, 21], determination of lower limbs' movements' bio-mechanical indicators [29], means of heart beats rate calculation depending on character of loads [19], determination of quickness, speed and acceleration values of mini football and classis football sportswomen [31]. The authors also note that it is necessary to apply modern training means [20], to increase general health [22, 25], implementation of health related technologies in educational process [23].

In our previous researches we studied the following questions: rational building of higher educational establishments' students' training process; specific features of circle mini football trainings' influence on girl students' physical fitness; changes of girls' anthropometrical indicators in puberty period. Besides, we found psychological components of mini football means in stimulation of universities' students' motor functioning and substantiated mini

doi:10.15561/18189172.2016.0406

football special training program for higher educational establishments' girl students with usage of informational technologies [7-11].

Nowadays the most important and urgent is the question of specific and non specific training means' correlation. Choice of rational correlation to large extent influences o rising of girl students' physical health level. Besides, the question about girl students sportsmanship's growing as well as interest to training is still discussible.

Hypothesis: we assumed that working out of one year extracurricular mini football training program got university girl students and its application in practice shall be based on usage of optimal specific and non specific means' correlation. Such approach will facilitate improvement of girls' physical condition and their effective preparation for future maternity and professional functioning.

The purpose: substantiation of one year mini football training program for first year girl students, in order to ensure their high level of physical and technical fitness, to improve organism's and health's functional state indicators.

Material and methods

Participants: one year experiment envisaged participation of 18-20 years' age 56 first year girl students (two groups, 28 people each). All participants gave consent for participation in the researches.

Organization of the research: we organized one-year comparative pedagogic experiment, in which two groups of first year university girl students participated. Before entering the university these girl students did not practice sports.

In extracurricular time girl students of both groups fulfilled different correlations of physical loads: groups 1 –– 70% of specific means and 30% of non specific; group 2 - 65% of specific means and 35% of non specific.

Trainings were conducted four times a week in extracurricular time during ten months (annual cycle) at the beginning, in the middle (after 5 months) and at the end (after ten months) of experiment we fulfilled testing of girl students' physical, technical and functional fitness. In the process of the research, on the base of commonly accepted control tests [3, 26] we studied indicators of their main motor qualities (quickness, speed-power, special and general endurance, relative strength of 5 leg's muscular groups), technical fitness and organism's functional state and health (using tests of Stanger, Genchi, Romberg; vital capacity of lungs and Rouffiet's index).

Reaction of girl students' organism to physical load was assessed on the base of questioning and pedagogic observations.

Statistical analysis: the received material was statistically processed with the help of Statistika 10.0 program. Confidence of differences between indicators of samples was checked with Student's criterion and was regarded as statistically significant at $p<0.05$.

Results of the research

One year experiment stipulated usage of different correlation of specific and non specific training means in both groups. The mentioned distribution of loads was based on results of researches of I.G. Maksymenko [3, 26]. The author substantiated effectiveness of the following specific and non specific training means' application in mini football: from 14 to 15 years' age – 55:45 (%); from 15 to 16 years' age – 60:40 (%); from 16 to 17 years' age – 65:35 (%). In football specific training means are exercises for mastering techniques and tactic, official and friendly games. Non specific training means are exercises for improvement of motor qualities (quickness, strength, dexterity, endurance, flexibility) and speed-power qualities (which are fulfilled without ball). Appropriate specific and non specific training means were fulfilled by both groups' girl students during one year experiment according to this classification.

At the beginning of one-year experiment we tested physical, technical and functional fitness. By the results of this testing no statistically significant differences were found between indicators of both groups.

Four times a week trainings in extracurricular time during 5 months resulted in certain shifts in physical, technical and functional fitness of experimental group girl students. Comparison of testing data of both groups' sportswomen permits to determine the following: group 1 has advantage in tests "30 meters' run from high start" and "special endurance" ($p<0.05$). Between indicators of strength, speed-power qualities and general endurance there were no statistically significant differences.

Similar results were observed in comparing of technical fitness tests. In this test group 1 girl students had advantage in juggling with ball and kicks for accuracy ($p<0.05$). In other exercises there were no substantial differences between groups. After five months of experiment, by functional fitness indicators and health state group

1 became better (p<0, 05). Only by results of Romberg's test we did not registered statistically significant differences between groups. According to plan of comparative experiment with both groups' sportswomen we fulfilled 160 trainings. Control testing of group 1 permitted to find the value of shifts in levels of girl students' physical and technical fitness at the end of experiment (see table 1). As we can see in the table, at the end of experiment, comparing with its beginning, in this group there was noticeable increment of physical and technical fitness indicators (p<0.05). Similar positive changes were registered in organism's functional state and health girl students (see table 2).

Table 1. Changes in physical and technical fitness levels in group 1 girl students at the end of comparative experiment

Control exercises	**At the beginning of experiment**		**p**	**At the end of experiment**		**Changes**
	$\overline{X}$	**M**		$\overline{X}$	**m**	
30 meters' run from high start, sec.	5.38	0.02	<0.05	5.0	0.01	-0.38
High jump from the spot, cm	36.82	0.26	<0.05	42.84	0.18	+6.02
Indicator of lower limb's five muscular groups' relative strength, kg	3.67	0.04	<0.05	4.18	0.05	+0.51
Special endurance (run 7×50 m), sec.	99.05	0.37	<0.05	92.79	0.25	-6.26
General endurance (Cooper's test), m	199.2	18.63	<0.05	2169.5	17.52	+179.3
30 meters' dribbling, sec.	6.38	0.02	<0.05	5.81	0.02	-0.57
Juggling with ball, times per min. $^{-1}$	5.67	0.02	<0.05	11.2	0.01	+5.53
Kicks for accuracy, quantity of times	2.98	0.01	<0.05	4.25	0.01	+1.27
Dribbling, dribbling around stands, kick in goal, sec.	8.79	0.02	<0.05	8.17	0.02	-0.62
Kicks for distance, m	46.15	1.07	<0.05	55/95	1.14	+9.8

Notes: p – Student's criterion

Table 2. Changes in indicators of health and functional state of group 1 girl students at the end of comparative experiment

Control exercises	At the beginning of experiment		p	At the end of experiment		Changes
	$\overline{X}$	m		$\overline{X}$	m	
Vital capacity of lungs, ml	3016.7	11.15	<0.05	3411.9	10.27	+395.2
Stanger's test, sec.	42.8	0.24	<0.05	57.4	0.19	+14.6
Genchi's test, sec.	21.2	0.11	<0.05	36.7	0.11	+15.5
Rouffiet's index, conv.un.	15.8	0.11	<0.05	7.1	0.09	-8.7
Romberg's test, sec.	14.8	0.05	<0.05	33.9	0.08	+19.1

Notes: p – Student's criterion

Appropriate testing of physical, technical and functional fitness in group2 at the end of comparative experiment showed that 160 trainings resulted in positive changes by all control exercises. With it statistically significant differences between initial and final indicators were not observed only in tests "30 meters' run from high start" and "Special endurance".

Effectiveness of specific and non specific training means' correlation in girl student's initial training is proved by comparison of physical, technical and functional fitness indicators of both groups at the end of annual cycle (160 trainings). It was found that for the period of one year experiment girl students of group1 achieved better indicators. They demonstrated statistically significant prevalence over group 2 girl students by results of 30 meters' run from high start, high jump from the spot and 7×50 meters' run. Indicators of general endurance was also better – Cooper's test ($p>0.05$). Practically the same was the total figure of relative strength of lower limb's five muscles groups ($p>0.05$). Group 1 sportswomen demonstrated noticeable advantage over group 2 in indicators of technical fitness ($p<0.05$). Analysis of organism's functional state and health of both groups' girl students at the end of experiment witnessed higher level of fitness in group 1. It is proved by statistically significant differences between all tests except Rouffiet's index.

The presented above material permits to state that in annual cycle of girl students' mini football training correlation of specific and non specific training means in proportion 70:30 (%) is the most effective. Such approach permitted to support or even improves certain indicators of group 1 girl students' physical fitness at mini football trainings.

Discussion

Recent years the mentioned above problem has acquired especial relevance for universities' girl students – future mothers. It is of common knowledge that one of the most important factors of involvement in healthy life style, health strengthening, prophylaxis of harmful habits and preparation for future maternity is sports practicing; in particular, mini football trainings, which, as on today, have been becoming still more popular in the world owing to its democratic character [8, 12-14]. Analysis of literature data and generalization of practical specialists' experience point at the fact that as on today there is a number of problems in respect of rising of effectiveness of mini football trainings for health strengthening of universities' girl students [3, 5, 16-20, 27-31]. Shortening of physical culture academic hours at higher educational establishments renders negative influence on the situation as well as the absence of single, scientifically grounded health improvement system and girl students' preparation for future professional functioning; insufficient approaches to information technologies' usage in students' mastering physical exercises.

The determined by us advantage of group 1 girl students in comparison with group 2 by most of indicators is explained by the following: higher volume of non specific training means in group 2 facilitated improvement of their indicators of strength, general endurance and workability. But these indicators do not significantly differ ($p>0.05$) from the same indicators of group 1.

In the age of 17-18 years main systems of girls' organism are in already formed state [1, 4, 7, 9]. That is why difference in specific and non specific means did not influence noticeably on strength and general endurance. Practically equal level of workability in both groups was ensured: in group 1 at the account of special endurance and in group 2 – at the account of general physical fitness.

Separately it should be noted that materials of our research once again proved specialists' conclusions about favorable influence of football practicing on different contingents of healthy youth and students with health problems [1, 2, 6]. The substantiated in one-year experiment correlation of specific and non specific training means in proportion 70:30 (%) does not substantially differ from loads' volumes of young sportsmen, who specialize in classic football [3].

Conclusions

1. It has been determined that one of direction of girl students' unsatisfactory health condition's improvement is application of different kinds of sports extracurricular practicing.

2. By results of one-year formation experiment we substantiated optimal program of extracurricular mini football trainings, which stipulates usage of specific and non specific training loads in proportion 70:30 (%). Implementation of the worked out extracurricular mini football training program for university girl students in practice will facilitated improvement of their physical and technical fitness, indicators of organism's functional state and health, effective preparation for future maternity and professional functioning.

The prospects of further researches imply determination of optimal structure of micro-cycles construction in respect to university girl students' extracurricular mini football trainings.

Acknowledgements

The work has been fulfilled according to combined plan of scientific research works in sphere of physical culture and sports for 2011 – 2015 within complex topic 2.4 "Theoretical-methodic principles of individualization in physical education and sports" (state registration number 0112U002001); and in the frames of scientific-research work for 2015 – 2016 "Theoretical-methodic principles of application of means of informational, pedagogic, medical-biological orientation for motor and spiritual development and formation of healthy life style" (state registration number 0115U004036).

Conflict of interests

The authors declare that there is no conflict of interests.

References

1. Vyprikov DV. *Postroenie uchebno-trenirovochnogo processa na osnove kompleksnoj ocenki nagruzok kvalificirovannykh sportsmenok v mini-futbole. Kand. Diss*. [Construction of training process on the base of complex assessment of elite sportswomen's loads in mini football. Cand. Diss.], Malakhovka; 2008. (in Russian)
2. Maevskij KV. *Metodika integral'noj podgotovki iunykh sportsmenov, specializiruiushchikhsia v mini-futbole (futzale) s akcentom na razvitie funkcii vnimaniia. Kand. Diss.* [Methodic of integral training of junior sportsmen, specializing in mini football with accent of attention function's development. Cand. Diss.], Volgograd; 2012. (in Russian)
3. Maksimenko IG, Bugaev GV, Sysoev AV, Kadurin VV. Sportivnye igry: faktory, obuslovlivaiushchie strategiiu mnogoletnej podgotovki iunykh sportsmenov [Sports games: factors, conditioning strategy of sportsmen's many years' training]. *Uchenye zapiski universiteta imeni P.F. Lesgafta*, 2015;11(129):154-157. (in Russian)
4. Pilipej LP. *Teoretiko-metodichni osnovi profesijno-prikladnoi fizichnoi pidgotovki studentiv vishchikh navchal'nikh zakladiv. Dokt. Diss.* [Theoretical-methodic principles of professional-applied training of higher educational establishments' students. Doct. Diss.], Kiev; 2011. (in Ukrainian)
5. Platonov VN. *Sistema podgotovki sportsmenov v olimpijskom sporte* [System of sportsmen's training in Olympic sports], Kiev: Olympic Literature; 2015. (in Russian)
6. Saenko EI. *Kriterii sportivnogo otbora i orientacii devushek dlia zaniatij futbolom v uchebno-trenirovochnykh gruppakh sportivnykh shkol. Kand. Diss.* [Criteria of girls' sports selection and orientation for football trainings in training groups of sports schools. Cand. Diss.], Moscow; 2002. (in Russian)
7. Tamozhanskaia AV, Bojchenko AV. Vliianie sekcionnykh zaniatij mini-futbolom na fizicheskuiu podgotovlennost' studentov 1-2 kursov vuzov [Influence of mini football sport-circle training on physical fitness of 1st – 2nd year HEE students]. *X mizhnarodna naukovo-metodichna Internet-konferenciia "Aktual'ni problemi rozvitku tradicijnikh i skhidnikh iedinoborstv", 25.03.2016r.* [10th international scientific-methodic Internet conference "Current problems of development of traditional and oriental martial arts", 25.03.2016], Kharkov: NANG; 2015. P. 488-492. (in Russian)
8. Tamozhanskaia AV. Izmeneniia antropometricheskikh pokazatelej devochek 11, 12 i 13 let v period pubertatnogo rosta [Changes of 11, 12 and 13 years' age girls' anthropometrical indicators in puberty period]. *XV Mizhnarodna naukovo-praktichna konferenciia molodikh uchenikh "Suchasni problemi fizichnogo vikhovannia i sportu riznikh grup naselennia"* [15th international scientific-practical conference of young scientists "Modern problems of physical education and sports in different population strata"] Sumy: SumDPU; 2015. 1. P. 178-182. (in Russian)
9. Tamozhanskaia AV. Issledovanie vliianiia zaniatij mini-futbolom na fizicheskoe sostoianie studentok 1-2 kursov vysshikh uchebnykh zavedenij [Study of mini football trainings influence on physical condition of 1st and 2nd year higher educational establishments' girl students]. *Visnik Chernigivs'kogo pedagogichnogo universitetu,* 2016;136:229-233. (in Russian)
10. Tamozhans'ka GV. Psikhologichni skladovi zasobiv mini-futbolu v stimuliuvanni rukhovoi aktivnosti studentok universitetiv [Psychological components of mini football means in stimulation of universities girl students' motor functioning]. *Pedagogika formuvannia tvorchoi osobistosti u vishchij i zagal'noosvitnij shkolakh,* 2016;47(100):363-367. (in Ukrainian)

11. Tamozhans'ka GV. Special'na programa navchannia studentok universitetiv mini-futbolu z vikoristanniam informacijnikh tekhnologij [Special program of universities girl students' mini football training with application of information technologies]. *Vseukrains'ka naukovo-praktichna konferenciia "Fizichne vikhovannia: teoriia i praktika"* [All-Ukrainian scientific-practical conference "Physical education: theory and practice"]. Poltava: Poltava National Pedagogical University, 2016. P. 246-249. (in Ukrainian)
12. Futornij SM. *Teoretiko-metodichni osnovi innovacijnikh tekhnologij formuvannia zdorovogo sposobu zhittia studentiv v procesi fizichnogo vikhovannia. Dokt. Diss.* [Theoretical-methodic principles of innovative technologies of students' healthy life style formation in process of physical education. Doct. Diss.], Kiev; 2015. (in Ukrainian)
13. Kharlamov AA. *Struktura i soderzhanie podgotovki studencheskoj komandy po mini-futbolu v godichnom cikle zaniatij. Kand. Diss.* [Structure and content of students' mini football team training in annual cycle of trainings. Cand. Diss.], Tula; 2011. (in Russian)
14. Iurchishin IuV. *Tekhnologiia zaluchennia studentiv do rukhovoi aktivnosti ozdorovchoi spriamovanosti u procesi fizichnogo vikhovannia. Kand. Diss*. [Technology of students' involvement in health related motor functioning in process of physical education. Cand. Diss.], Kiev; 2012. (in Ukrainian)
15. Chistiakov VA, Aronov GZ. Imitacionnoe modelirovanie v sfere fizicheskoj kul'tury [Immitation simulation in sphere of physical culture]. *Uchenye zapiski universiteta imeni P.F. Lesgafta*, 2006;2:83 – 86. (in Russian)
16. Angel Rubio-Arias J, Ramos Campo DJ, Poyatos JMRN, Carrasco Poyatos M, Alcaraz Ramon PE, Jimenez Diaz FJ. Adherence to a mediterranean diet and sport performance in a elite female athletes futsal population. *Nutricion hospitalaria,* 2015; 31: 2276-2282.
17. Boia do Nascimento MG, Gomes SA, Mota MR, Aparecida R, de Melo GF. Psychological profiles of gender and personality traces of Brazilian professional athletes of futsal, and their influence on physiological parameters. *Psychology research and behavior management,* 2016; 9: 41-51.
18. Clemente FM, Nikolaidis PT. Profile of 1-month training load in male and female football and futsal players. *Springerplus,* 2016; 5: 40-45.
19. de Souza EG, Istchuk LL, Lopez JA, da Silva KA, Batista LdA, Goncalves HR, Reeberg Stanganelli LC. Comparison of maximum heart rate predicted and measured in indoor soccer adolescent athletes. *Revista brasileira de futsal e futebol,* 2015; 7: 455-459.
20. Flatt AA, Esco MR. Evaluating individual training adaptation with smartphone-derived heart rate variability in a collegiate female soccer team. *Journal of strength and conditioning research,* 2016; 30: 378-385.
21. Ilyin VN, Alwani AR. Ubiquity and formation of chronic fatigue in qualified sportsmen. *Pedagogics, psychology, medical-biological problems of physical training and sports*, 2016;3:11-17. doi:10.15561/18189172.2016.0302
22. Kenioua Mouloud, Boumasjed Abd Elkader, Sport and mental health level among university students. *Physical Education of Students*, 2016;3:39-42. doi:10.15561/20755279.2016.0305
23. Kondakov VL, Kopeikina EN, Usatov AN. On purposefulness of application of physical culture-health related technology for prophylaxis of students' respiratory system disorders. *Physical Education of Students*, 2016;20(2):4-12. doi:10.15561/20755279.2016.0201
24. Kotelevskiy VI. Integrative technology of massage manipulations in physical rehabilitation of students with backbone pathology. *Pedagogics, psychology, medical-biological problems of physical training and sports*, 2016;3:31-40. doi:10.15561/18189172.2016.0305
25. Kudryavtsev MD, Kopylov YuA, Kuzmin VA, Ionova OM, Yermakova TS. Personality oriented system of strengthening of students' physical, psychic and social-moral health. *Physical Education of Students*, 2016;3:58-64. doi:10.15561/20755279.2016.0308
26. Maksimenko I, Mutate AS. *Soccer training foundations*. Amman: Daraltakfa; 2006.
27. Noormohammadpour P, Rostami M, Mansournia MA, Farahbakhsh F, Shahi MHP, Kordi R. Low back pain status of female university students in relation to different sport activities. *European spine journal,* 2016; 25: 1196-1203.
28. Saeedy M, Bijeh N, Moazzami M. The effect of six weeks of high-intensity interval training with and without zinc supplementation on aerobic power and anaerobic power in female futsal players. *International journal of applied exercise physiology*, 2016; 5: 1-10.

29. Sainz de Baranda P, Cejudo A, Ayala F, Santonja F. Optimum profile of lower-limb muscle flexibility in female futsal players. *Revista internacional de medicina y ciencias de la actividad fisica y del deporte,* 2015; 15: 647-662.
30. Soares BM, Erthal Chagas ME, Sehnem RC, Cirico D. Assessment of caloric intake and body composition of female futsal athletes in the city of Guarapuava-Parana. *Revista brasileira de futsal e futebol,* 2016; 8: 129-141.
31. Unveren A. Investigating Women Futsal and Soccer Players' Acceleration, Speed and Agility Features. *Anthropologist,* 2015; 21: 361-365.

Information about the authors:

Tamozhanskaya A. V.; http://orcid.org/0000-0003-2430-8467; kulichka79@ukr.net; Kharkov State Academy of Physical Culture; Klochkovskaya str. 99, Kharkov, 61022, Ukraine.

Shkola O. M.; http://orcid.org/0000-0003-3013-0423; alesik1974@mail.ru; Kharkiv Humanitarian Pedagogical Academy; Sh.Rustaveli alley 7, Kharkov, 61000, Ukraine.

Cite this article as: Tamozhanskaya A.V., Shkola O.M. On program of extracurricular mini-football training program for university girl students. *Pedagogics, psychology, medical-biological problems of physical training and sports*, 2016;4:35–41. doi:10.15561/18189172.2016.0406

The electronic version of this article is the complete one and can be found online at: http://www.sportpedagogy.org.ua/html/arhive-e.html

Received: 17.07.2016
Accepted: 26.07.2016; Published: 30.08.2016

SIMULATION OF REALIZATION OF SKI-RACERS' FUNCTIONAL POTENTIALS IN PASSING SKI TRAILS OF DIFFERENT COMPLEXITY

Khmelnytska J.K.
National University of Physical Education and Sport of Ukraine

Abstract. *Purpose:* to substantiate model characteristics of functional fitness components of elite ski-racers, depending on competitions' conditions. *Material:* We tested 20 sportsmen of combined team of Ukraine. *Results:* it was found that climbing hills of different length and steepness is accompanied by certain functional tension of organism and changes in cardio-respiratory system. It influences on effectiveness of further descent and moving on plain. It was also determined that correlation of aerobic and anaerobic efficiency changes according to trail relief. *Conclusions:* we worked out model characteristics of skiers' fitness most important parameters, usage of which can facilitate maintaining high special workability on all segments of competition distance. In particular it concerns climbing hills of different steepness.
Key words: skiers, racers, functional fitness, relief, ski trail, cardio-respiratory system.

Introduction

At modern stage of sportsmen's training simulation of sports functioning's different sides is widely used. The developed models are results of profound analysis and study of the researched processes. They become one of main means of control over complex systems of sportsman's training [8].

Further specification and approaching of model characteristics to competition requirements are presented in appropriate works. It is noted that building of sports training is impossible without simulation of some trainings, competitions and different training aspects [5].

It should be noted that simulation shall not be reduced to working out generalized models and prognostic model characteristics of sportsmen's potentials. The models shall reflect individual features of sport perfection in compliance with stage of sport training.

The presence of model characteristics permits to raise effectiveness of training process control and creates necessary pre-conditions for working out system of promising sportsmen's selection.

In skiing kinds of sports there are specific peculiarities of competition's simulation, which are connected with competition conditions, competition's rules and other factors. Leading specialists in skiing note that for systematic and purposeful functional preparation for the highest sports achievements of ski-racers it is necessary to consider metrical and time parameters of competition load on different parts of trail relief [1, 4, 15, and 17]. Orientation on competition functioning structure is one of the most important factors, when working out optimal model characteristics of ski-racers [2, 6, and 10].

In our previous works, on the base of systemizing of female-skiers' special fitness indicators, we determined model characteristics of functional fitness quantitative values for conditions of climbing hills of different complexity. We also conditioned values of aerobic and anaerobic energy supply mechanisms' contribution. Anaerobic mechanisms are one of key components of high results in ski racings, when climbing hills [8, 24].

Hypothesis: it is assumed that functional fitness of skiers is taken as the basis of sportsmen's workability in conditions of passing competition distance. That is why there is a need in increasing the significance of elite sportsmen's functional potentials' study. The purpose of such work is substantiation of clear requirements to training process's building, considering targeted models of competition functioning and sportsmen's functional fitness.

The purpose of the work: is to substantiate model characteristics of components of elite ski-racers' functional fitness, depending on conditions of competition functioning.

Material and methods

Participants: in the research 20 skiers of 21-34 years' age took part. Their qualification was: international masters of sports (n=6), masters of sports (n=14). They were 10 girls and 10 boys. All sportsmen were members of National ski-racing combined team of Ukraine.

doi:10.15561/18189172.2016.0407

Organization of the research: model studies were fulfilled on the base of university's laboratory. Testing of special endurance and realization of sportsmen's functional potentials in natural conditions of competition distance passing was carried out at sports training base "Tysovets" (Lvovskaya region). Functional potentials of sportsmen were assessed with complex testing. The testing included ergo metering, speed metering, analysis of respiratory system with the help of gas analyzer «MetaMax 3B» (Cortex, Germany) and pulse metering. Objective measurements of muscular work's characteristics in laboratory conditions were realized with the help of specialized ergo meter with increased area of track Wide Folding Track (POMA, Germany). Application of ergo meter permits to move on ski-rollers in free style.

In natural conditions we used system of GPS-navigation of HBR telemetric register «Polar RS800» («Polar», Finland), which permitted to register heart beats rate (HBR), speed of distance passing and height above sea level. On the base of these indicators we determined trails' relieves; received the data of sportsman's speed on different parts of distance, power of work and etc.

Statistical analysis: statistical processing of materials was fulfilled with the help of Statistica 10.0 and Excel 2003, 2007 programs. Confidence of differences between groups was found with Wilkinson's criterion.

Results of the research

The data, received in our research, permitted to find certain dependence of competition functioning's effectiveness indicators on current functional and working state of sportsmen, reflected in model characteristics.

Model characteristics of functional potentials' realization in conditions of simulation of competition distance's passing were worked out on the base of regression models' construction. As a reference value (see table 1) we offered mean values of functional indicators, required for maintaining speed 6.2 m.p.sec. (22.3 km.p.h.) at distance 6 km.

Table 1. Reference and mean-group values of respiratory and blood circulation functional indicators of sportsmen, - ski-racers

Indicator			Reference values	Mean values for group
f	Breathing frequency	l/min	56.94	57.2
VE	Lung ventilation	l/min	153.66	131.25
V_{O2}	Level of oxygen consumption	l/min	4.30	3.68
V_{CO2}	Level of carbon dioxide release	l/min	4.349	4.12
V_{O2}/m	Level of oxygen consumption per 1 kg of body mass	ml/min/kg	71.44	65.75
RQ	Respiratory coefficient	conv.un.	1.01	1.12
VE/V_{O2}	Ventilation equivalent by O_2	conv.un.	38.91	34.37
VE/V_{CO2}	Ventilation equivalent by CO_2	conv.un.	36.5	30.725
HR	Heat beats rate (HBR)	l/min	191	186
V_{O2}/HR	Oxygen pulse	ml	24.43	19.775

The values, given above, do not contain peak values, which are characteristic for climbing hills. They significantly depend on hill gradient (relation of hill length to differential of heights) and height above sea level, as well as on weather conditions. For working out the model of dynamic functional reactions we made a map of trail profile, on which competitions would take place.

The conducted by us researches showed that mean-distance speed at competition distance depended on characteristics of anaerobic metabolism threshold (TAM). Power of anaerobic metabolism threshold (TAM, W; W/kg $^{-1}$ of body mass, % form maximal oxygen consumption) is a characteristic of work, with which intensity of anaerobic energy supply reactions is insufficient for satisfying energy demand. As a result there happens active start of glycolytic processes, which are accompanied by lactate accumulation to more, than 4 mmole^{-1}. In sports practice TAM is used

for dozing of loads. That is why in practice relation of current oxygen consumption to its maximal value is often used (%). Besides, it is known that workability at TAM level is one of leading criteria of ski-racers' special endurance assessment [3, 7, 9].

Model characteristics were worked out on the base of concept about significance of workability at TAM level for prediction of high sport results in kinds of sports, which require high endurance. As reference we determined values of functional indicators at TAM level, required for maintaining speed 6.2 m.p.sec. (22.3 km.p.h.) at distance 6 km. Such characteristics were obtained on the base of regression equations (see fig. 1).

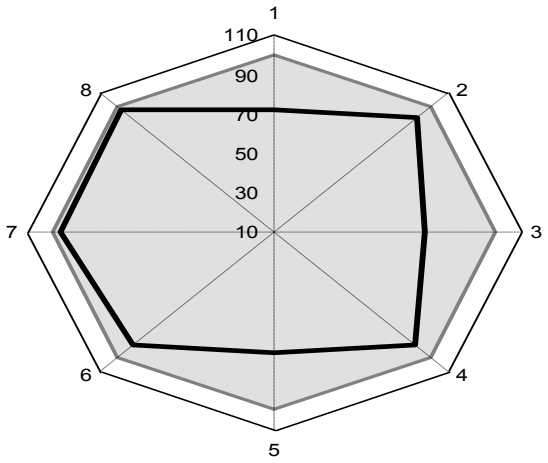

Fig.1. Functional characteristics of ski-racers at TAM level (% from reference value):
1 – TAM power; 2 – TAM power per 1 kg of body mass; 3 – lungs ventilation; 4 – lungs ventilation per 1 kg of body mass; 5 – oxygen consumption; 6 – intensity of oxygen consumption per 1 kg of body mass; 7 – heart beats rate (HBR); 8 – oxygen consumption in % from maximal oxygen consumption (MOC).

We also determined model characteristics of functional potentials' realization in conditions, simulating passing competition distance (see fig. 2).

We worked out and experimentally tested method of application of experimental data, received in laboratory conditions (ski treadmill) for prediction of speed, energy consumption and economy of skiing in real conditions of ski trail.

For assessment of functional potentials indicators we studied regression dependences between characteristics of skiers' special workability, their functional potentials and specificities of ski trails relief. We found that sportsmen's special workability is determined by indicators of maximal aerobic and anaerobic efficiency, economic character of external breathing in conditions of intensive muscular functioning ($R=0.71$; $p<0.05$).

The model, reflecting interconnection of functional fitness indicators and specificities of hills permitted to assess influence of hills steepness and speed of their climbing at distance as well as realization of sportsmen's organism's functional potentials. From many indicators of sports efficiency in ski racings and aerobic (anaerobic) energy supply contribution in work we chose the most significant: level of oxygen consumption, excess of carbon dioxide (ExCO2) and heart beats rate (HBR).

We determined special workability of skiers, connected with aerobic efficiency. It reached the highest values at low values of speed of hills climbing and slope angle. It reached the least value at the highest slope angle and the least speed of its climbing (see figs. 3, 4).

The presented characteristics permit to conclude that for achievement high result in ski racings it would be insufficient to realize only aerobic potentials of sportsmen's organism. To achieve this target it is necessary to realize anaerobic potentials. Due to anaerobic energy supply mechanisms skiers climb hills of different complexity, which are more than 50% of all trail.

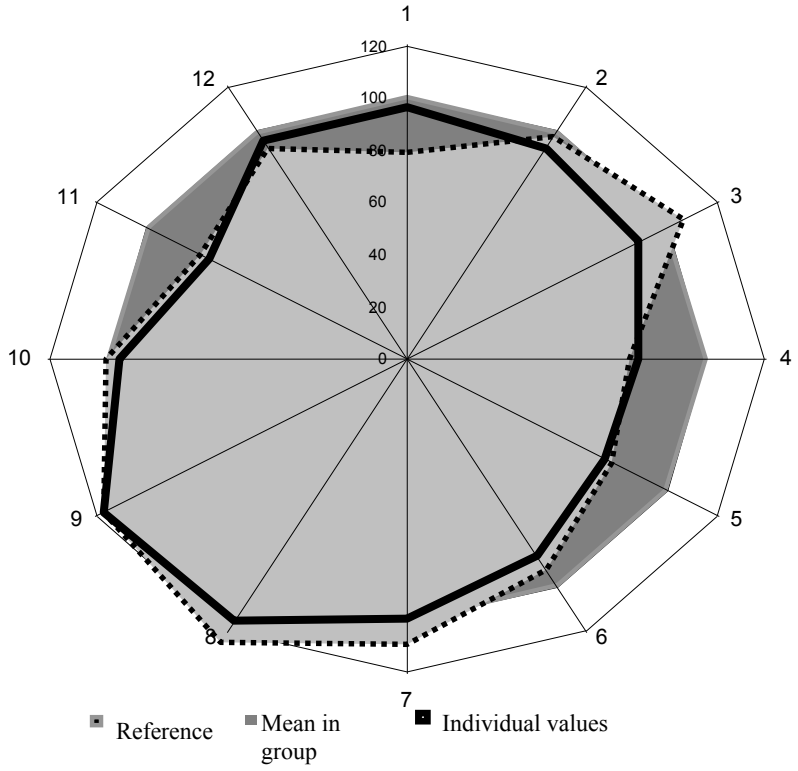

Fig. 2. Functional indicators of ski-racers in conditions, simulating passing competition distance (% from reference value):
1 – volume of inhale; 2 – breathing frequency; 3 – lungs ventilation; 4 –oxygen consumption; 5 – carbon dioxide release; 6 – carbon dioxide release per 1 kg of body mass; 7- intensity of oxygen consumption per 1 kg of body mass; 8 – respiratory coefficient; 9 – ventilation equivalent by oxygen; 10 – ventilation equivalent by carbon dioxide; 11 – heart beats rate; 12 – oxygen pulse.

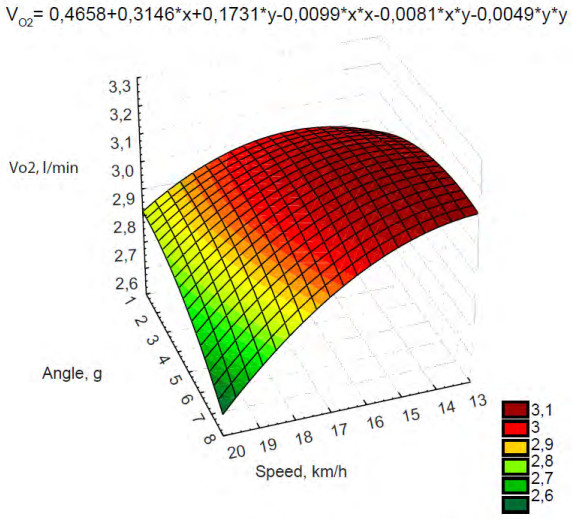

Fig.3. Model of interdependence of ski racers' aerobic efficiency and speed of hills' climbing, slope angle

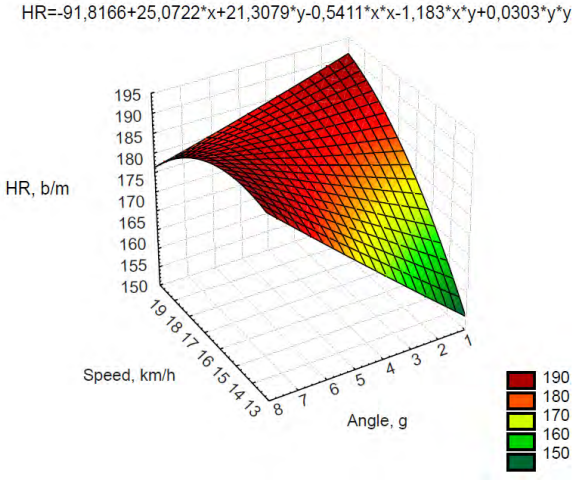

Fig.4. Model of ski racers' HBR interdependence and speed of hills' climbing, slope angle

To prove elite skiers' special workability's interconnection with economizing of respiratory functional system's reaction in conditions of special loads we worked out the model of interconnection of slope angle, speed of hill climbing with $ExcCO_2$ (excess of CO_2 release). This model reflects anaerobic metabolism processes in organism (see fig. 5). With characteristic of sportsmen's functional maintenance on hills of different steepness and length $ExcCO_2$ is an important indicator. This indicator is a result of metabolic acidosis (disorder of internal medium constancy at excessive acids' formation, when buffer reserves drop lower than norm). It reproduces rather exactly the changes of lactic acid and blood bi-carbonates content. It permitted to determine the sportsmen's optimal range of anaerobic lactate power realization.

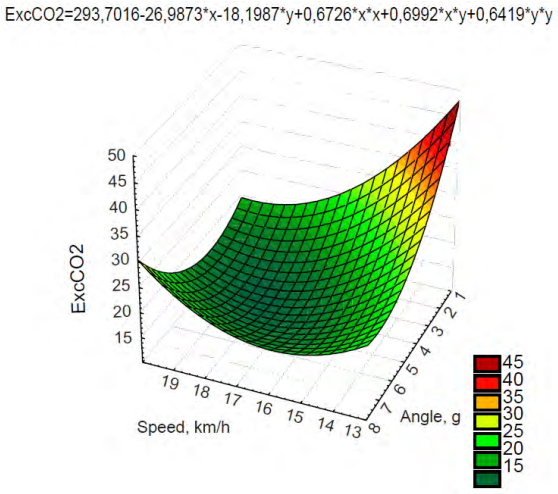

Fig. 5. Model of $ExcCO_2$ interconnection of ski-racers with hills' climbing speed and slope angle

Thus, we showed possibility of orientation with assessment of sportsman's organism's functional reserves on interconnection of several indicators. These indicators characterize organism's potentials. They permits to predict realization of skiers' special workability, assess effectiveness of their functional fitness some components. Comparison of individual data of single sportsman with model indicators permitted to determine correspondence of sportsmen's functional potentials to the pre-set level of fitness, depending on sportsman's specialization.

Discussion

Results of the researches proved confident interconnection of ski trails characteristics with level of sportsman's organism's functional potentials realization. The received data comply with the data of other authors [12, 13, 20, and 21] about need in determination of sportsmen's special workability optimal parameters. The conducted researches resulted in finding that work at competitions on rugged trails is of alternative character. The main source

of energy supply of sportsman's workability is organism's aerobic potentials. Their level reaches 92-95% from maximal values. Alongside with it passing of different by length and time hills and descents causes unequal intensification of anaerobic metabolism. We found that during climbing hills significant role in energy supply of skiers' organism belongs to anaerobic sources. Their volume reaches 80% from maximal values. Thus, correlation of metabolic reactions conditions higher orientation of adaptation changes of main functional systems, which ensure sportsmen's special workability. Functional potentials of sportsmen with high level of aerobic and anaerobic reserves realization are close to proper values of functional fitness.

Analysis of advanced specialists' publications witnesses [11, 14], that simulation of sportsmen's special fitness includes development of complex of the most important and ranked by significance level indicators – model characteristics. Such characteristics shall be received in the process of training by the beginning of competitions. Special attention is paid to simulation of sportsmen's functional potentials, required for hills climbing. This fact is a fundamental condition of skiers' special workability formation.

Analysis showed that one of the most problematic questions of increasing of sportsmen's functional potentials is development of respiratory function, compensating metabolic acidosis. Such approach is in agreement with the data of other authors [16, 18, and 19]. In the base of this function's assessment is the change of lungs ventilation's reaction, which characterizes organism's ability to release excessive CO_2. With it, among the found factors of aerobic power, the most significant are absolute and specific indicators of oxygen consumption ($r=0.96$; $p<0.05$) and maximal level of work intensity ($r=0.73$; $p<0.05$). Among the found factors of anaerobic power the highest specific weight belongs to total speed of CO_2 formation and release ($r=0.79$; $p<0.05$), respiratory coefficient ($r=0.98$; $p<0.05$) and excess of formed CO_2 ($r=0.96$; $p<0.05$). It is a factor, which proves impossibility to achieve high efficiency in ski racings without noticeable realization of anaerobic potential in process of competition distance passing.

Materials of our researches to certain extent supplement theoretical principles, devoted to the problem of ski-racers' functional fitness perfection at different segments of distance. For the first time we determined model characteristics of ski-racers' functional potentials at hills' climbing of different complexity, which can serve as the basis of assessment of sportsmen's special workability components at different segments of competition distance.

Conclusions

On the base of our researches we worked out model characteristics of most important parameters (functional and competition functioning) of elite sportsmen's fitness. Their application can facilitate maintenance of special workability at high level on all segments of competition distance. Especially it concerns the trails with hills of different steepness.

The found individual distinctions in special workability of ski racers permit to work out training programs with accent on "leading" indicators. Besides, they permit to build group and individual models of competition distances' passing, considering sportsmen's functional fitness. These results can be used for control over special fitness dynamic on stages of preparatory period and realization of individual approach to control over training process.

Acknowledgements

The work has been fulfilled in compliance with combined plan of SRW in sphere of physical culture and sports of Ukraine by topic 2.22. "Development of complex system for determination sportsmen's individual-typological properties on the base of genome's manifestation"; (state registration № 0106U010778; USC 796.072.

Conflict of interest

The author declares that there is no conflict of interests.

References

1. Batalov AG. Model'no-celevoj sposob postroeniia sportivnoj podgotovki vysokokvalificirovannykh sportsmenov v zimnikh ciklicheskikh vidakh sporta [Model-target method of construction of elite sportsmen's training in winter cyclic kinds of sports] *Teoriia i praktika fizicheskoj kul'tury*, 2001;11:46–52. (in Russian)
2. Vlasenko SO, Kuz'menko LN. Osoblivosti prokhodzhennia riznikh za rel'iefom dilianok distancii v lizhnikh gonkakh [Peculiarities of passing of different by relief distances in ski racings] *Pedagogics, psychology, medical-biological problems of physical training and sports,* 2005;1:18-22. (in Ukrainian)
3. Dunaev KS. *Tekhnologiia celevoj fizicheskoj podgotovki vysokokvalificirovannykh biatlonistov v godichnom cikle trenirovki. Dokt. Diss.* [Technology of targeted physical training of elite biathlon sportsmen in annual cycle of training. Doct. Diss.], Sankt Petersburg; 2007. (in Russian)

4. D'iachenko AIu. Praktichni aspekti optimizacii fiziologichnoi reaktivnosti v sportivnij pidgotovci kvalifikovanikh sportsmeniv [Practical aspects of optimization of physiological reactivity in sports training of elite sportsmen]. *Teoriia i metodika fizichnogo vikhovannia i sportu,* 2010;3:22-27. (in Ukrainian)
5. Kotliar SN. Model'nye kharakteristiki funkcional'nykh vozmozhnostej lyzhnikov-gonshchikov vysokoj kvalifikacii uspeshno vystupaiushchikh v gonkakh klassicheskim i kon'kovym stiliami peredvizheniia [Model characteristics of functional potentials of elite ski racers, who successfully participate in racings with classic and skate styles] *Pedagogics, psychology, medical-biological problems of physical training and sports,* 2002;27:86-92. (in Russian)
6. Mikhajlovskij SP. Upravlenie trenirovochnym processom na osnove modelirovaniia vedushchikh pokazatelej podgotovki lyzhnikov-gonshchikov [Control of training process on the base of simulation of most important indicators of ski racers' training] *Uchenye zapiski universiteta imeni P.F. Lesgafta*, 2009;7(53):74-77. (in Russian)
7. Mulik VV. *Sistema mnogoletnego sportivnogo sovershenstvovaniia v uslozhnennykh usloviiakh sopriazheniia osnovnykh storon podgotovlennosti sportsmenov (na materiale lyzhnogo sporta). Kand. Diss.* [System of many years' sport perfection in complicated conditions of combination of main sides sportsmen's fitness (on materials of ski sports). Cand. Diss.], Kiev; 2002. (in Russian)
8. Nesterov VN, Khmelnytska JK. Obshchaia kharakteristika funkcional'noj podgotovlennosti lyzhnikov-gonshchikov vysokoj kvalifikacii. [General characteristic of elite ski racers' functional fitness]. *XIII Mezhdunarodnyj nauchnyj kongress «Sovremennyj Olimpijskij sport i sport dlia vsekh»* [XIII International scientific congress "Modern Olympic sports and sports for all], Almaty: KazAST, 2009. p. 249-252. (in Russian)
9. Platonov VN. *Obshchaia teoriia podgotovki sportsmenov v olimpijskom sporte* [General theory of sportsmen's training in Olympic sports]. Kiev: Olympic Literature; 2004. (in Russian)
10. Filippov MM, Davidenko DN. *Fiziologicheskie mekhanizmy razvitiia i kompensacii gipoksii v processe adaptacii k myshechnoj deiatel'nosti* [Physiological mechanisms of training and compensation of hypoxia in process of adaptation to muscular functioning], Sankt Petersburg-Kiev, BPA; 2010. (in Russian)
11. Khokhlov G.G. Testirovanie lyzhnikov-gonshchikov v estestvennykh usloviiakh [Testing of ski racers in natural conditions]. *Slobozhanskij naukovo-sportivnij visnik*. 2002;5:120-122. (in Russian)
12. Astorino TA. Effect of high-intensity interval training on cardiovascular function, VO2max, and muscular force. *J Strength Cond Res*, 2012;26(1): 138-145.
13. Carlsson P, Ainegren M, Tinnsten M, Sundström D, Esping B, Koptioug A, & Bäckström M. *Cross-Country Ski. In The Engineering Approach to Winter Sportsm.* Springer: New York; 2016.
14. Dubrovinskiy SS, Batalov AG. modelling of technical and tactical actions in competitive sprint activity of elite cross-country skiers (the case of olympics 2010 and 2014). *Theory and practice of physical culture*, 2015;9:20-25.
15. Gabrys T, Szmatlan-Gabrys U, Plewa M. Dynamics of aerobic capacity in cross-country skiing in the view of training loads structure. In: Koskolou M. (ed.), *European College of Sport Science, Proceedings of the 7th annual congress of the European College of Sport Science*, *Athens, Greece, 24-28 July 2002*. (p.448). Athens: Pashalidis Medical Publisher; 2002.
16. Holmberg H. Integrative biomechanics and physiology in c-c skiing. *6 International Congress on Science and Skiing* (p. 7). Austria; 2013.
17. Klusiewicz A, Faff J, Starczewska-Czapowska J. Prediction of maximal oxygen uptake from submaximal and maximal exercise on a ski ergometer. *Biol. Sport*. 2011;28:31-35.
18. Losnegard, T. Seasonal variations in VO2max, O2-cost, O2-deficit, and performance in elite cross-country skiers. *J Strength Cond Res*, 2013;27(7): 1780-1790.
19. Losnegard T, Hallén J. Physiological differences between sprint-and distance-specialized cross-country skiers. *Int. Journal Sports Physiol. Perform*. 2014; 9(1): 25-31.
20. Saltin B. Success in cc skiing: no longer just a question of a high aerobic capacity. *6 International Congress on Science and Skiing* (p. 14). Austria; 2013.
21. Vandbakk K. *Effects of upper body sprint interval training on endurance performance, aerobic capacity and work economy in female cross-country skiers during classical roller skiing*. Høgskolen i Nord-Trøndelag; 2015.

22. Žiška P, Olasz D, Krčmár M. The Impact of Endurance Training on Functional Parameters During the Preparation Phase among Cross-Country Skiers. *Acta Facultatis Educationis Physicae Universitatis Comenianae,* 2016;56(1):53-65.
23. Szmatlan-Gabrys Urszula, Cepulenas Algirdas, Gabrys Tomasz, Gromisz Wilhelm, Mroz Anna, Plewa Michal. Anaerobic Threshold Indices of Cross-Country Skiers During Preparatory Yearly Macrocycle Period. *Education. Physical Training. Sport,* 2004;3(53): 65-73.
24. Khmelnytska J.K., Filippov M.M. Characteristics of functional tension of qualified skiers when passing rises of different difficulty. *Pedagogics, psychology, medical-biological problems of physical training and sports*, 2015;10:70-76. doi:10.15561/18189172.2015.1011

Information about the author:
Khmelnytska J.K.; http://orcid.org/0000-0002-0231-1879; juliya_2008@bigmir.net; National University of Physical Education and Sport of Ukraine; Fizkultury str. 1, Kiev, 03680, Ukraine.

Cite this article as: Khmelnytska J.K. Simulation of realization of ski-racers' functional potentials in passing ski trails of different complexity. *Pedagogics, psychology, medical-biological problems of physical training and sports*, 2016;4:42–49. doi:10.15561/18189172.2016.0407

The electronic version of this article is the complete one and can be found online at: http://www.sportpedagogy.org.ua/html/arhive-e.html

Received: 22.07.2016
Accepted: 26.07.2016; Published: 30.08.2016

PEDAGOGICS
PSYCHOLOGY
medical-biological
problems of physical
training and sports

THE RELATION BETWEEN SERVICE QUALITY OF SPORTS CAMPS AND ELITE ATHLETES' SATISFACTION OF THE NATIONAL TEAMS' FREESTYLE & GRECO-ROMAN WRESTLING

Goharrostami Hamid Reza[1], Hodhodi Abkenari Behnam[2], Eftekhari Ozra[3], Khodayari Abbas[4]
[1]Associate Professor at University of Guilan, Iran
[2]Master Student of Sport Management Islamic Azad University Karaj, Iran
[3]Master in Sport Management, University of Shomal, Iran
[4]Associate Professor at Islamic Azad University of Karaj, Iran

Abstract. *Purpose:* One of the most important factors influencing satisfaction of athletes in sports camps is the quality of services provided therefore. The main objective of this study is investigation of relation between service quality and elite athletes' satisfaction in free style and Greco Roman wrestling national teams. *Material:* Methodology of the research was descriptive correlation, fulfilled as a field study. The statistical population included all athletes invited and presented in the national camps of wrestling (free and Greco Roman wrestling) in different ranges of ages in 1993 and the sample size is equal to the statistical population (N=160). The data collection tool was a questionnaire made by the researcher. To analyze the data, descriptive and inferential statistics as Kolmogorov-Smirnov, Kruskal-Wallis, Friedman, Binominal test and Regression calculated by SPSS (Statistical package for social science) V.22 are used. The findings showed that there was a significant relation between service quality variables and the athletes' satisfaction. In addition, according to Friedman test, there is not a significant difference in the mean of ranks in service quality variables of training camps. *Results* The results of binominal test showed that the quality of services in the training camps left much to be desired. The Demography results indicated that the athletes presented in the camps during longer periods were more satisfied with quality of services provided. *Conclusion*: According to results, it can be said that, one of the most important factors influencing on satisfaction of athletes in Sports camps, was quality of provided service. Therefore it is important to regard satisfaction of athletes as an essential issue in order to find the gaps and provide proper services.

Keywords: quality of services, sports camps, satisfaction of athletes, wrestling.

Introduction

Although rather long time has passed from bringing up the issue of the quality of services and methods relating to its evaluation and measurement, considering the issue has been increasing and its role has gained a great importance due to growing significance of services in the economies of all countries [2]. A number of studies show that during last two decades, interest towards the quality of services has also moved to sport industry [27]. Sport organizations possess special service features which differentiate them from the other service organizations including banks or insurance companies. The first feature is that the cost of sport and recreational activities are optional. The second feature implies that usually, the consumer is attracted by the sport organizations during his/her free time; and the third one is that among the activities of sports organizations, there exist emotional investments such as supporting a team, belonging to a sport club and the health improvement. Probably, these factors induce more expectations from sports organizations rather than service providers of the other companies. Therefore, the different nature of services relative to products and the special features of sport industry cause more contemplation to be focused on understanding the expectations of the consumers of sports organizations and the distance between the expectations and perceptions [23]. Satisfaction of the athletes in sports camps is an important factor of their retention, stability of sports organizations and the success of that organization. Satisfaction makes the athletes to remain in sport camps. On the one hand, quality of the services in sports industry causes the society to gain achievements regarding economy, culture, knowledge bases and social demands [6]. Awareness about the methods of satisfying athletes' needs leads to satisfaction of them and hence, brings balance, mental comfort and efficiency. Although getting general knowledge about all dimensions of athletes' satisfaction in a direct and accurate manner is really difficult, awareness of these behavioral aspects confute the trainers to take a fundamental step towards mental maintenance and retention of the athletes by teaching and practicing good behaviors [24]. If there is no proper plan for establishment of the camps and dispatching the athletes

doi:10.15561/18189172.2016.0408

to sport camps, surely a great deal of untargeted costs, physical and behavioral insecurities and many other problems will appear and cause deviation from sport goals. Provision and preparation of sport equipment, instruments and facilities and also, proper usage of them are some abilities which can help the sport executive managers to attract trainers and athletes to athletic activities and exercises and to reach the goals. Possessing accurate knowledge about modern facilities, equipment and technologies can assist managers to provide opportunities for consultation; reduce unnecessary costs and use standard equipment [14]. According to the important influence of the quality of sport camps on the triumph of athletes, there exists a necessity in conducting the present study in order to consider the least needs of the athletes in sport camps and to help in establishment of regular and high-quality camps. In the following, a number of the research conducted on this filed will be mentioned.

Mirzayi (2006) has conducted a research titled "the comparison of the profile of behavioral modes of wrestlers in junior and senior national teams in two fields of freestyle and Greco Roman wrestling". In this research, he has concluded that quality of sport camps rendered rather significant impact on athletes' satisfaction. Akhlaghi (2011) identified and compared the levels of athletes' satisfaction (Freestyle and Greco Roman wrestlers) in the clubs of Khoozestan Province in terms of three issues (performance of managers, service and facility provisioning and performance in public). He showed that the wrestlers were not satisfied with these three kinds of services. According to Shonk (2008), the quality of services in sports camps includes the quality of accessibility, quality of sport association, quality of the domicile and quality of the champions. Huyen (2011) has conducted a research, titled "Investigation of the Consumers' Satisfaction in Kukula Body-Building Club"; and he has found that the consumers are generally satisfied with the services provided by the club. Nicholas et all (2013) has conducted a research, titled "The Role of Quality of Services and Satisfaction in Predicting the Behavioral Goals of the Spectators in Professional Football"; they have found that the quality of services influences on level of satisfaction, and that these two factors rendered great impact on behavioral intentions.

Purpose. One of the most important factors influencing on satisfaction of athletes in sports camps is the quality of services provided therefore. The main objective of this study is the investigation of relation between service quality and elite athletes' satisfaction in free and Greco Roman wrestling national teams.

Material and Methods

Participants. The statistical population (160 athletes) includes all the invited athletes who are present in national camps of freestyle and Greco Roman wrestling; these athletes were selected from different age categories. The sample population is equal to the statistical population (n=160).

Research Design. The current research was based on a descriptive-correlational research project and shall be regarded as an applied one, considering the purpose which was accomplished on the basis of surveys and field study. The data were collected in two stages; the first with the help of questionnaire, prepared as a tool for collecting the data. At the second stage, the questionnaires were reviewed and verified by 7 experienced trainers in the field of sport management; the stability level of it was defined by Cronbach's alpha coefficients, and then they were used. The questionnaire was divided into two parts (quality of services and athletes' satisfaction). The first part is designed to collect the information from respondents and it consists of 8 questions. The second part includes 40 questions which are completed by variables of service quality with 35 items and by variables of athletes' satisfaction with 5 items. Therefore, 160 questionnaires have been distributed, collected and analyzed in order to organize data analysis and fulfill it..

Statistical Analysis. To analyze and investigate the data, descriptive statistics has been used to describe the variables, items and indices. At the level of inferential statistics, Kruskal-Wallis, Binomial, Regression and Kolmogorov-Smirnov are performed to investigate the normality of the data. According to lack of normality in the data, Spearman Correlational Coefficient is used to study the relationship between the variables.

Results of the research

Personal characteristics of respondents are briefly presented in Table 1.

After performing Kolmogorov-Smirnov test (KS) and making sure about non-normal distribution of the data ($P<0.05$), Friedman test has been executed. The results of this test, presented in Table 2, showed that there were no significant differentiation between average rank of the variables of dimensions of service quality in sport camps; because significance level equals to $P<0.10$ which is higher that error level ($P<0.05$). In other words, there is no

significant differentiation between dimensions of service quality in sport camps. According to these results, Quality of the Trainer and Quality of Non-Sport Equipment have gained the highest and the lowest average ranks, respectively.

Table 1. Description of Personal Characteristics of Respondents

Variable		Count	Percentage	Variable		Count	Percentage
Age	Under 20 years	57	34/4	Sport and Attending sports camp courses	GRECO	73	47/2
	21 to 25 years	42	29/3		Wrestling	87	52/8
	26 years and over	61	36/3		Less than 5 times	24	12/4
Sports experience	Under 5 years	29	16/7		6 to 10 spring	41	24/6
	6 to 10 years	40	24/4		11 to 15 spring	39	22/8
	11 to 15 years	48	29/6		16 to 20 spring	34	20/4
	15 years and over	43	28/3		Over 20 times	32	19/8

Table 2. Results of Friedman Test and the Conditions of Distribution of the Data Regarding Research Variables Obtained by Kolmogorov-Smirnov Test

Quality of Services	Average Rating	SD	Sig	Chi	Df	K-S
Sports equipment	2/21	0/45	0/10	10/6	6	2/10
non Sports equipment	2/20	0/39				1/54
Quality of coach	2/37	0/42				2/22
Interaction of Quality	2/20	0/41				1/95
Workout program	2/29	0/38				1/92
Discipline	2/35	0/58				1/37
extra service	2/32	0/52				2/43

Moreover, the result, obtained through investigation of correlation between dimensions of service quality is sport camps and athletes' satisfaction are presented in Table 3.

Table 3. Matrix of Spearman Correlation between Dimensions of Service Quality in Sport Camps and Athletes' Satisfaction

Variable / statistical indicators	Quality of coach	Workout program	extra service	Discipline	Sports equipment	Correlation of Quality	non Sports equipment
R	0/042	**0/405	**0/282	**-0/045	**0/252	**0/623	0/001
Sig	0/001	0/001	0/001	0/49	0/001	0/001	0/99

** Significant at P<0.001

The results of correlation analysis show that there is a positive and significant relationship between dimensions of service quality in sport camps (except in dimension of discipline and regularity, and dimension of non-sport equipment) and athletes' satisfaction. In order to determine which one of these 7 dimensions of service quality play the most important role in predicting the athletes' satisfaction and which one of them is the better determinant for the variance of consumers' satisfaction, a step-by-step multi-variable regression analysis has been performed. The data show that in the first step, the dimension of interactive quality of service quality in entered into regression model to explain the level of athletes' satisfaction variance; also, 63% of the variances are explained solely. At the second step, the dimension of exercise plan is integrated into the model and it brings correlational coefficient up to 0.73% and changes the coefficient of determination from 0.53 to 0.55. At the third step, the dimension of non-sport equipment is accompanied by the model and the three dimensions of interactive quality, exercise plan and non-sport equipment can explain 74% of the variance of athletes' satisfaction, simultaneously. At the fourth step, correlational coefficient and the coefficient of determination reach to 0.75 and 0.56, respectively, due to entrance of the dimension of extra services. Regression analysis has been terminated at the fourth step and three dimensions of sport equipment, quality of the trainer and discipline have been removed from the regression model. Accordingly, 56% of variance of the wrestlers'

satisfaction is derived from the four dimensions of interactive quality, exercise plan, non-sport equipment and extra services.

Table 4. Final Results of Regression Analysis in the Form of Step-by-Step method

Phase	Variables in regression model	R	R^2	Beta	B	Sig
1	Interaction of Quality	0/63	0/404	0/662	0/563	0/001
2	Interaction of Quality and Workout program	0/73	0/535	0/464	0/423	0/001
3	Interaction of Quality, Workout programand non Sport equipment	0/74	0/550	-0/158	-0/140	0/001
4	Interaction of Quality, Workout program, non Sport equipment and Extra Service	0/75	0/561	-0/128	-0/085	0/05

According to the report presented in Table 4, significance level of R is below 0.05 during the first step. Therefore, the first model is verified. In the second, third and fourth models also, level significance is below 0.05 and accordingly, the second, third and fourth models are verified, too.

In model 1, the dimension of interactive quality is integrated into regression model; Standard Beta is set at 0.662 which is significant. In model 2, exercise plan is added to the model, in addition to interactive quality; here, Standard Beta is decreased to 0.464. In model 3, non-sport equipment is added to the model in addition to interactive quality and exercise plan; here, Standard Beta is calculated as -0.158. In model 4, extra service is added to the model in addition to interactive quality, exercise plan and non-sport equipment; here, Standard Beta is calculated as -0.128. The negativity of Standard Betas in the third and fourth models shows that in the presence of the first and the second variables (interactive quality and exercise plan) which have positive Standard Betas, the third and fourth models (non-sport equipment and extra services) have no significant influence on explanation of variance level of athletes' satisfaction. Also, the Beta of all the four models are significant (sig $\leq$ 0.05).

According to the fact that the distribution of the data is not normal, Binomial test has been executed in order to investigate the condition (good, moderate, weak) of the dimensions of service quality and athletes' satisfaction with cut point of 3.66 and a five-valued spectrum of Likert. Average below 2.33 shows weak condition; average between 2.34 and 3.66 shows moderate condition and average higher than 3.66 shows good condition.

Table 5. Result of Binomial Test for Dimensions of Service Quality with Athletes' Satisfaction and Cut Point of 3.66

Quality of Service	Average	Standard deviation	Reports lower number of points3/66	Reports Upper number of points3/66	Significance level
Sport equipment	2/21	0/454	160	0	0/001
Non Sport equipment	2/20	0/398	160	0	
Quality of coach	2/37	0/424	160	0	
Interaction of Quality	2/20	0/415	160	0	
Workout program	2/29	0/386	160	0	
Discipline	2/35	0/588	160	0	
Extra Service	2/32	0/529	160	0	
Satisfaction	2/44	0/498	160	0	

* Significant at P≤0.05

As we can see in Table 5, the average of all questions are below the good level and sport services are not in desirable mode; therefore, we use the findings presented in Table 2 with cut point of 1.33 to calculate how many of the members in sample population consider the dimensions of service quality in the range of moderate to weak. The results of Binomial test with cut point of 1.33 are presented in Table 6.

As we can see in Table 6, 101 members of the sample population believe that the conditions of dimension of sport equipment is below moderate (weak) and 59 members of them have reported that this dimension is moderate. The result of Binomial test for sport equipment shows an average value of 2.21, which implies that this dimension is perceived as moderate. In terms of non-sport equipment, 110 member of the sample population believe that the

conditions of this dimension is below moderate (weak) and 50 member of them have reported that this dimension is weak.

Table 6. Result of Binomial Test for Dimensions of Service Quality with Athletes' Satisfaction at Cut Point of 1.33

Quality of Service	Average	Standard deviation	Reports lower number of points3/66	Reports Upper number of points3/66	Significance level
Sport equipment	2/21	0/454	101	59	
Non Sport equipment	2/20	0/398	110	50	
Quality of coach	2/37	0/424	102	58	0/001
Interaction of Quality	2/20	0/415	100	60	
Workout program	2/29	0/386	89	71	
Discipline	2/35	0/588	81	79	
Extra Service	2/32	0/529	70	90	
Satisfaction	2/44	0/498	89	71	

* Significant at P≤ 0.05

The results of Binomial test for non-sport equipment show an average of 2.20 which implies weakness of the quality of this dimension. In terms of quality of the trainer, 102 members of the sample population think that the conditions of this dimension is below moderate (weak) and 58 members of them have reported that this dimension has a moderate quality. The results of Binomial test for the dimension of quality of the trainer show the weakness of this dimension in the sample population. In terms of interactive quality, 100 members of the sample population have reported that this dimension has a below-moderate (weak) quality and 60 members think that this dimension is moderate. The results of Binomial test for the dimension of interactive quality show an average value of 2.20 which implies the weakness of this dimension in our population. In terms of exercise plan, 89 members of the sample population have reported that this dimension has a below-moderate (weak) quality and 71 members think that this dimension is at moderate level. The results of Binomial test for exercise plan show an average of 2.29 which implies the weakness of this dimension in our population. In terms of discipline and regularity, 81 members of the sample population have reported that this dimension has a below-moderate (weak) quality and 79 members think that this dimension is at moderate level. The results of Binomial test show an average value of 2.35 which implies the weakness of this dimension in our sample population. In terms of extra services, 70 members of the population believe that the condition is below moderate (weak) and 90 members of them have reported that this dimension is at moderate level. The results of Binomial test for this dimension show an average value of 2.32 which implies the moderate level of this dimension in our sample population. In terms of satisfaction, 89 members of the population think that this dimension is posited at below moderate (weak) level and 71 members of them have reported that this dimension has a moderate quality. The results of Binomial test for this dimension show an average of which implies the weakness of this dimension in our population.

In tables 7 and 8, the results of Kroskal-Wallis test are presented for the research sample to investigate the difference between different athletes' viewpoints.

Table 7. Comparison of prioritization of satisfaction level in elite athletes of National Wrestling Team in terms of the quality of services in sport camps at different age categories

Age groups	Average Rating	Chi square	Degrees of freedom	Significance level
Less than 20 years	71/09			
21 to 25 years	82/50	5/22	2	0/073
26 years and over	92/63			

The results of Kroskal-Wallis test, presented in table 7, show that there is a significant differentiation between the average rank of the athletes' satisfaction with quality of the sport services, in different age categories. This is because the level of significance is P<0.073 which is below error level of P<0.05. In other words, there is a significant differentiation between the viewpoints of the athletes in different age categories.

Table 8. Comparison of prioritization of satisfaction level in elite athletes of National Wrestling Team in terms of the quality of services in sport camps during different times of their presence in camp

Courses attended sports camp	Average Rating	Chi square	Degrees of freedom	Significance level
Less than 5 times	78/55			
Between 6 to 10 times	76/86			
11 to 15 times	76/14	11/46	4	0/022
16 to 20 times	132/57			
more than 20 times	121/75			

Moreover, the results of Kroskal-Wallis, presented in table 8, show that there is a significant differentiation in average rank of athletes' satisfaction with the quality of sport services during different times of their presence in sport camps; because level of significance is $P<0.022$ and it is below error level of $P<0.05$. In other words, there is a significant differentiation between viewpoints of the athletes who have been in sport camps during different times.

Discussion

The analysis of research findings reveals that there is a significant relationship between dimensions of service quality and athletes' satisfaction (except in dimension of discipline and regularity and in dimension of non-sport equipment). The findings of the current research imply a significant and positive relationship between service quality in sport camps and athletes' satisfaction; the correlational coefficient is calculated as 0.615. This means that there exists a significant differentiation between dimensions of service quality in sport camps. The results of the current study are complied with researches of Saatchiyan et al (2010), Fallahi et al (2011), Ali Dust Ghah-farrokhi and Ahmadi (2012), Honari et al (2014), Lim (2006), Liu (2008), Lin (2008). Moreover, the relationship between demographic characteristics and athletes' satisfaction implies a significant statistical relationship between demographic characteristics (age, times of being present in sport camps) with satisfaction level (table 7 and 8). These finding are complied with the researches of Liu (2008) and Eftekhari et al (2015), regarding the variable of age; so that the higher the ages of the athletes are, the lesser their needs and the higher their satisfaction level would be with the available service, and vice versa. But these findings are not consistent with the research of Moradi et al (2013) in which there is found no significant statistical relationship between demographic characteristics and satisfaction level in athletes. Furthermore, the findings show a significant relationship between the number of periods being present in the camp and level of satisfaction in the athletes; so that the higher the numbers of these periods is, the higher their satisfaction level would be relative to the athletes who have had limited performance in the sport camps. According to the findings, we can conclude that there is a positive relationship in perceived quality of sport services in sport camps and athletes' level of satisfaction with the number of times (periods) they attend in the camps. This is because occurrence of satisfaction cause the athletes to attend in the next camps.

The results of Binomial test show that the average of all the responses are below the desired level and the quality of sport services is not good at all. All average values of the respondents' state witness that the quality of services in sports camps is at weak level, except sport equipment, which is reported as moderate. The results of regression test also reveal that different dimensions of service quality can predict the level of satisfaction of wrestlers in national camps, so that four dimensions of interactive quality, exercise plan, non-sport equipment and extra services can explain 56% of the variance of athletes' satisfaction. Among these four dimensions, interactive quality of the service has gained the highest value of correlational coefficient and, therefore, it plays an important role in athletes' level of satisfaction. Hence, the managers and trainers and authorities of the sport camps can provide various services in line with the athletes' needs and can enhance communication with the athletes in the sport camps more than ever, in order to reach consumers' satisfaction.

The other results of the research show that there is a significant relationship between quality of sport equipment and athletes' level of satisfaction; these findings are consistent with the researches of Gohar Rostami (2007) and Hopson (2002). Hopson believes that providing high-quality services is one the most important factors influencing on level of athletes' satisfaction; moreover, he states that providing proper-quality equipment at the camps and encouraging the athletes to attend exercises are irrefutable necessities which make the athletes participate in the activities with more power and better performance. On the other hand, variety of sport equipment is important due to two reasons: first, sports equipment should improve the quality of athletes' performances and second, they must

guarantee the health of athletes. Due to this fact, sports equipment is of a great importance in different sport fields. Seye Javadin et al. (2010), Chia Chin (2002) and Ting (2004) also believe that the quality of services and equipment can directly influence on the athletes' level of satisfaction and it can be regarded as foundation for satisfying the consumer.

Moreover, there is no significant correlation between non-sport equipment and the athletes' level of satisfaction; but some factors such as transportation vehicles, heating and cooling systems, quality of the place in which the exercises are held and etc. can have a significant impact on level of satisfaction in the athletes' attending the camps. The other results show that there is no significant relationship between quality of coach and athletes' level of satisfaction; the correlation coefficient is calculated as 0.042. These findings are not consistent with Warren (1994); because Warren has proved that the qualities of training and relationship between coach and athletes are important dimensions of athletes' level of satisfaction. We can attribute this lack of consistency to a number of research samples; because as Lin (1991) says, the number of samples has an influence on the quality of relationship held between different variables. In a small sample population, the relationship might be reported as significant, while in there is no relationship found in big samples. According to the research samples, presence of a psychologist trainer in the camp has guaranteed the highest level of satisfaction among other items of this dimension. Because long-terms camps cause a lot of mental pressure such as stress and anxiety for the athletes and since most of the athletes attend in the professional sports during teenage periods and are in sensitive situations and since we have watched a lot of champions in which the players show weak performances due to grave mental spaces of the plays and because most of the decisions of the athletes are made in severe circumstances, then it is desirable for the athletes to experience exercising in difficult situations; taking advantage of the psychologist trainers in the team can be beneficial. Furthermore, the results reveal that there is a significant and positive relationship for the dimensions of interactive quality, exercise plans and discipline and regularity with athletes' level of satisfaction. In order to hold a friendly environment among the athletes attending in camps, group coherence is needed. The more cohesive groups show better performances than the ones with less solidarity. In a sport team also, the conditions would be the same and higher solidarity leads to higher personal satisfaction in the athletes. These findings are consistent with the researches of Rhymers and Cheladoray (1998) in which satisfaction with individual and team performance and satisfaction with exercises and training process are considered to be the determining factors of athletes' satisfaction; moreover, Omand (2005) believes that team performance renders great influence on athletes' satisfaction. At the dimension of exercise plan, the importance of choosing proper and diverse times for activities during the camps can help the athletes to regulate their biological clock, temperature and hormone secretion, correctly. On the other hand, allocation of diverse times of exercising to the professional athletes is really important. This is because doing exercises at the final hours of a day (evening) can help the athletes to be active during the times in which their body possess the highest level of physical readiness and to achieve the best outcome. In this way, even if the champions are held at the initial or final hours of a day, the athletes think that they are still spending the evening times and this imagination which is derived based on their biological clocks of their bodies in simulated environments, help the athletes to exhibit better performances during competitions. Overall, a special system and structure based on scientific principles for the exercises can be useful for developing different skills (physical, technical-tactical, mental) of the athletes. In his study, Gohar Rostami (2007) introduces satisfaction with exercise plans as an influential factor of consumers' satisfaction in sport camps; his findings are compliant with the present study. On the other hand, one the most important issues in sport camps is regularity/discipline. The athletes' attending camps must follow their exercises regularly, in addition to holding the camp sessions. Coaches also should supervise the camps and the procedure of athletes' training and activities, based on predefined plans; they should also, consider the discipline in their schedules. Discipline is an important pillar of athletic sport. The experiences imply that discipline brings great incentive and athletic spirit for the athletes.

Conclusions

According to the results of present study and significance of correlation between variable of service quality and athletes' level of satisfaction, it is recommended to the executive managers of the camps to measure the level of service quality continually and periodically and meet the needs of athletes by doing their bests. This is because of the fact that lack of attention towards athletes' level of satisfaction can cause protesting, negligence and leaving. Therefore, it is desirable to pay considerable attention to this issue; and coaches and authorities must try their best to provide and maintain the satisfaction of athletes, emphasizing at provisioning of desirable and high-quality service, because higher

levels of satisfaction can bring a sense of belonging to team and dependence on team; better performance, reduction of absence and even not leaving the team; finally, it ensures success and efficiency. Therefore, it is recommended to coaches and authorities of sports camps to realize proper targeted supports and emphasize on influential aspects of motivations and sports commitment, and to direct the athletes' level of satisfaction in order to create their highest level of satisfaction and get the best outcome and success.

Conflict of interests

The authors declare that there is no conflict of interests.

References

1. Akhlaghi HA. *Identification and comparison of satisfaction level in wrestlers (freestyle and Grece Roman) from different clubs of Khoozestan Province by providing some approaches for improving the existing situation. Master Thesis,* Shahid Chamran Universiy of Ahwaz. Sport School: Sport management department; 2011.
2. Aldlaigan HA, Buttle F. Systera-SQ: a new measure of bank servise quality. *Internatinal Journal of Service Industry management*, 2002; 4: 78-93.
3. Ali Dust Ghahfarrokhi A, Kuzechiyan H, JalaliFarahani M, Torki M. Investigation and comparison of female consumers' level of satisfaction in private and public clubs of body-building in Tehran. *Journal of Sport Management,* 2010; (2)5:127-140.
4. Aumand BA, Elizabeth A. *For the Love of Gime Factors in Fuencing Athlete Enjoyment in Sport.* Thesis submitted to the school of physical education at west Virginia university in partial fulfillment of the requirements for the degree of master of science in sport and exercise psychology. Virginia; 2005
5. Chia Chin MC. Areview of service quality in corporate and recreational. Sport fitness programs. *The Sport Journal*, 2002; (5)3: 1-9.
6. De Knop P, Van Hoeke J, & De Bosscher V. Quality management in sports clubs. *Sport Management Review*, 2004; 7: 57-77.
7. Eftekhari A, GoharRostami HR, Haji Agha Pur J, Khanmohammadi AM.. Investigation of the service qualities in sport camps and its relationship with satisfaction level of Basketball National Team, and providence of a proper model. *The Journal of Modern Approaches in Sport Management*, 2015; 1: 34-40.
8. Fallahi A, Ehsani M, Purnaghi A. Comparison of quality of provided services in private and public sport clubs (body-building and physical readiness) of Tehran in viewpoints of the athletes. *Researches in Sport Management and Motor Sciences,* 2011; 2(1): 33-48.
9. GoharRostami Hamidreza. *Investigation of consumers' satisfaction in private and public clubs of men in Tehran and ranking the influential factors. Master Thesis.* Tarbiat Modarres University: Sport Management Group; 2007
10. Heydari Nezhad S, Akhlaghi H, ShafiNiya P, Sharifi Bahreyni N. Investigation of the service quality in body-building clubs of Ahwaz in athletes' viewpoints. *Bulletin of Sport Management and Motor Behaviors*, 2015; (9) 21: 149-156.
11. Hopson Barrie, Lugar Jack, Murgatroyd Stephen, Ripley Tyres, Scully Mike, Simpson Dan. *Service Management (Consumer-orientation Culture).* National Library of Iran; 2002.
12. Huyen NL. Customer Satisfaction Survey for A Fitness Center – Kokkola. *Kokkola,* 2011; 5: 23-32.
13. Juga J, Juntunen J, & Grant DB. Service Quality and its Relation to Satisfaction and Loyalty in Logistics Outsourcing Relationships. *Managing Service Quality*, 2010; 20(6): 496-510.
14. Kuzechiyan H, Khatibzade M, Honarvar A. The role of dimensions of tourism service quality in satisfaction level of athletic tourists. *Journal of Research in Sport Management and Motor Sciences*. 2011; (1)2:19-32.
15. Khodadadi H. *Investigation of the factor relating to consumers' satisfaction in sport associations of Municipality of District 15 of Tehran*. Sport School: Sport management department; 2010
16. Lee H. The influence of service quality on satisfaction and intention: A gender segmentation strategy. *Sport Management Review* 2010; 1: 23-30.
17. Lee H, Kim HD, Ko YJ, & Sagas M. The influence of service quality on satisfaction and intention: A gender segmentation strategy. *Sport Management Review*, 2011; 14: 54-63.
18. Lim JS. *The influence of service quality on customer satisfaction, attitudinal loyalty, and behavioral future intention for participation of fitness centers in South Korea.* [PhD thesis]. United States Sports Academy; 2006.
19. Lin J-C. *Service quality of the Ocean sport clubs and its impact on customer loyalty*. [PhD thesis]. United States Sports Academy; 2008.
20. Liu YC. *An Analysis Service Quality, Customer Satisfaction and Customer Loyalty of Commercial Swim Clubs in Taiwan.* [PhD thesis]. United States Sports Academy; 2008.
21. Mirzayi B, RahmaniNiya F. the comparison of the profile of behavioral modes of wrestlers in junior and senior national teams in two fields of freestyle and Grece Roman. *Journal of Olympic*. 2006; (33) 1: 31-40.
22. Nicholas D, Kostas A, Nikolaos T, & Serafim K. Predicting spectators' behavioural intentions in professional football: The role of satisfaction and service quality. *Sport Management Review*, 2013; 16(1): 85-96.

23. Pur Iran Z. *Investigation of the service quality in indoor swimming pools of Mashhad. Master Thesis.* Amol University of North. Sport School: Sport Management Department; 2008.
24. Riemer & Chelladurai. Role ambiguity and athlete satisfaction. *Journal of sport science*, 1998; 9: 1-5.
25. Saatchiyan V, Safari H, Rasuli SM, Eskandari A, Elahi A. Influence of service quality, level of satisfaction, commitment to future behavioral decisions of the consumers in order to be present in Aerobic and Physical Readiness Clubs. *Journal of Research in Sport Management and Motor Behaviors*, 2010; (3)5: 125-138.
26. Seyyed Javadeen SR, Khanlari A, & Esteeri M. A model of the assessment of the service quality affecting the sports service customers' loyalty. *Olympic Journal*, 2011; 52: 41-54.
27. Seyed Javadin SR, Khanlari A, Estiri M. A model for evaluating the influence of service quality on loyalty of the sport service consumers. *Journal of Olympic,* 2010; (18)52: 41-54.
28. Ting DH. Service Quality and Satisfaction Perceptions: Curvilinear and Interaction Effect. *The International Journal of Bank Marketing*, 2004; (22)6: 407-420.
29. Warren D. *The influence of leader behaviors, Coach attributes and institutional variables on performance and satisfaction of collegiate Basketball teams.* 1984. Available from: http://Proquest.umi.com/pqd
30. Yung Lin H. *The study of exercise participation motivation and the relationship among service quality, customer satisfaction, and customer loyalty at selected fitness health clubs in Taipei city*, *Taiwan*. [PhD thesis]. United States Sports Academy; 2010.

Information about the authors:

Goharrostami Hamid Reza; Assistant professor; http://orcid.org/0000-0002-6518-466X; goharrostami@gmail.com; Faculty of Physical Education and Sport Sciences, University of Guilan; Box 1841, Rasht, Iran.

Hodhodi Abkenari Behnam; Master in Sport Management; http://orcid.org/0000-0003-4734-6204; saba_cn44@yahoo.com; Islamic Azad University; Box 1841, Karaj, Iran.

Eftekhari Ozra; Master in Sport Management; http://orcid.org/0000-0001-7445-7351; ozra.eftekhari@gmail.com; Faculty of Physical Education and Sport Sciences, University of Shomal; P.O.Box 731. Amol, Mazandaran, Iran.

Khodayari Abbas; Associate Professor; http://orcid.org/0000-0003-1861-0811; a.khodayari@kiau.ac.ir; Islamic Azad University; Box 1841, Karaj, Iran.

Cite this article as: Goharrostami Hamid Reza, Hodhodi Abkenari Behnam, Eftekhari Ozra, Khodayari Abbas. The relation between service quality of sports camps and elite athletes' satisfaction of the national teams' freestyle & Greco-Roman wrestling. *Pedagogics, psychology, medical-biological problems of physical training and sports*, 2016;4:50–58. doi:10.15561/18189172.2016.0408

The electronic version of this article is the complete one and can be found online at: http://www.sportpedagogy.org.ua/html/arhive-e.html

Received: 10.07.2016
Accepted: 26.07.2016; Published: 30.08.2016

COMPARISON OF 9TH GRADE STUDENTS' PHYSICAL ACTIVITY LEVELS DURING RECESS AND REGULAR CLASS PERIODS USING OBJECTIVE MEASUREMENT

Rolf Kretschmann
TU Dortmund University, Dortmund, Germany

Abstract. *Purpose:* to assess and compare secondary school students' physical activity levels during recess and regular class periods using objective measurement. *Material:* The study sample consisted of 26 9th grade school students (M = 15.28 years, SD = 0.47) of a German secondary school. They wore the Actiheart the whole school day for one week. All students followed the same school schedule and participated in the same classes. 9th grade school students' physical activity levels during recess and regular class periods were assessed using the physical activity monitoring device Actiheart, which validly and objectively measures physical activity. *Results:* total recess time physical activity levels accounted for M = 2.38 METs, whereas total class period time physical activity levels only reached M = 1.58 METs. This difference could be proven statistically significant. *Conclusions:* Total recess time accounts for significantly higher physical activity levels compared to total class period time and the overall time students spend in school, respectively.
Key words: recess breaks, physical activity, physical activity level, secondary school students, adolescents.

Introduction

School as an institution plays an important role in providing physical activity [1, 2]. Besides the fact that students simply spend a great deal of their time at school, school is also relevant because it has the potential of reaching large numbers of children and adolescents [3]. In fact, and due to compulsory education, it should reach nearly all children and adolescents. There is no other setting or institution that can guarantee this high degree of participation, as school participation is conceptually mandatory.

Beyond physical education as a main possible provider of physical activity during the school day at first sight, other factors and areas support overall physical activity of school-aged students over an entire school day, week, and academic year [4]. Physically active school transport (e.g., bicycling) and physical activity during recess significantly add to school students' overall amount of physical activity [1, 3].

Recess may be an underestimated resource to employ to provide and promote physical activity because this "special time" is usually not associated with "serious" learning time in class period settings, as recess is allocated by school for students to engage in leisure activities and free play [1]. For adolescents, this dimension of "playing" seems definitely less important, but the nature of having a short period of leisure time usually results in the urge to stand up, move around and interact with peers [1].

The major benefits of recess breaks according to empirical evidence are an improvement of students' classroom behavior and attentiveness [5, 6], and most importantly the accumulation of up to 40 percent of school students' total daily physical activity during recess, indeed [7]. Furthermore, recess has a high potential being targeted by interventions aiming at increasing school students' physical activity during the recess timeslot [8].

Overall, school recess provides a major opportunity to increase students' total physical activity, which is backed up by various research outcomes [9]. On the one hand, recess itself serves as a time period students "naturally" and mundanely use for activities that involve certain levels of physical activity. In terms of physical activity levels, recess therefore may be treated as an opposing area compared to common classroom settings that usually enforce students to spend almost the entire class period time sitting. On the other hand, there is plenty of room for developing and implementing school programs that feature recess as a legitimate physical activity provider [10, 11].

The purpose of the work is to compare 9th grade secondary school students' physical activity levels during recess and regular class periods using objective measurement.

The tasks of the work:

1) Objective measurement of physical activity levels in 9th grade students during recess;

2) Objective measurement of physical activity levels in 9th grade students during regular class periods (and the overall time students spend in school);

3) Compare physical activity levels in 9th grade students during recess and regular class periods using descriptive and inferential statistics.

Material and Methods

Participant: The study sample consisted of 26 9th grade school students (M = 15.28 years, SD = 0.47) of a German secondary school [16, 17]. They wore the Actiheart the whole school day for one week. All students followed the same school schedule and participated in the same classes.

Research Design: Physical activity was objectively measured via the physical activity monitoring device

doi:10.15561/18189172.2016.0409

Actiheart (Cambridge Neurotechnology Ltd., Papworth, Cambridge, UK), which combines accelerometry and heart rate monitoring. The Actiheart device objectively and validly measures physical activity levels [12] and has been proven to be a feasible instrument in researching children and adolescents [13-17].

The Actiheart device was attached to participants' chest using two ECG electrodes (Figure 1). The Actihearts setting was adjusted to record heart rate in short-term recording mode continuously over 30-seconds epochs.

Statistical Analysis: Actiheart data was analyzed using Actiheart software (Version 4.032, Cambridge Neurotechnology Ltd., Papworth, Cambridge, UK).

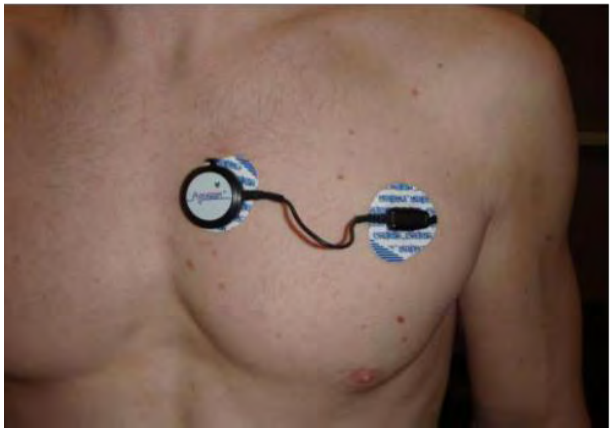

Figure 1. Actiheart set-up (18)

Results

The following diagram (Figure 2) has been randomly selected among participants to make it easier to refer to corresponding recess times and gives a first indication that students are at least a little more physically active in breaks than in lesson times.

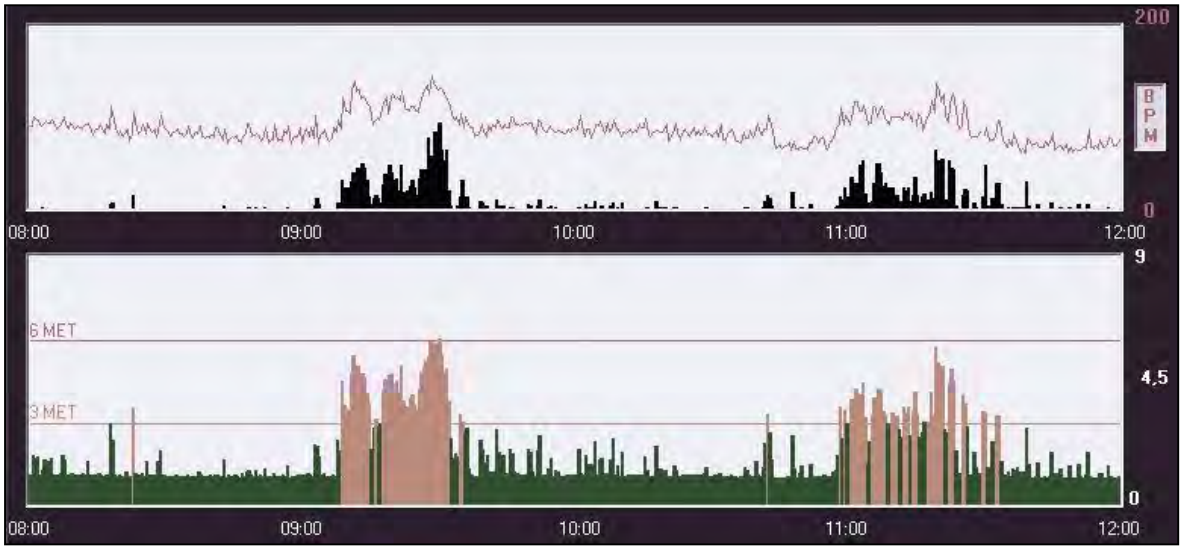

Figure 2. An average forenoon's physical activity-diagram of an adolescent 9th grade student

Recess breaks were regularly scheduled from 9.10 to 9.30 am and from 11.00 to 11.20 am. Before, after and in between the two breaks, students attended regular school subject classes. Table 1 descriptively shows that recess time has higher means for METs than other school times.

Table 1. Comparison of physical activity's intensity between recess time (breaks) and other significant periods

	N	Minimum	Maximum	Mean	SD
Total recess time	26	1.88	3.44	2.38	0.36
Total class period time	26	1.25	1.91	1.58	0.17
Total school time	26	1.30	2.14	1.68	0.20

Note. Minimum, maximum, and mean values' unit is MET.

An average MET value of 2.4 is roughly equivalent to carrying 7 kg or walking from house to car or bus [19] and indicates that students are definitely more physically active during recess than during mere class period times. To look closer at the actual physical activity levels of the students during recess, it makes sense to compare the METs according to the grouping variable of type of timeframe (i.e. comparing values from recess time to values from class period or school time). Though the variable is normally distributed, its variances are not. Thus, a Mann-Whitney U test has been conducted (see Table 2).

Table 2. Relationship physical activity level of recess and total class period time/school time (Mann-Whitney U test)

	Recess vs. total class period time	**Recess vs. total school time**
Mann-Whitney U	2.00	16.00
Wilcoxon W	353.00	367.00
Z	-6.149	-5.839
Asymptotic significance (2-sided)	$p < 0.001$	$p < 0.001$

The Mann-Whitney U test shows that there is a highly significant difference (recess vs. total class period time: $p < 0.001$, and recess vs. total school time: $p < 0.001$) in both cases. This means that descriptive analysis and the related suggestion of Table 2 indicate that students show statistically significantly higher levels of physical activity during recess time as compared to mere class period time.

To see whether the same holds for amounts of energy expenditure, active energy expenditure (AEE) has been calculated for single hours, giving the results of Table 3 (inferential statistical analysis). AEE is the amount of calories a person burns over a certain period of time that accounts for physical activity during periods of non-rest [20]. AEE was chosen for display in Table 3 to highlight the realistic MET values for recess, total class period time, and total school time due to physical activity only. Total school time is the accumulated time students spend at school on a given school day.

Table 3. Comparison of physical activity amounts between recess time (breaks) and other significant periods

AEE per hour	**N**	**Minimum**	**Maximum**	**Mean**	**SD**
Total recess time	26	48.28	143.20	85.75	21.73
Total class period time	26	15.17	75.30	43.56	14.09
Total school time	26	20.06	74.18	48.37	13.14
Note. Minimum, maximum, and mean values' unit is kcal.					

Again, a Mann-Whitney U test has been conducted to find out about the statistical significance that can be assumed from the obvious descriptive differences that can be seen in Table 4.

Table 4. Relationship between AEE of recess and total class period time/total school time (Mann-Whitney U test)

	Recess AEE vs. total class period time AEE	**Recess AEE vs. total school time AEE**
Mann-Whitney U	28.00	39.00
Wilcoxon W	379.00	390.00
Z	-5.673	-5.472
Asymptotic significance (2-sided)	$p < 0.001$	$p < 0.001$

As the result of the Mann-Whitney U test shows, the amount of physical activity (AEE) show statistically highly significant differences between recess time and total class period time ($p < 0.001$), and respectively total school time ($p < 0.001$), too. Conclusively, students show higher amounts and levels of physical activity during recess as compared to accumulated mere class period time physical activity levels.

All together, the sample's schedule included 10 major breaks that made up 3 hours and 20 minutes. It could be shown that the students use recess times to be physically active to a higher degree than during class periods and overall school time. The statistically highly significant difference between intensities and energy expenditures per average hour, verify that students show higher amounts and levels of physical activity during recess time as compared to mere class period times.

Discussion

Investigating physical activity behavior of students during recess time can be interesting regarding to find out about the influence school-related physical activity has on overall amounts of physical activity, as well as for legitimization of recess time per se.

The results of this study show that school and recess is an ideal area to promote physical activity in children and adolescents. Unfortunately, efforts by policy makers, and national and regional programs to cut recess and breaks in schools can be seen in various countries, however, with the intention to maximize learning time. To combat these trends, Comprehensive School Physical Activity Programs that center around 1) quality physical education, 2) physical activity before and after school, 3) physical activity during school (both recess and classroom activity), 4) staff involvement, and 5) family and community engagement should be strengthened [21].

In line with developing school (physical activity and health) programs that explicitly cover recess, specific interventions can be developed and applied that may be particularly tackling age ranges and gender appropriateness. For instance, female students seem to be less engaged in physical activity during recess in the school settings compared to male students [22].

The Actiheart device has proven a feasible research method to assess physical activity levels in the target population of school-aged adolescents. The Actiheart can therefore be applied to any school setting. However, the costs per device may exceed ordinary funding options in most cases. In addition, the proper set-up and attachment to study participants need properly trained personnel and additional clearance to use on students. Nevertheless, in regard to validity and objectivity standards, the Actiheart appears to be the device most accurate to be used in field studies and real-world settings in school.

Conclusions

Total recess time accounts for significantly higher physical activity levels compared to total class period time. Moreover physical activity levels during recess by itself are also higher than the accumulated physical activity levels for the time students spend in school (school time).

The results indicate that even unaltered "natural" recess provides high amounts of physical activity. Its potential to significantly and evidently add to school students' overall physical activity legitimized its own existence, defying any effort to cut school recess times short.

Future research may focus on developing and applying interventions to promote and increase physical activity during recess. Particular emphasis may be put on school-aged children and adolescents' socioeconomic status, race, gender, and/or age [23, 24].

Acknowledgements

Special thanks go to the physical education teachers Harald Graef and Jonas Holder for collecting the data and setting up the research site, the school's principal for allowing the study to take place at his school, all students who volunteered to participate in the study, and all parents who gave permission to their child to participate.

Conflict of interests

The author declares that there are no conflicts of interest.

References

1. Stratton G, Fairclough SJ, Ridgers N. Physical activity levels during the school day. In: Smith AL, Biddle SJH, editors. *Youth Physical Activity and Sedentary Behaviour Challenges and Solutions*. Champaign, IL: Human Kinetics; 2008. p. 321-350.
2. Trudeau F, Shephard RJ. Contribution of School Programmes to Physical Activity Levels and Attitudes in Children and Adults. *Sports Medicine*. 2005;35(2):89-105.
3. Slingerland M, Borghouts L. Direct and Indirect Influence of Physical Education-Based Interventions on Physical Activity: A Review. *Journal of Physical Activity and Health*. 2011;8(6):866-78.
4. Bradley VR, O'Connor JP. The Development of a Resource for Physically Active School Settings. *ACHPER Australia Healthy Lifestyles Journal*. 2009;56(2):11-16.
5. Barros RM, Silver EJ, Stein REK. School Recess and Group Classroom Behavior. *Pediatrics*. 2009;123(2):431-436.
6. Pellegrini AD, Huberty PD, Jones I. The Effects of Recess Timing on Children's Playground and Classroom Behaviors. *American Educational Research Journal*. 1995;32(4):845-64.
7. Ridgers ND, Stratton G, Fairclough SJ. Physical Activity Levels of Children during School Playtime. *Sports Medicine*. 2006;36(4):359-371.
8. Beighle A. *Increasing Physical Activity through Recess. Research Brief*. San Diego, CA: Active Living Research. Robert Wood Johnson Foundation; 2012.
9. Ridgers ND, Saint-Maurice PF, Welk GJ, Siahpush M, Huberty J. Differences in Physical Activity during School Recess. *Journal of School Health*. 2011;82(9):545-551.
10. Escalante Y, García-Hermoso A, Backx K, Saavedra JM. Playground Designs to Increase Physical Activity Levels during School Recess: A Systematic Review. *Health Education & Behavior*. 2014;41(2):138-144.
11. Hayes LB, Van Camp CM. Increasing Physical Activity of Children during School Recess. *Journal of Applied Behavior Analysis*. 2015;48(3):690-695.
12. Crouter SE, Churilla JR, Bassett DR. Accuracy of the Actiheart for the assessment of energy expenditure in adults. *European Journal of Clinical Nutrition*. 2008;62(6):704-711.

13. Butte NF, Wong WW, Adolph AL, Puyau MR, Vohra FA, Zakeri IF. Validation of Cross-Sectional Time Series and Multivariate Adaptive Regression Splines Models for the Prediction of Energy Expenditure in Children and Adolescents Using Doubly Labeled Water. *Journal of Nutrition*. 2010;140(8):1516-1523.
14. Corder K, Brage S, Wareham NJ, Ekelund U. Comparison of PAEE from combined and separate heart rate and movement models in children. *Medicine & Science in Sports & Exercise*. 2007;37(10):1761-1767.
15. Slingerland M, Oomen J, Borghouts L. Physical activity levels during Dutch primary and secondary school physical education. *European Journal of Sport Science*. 2011;11(4):249-257.
16. Kretschmann R. Objective Measurement of Physical Activity Levels in Everyday Physical Education. *Research Quarterly for Exercise and Sport* 2014;85(Supplement 1):A-143.
17. Kretschmann R. Physical Activity Levels during the School Day - Findings from a German Sample. *Research in Kinesiology*. 2014;42(2):188-190.
18. Crawlea MB. *Validation of the sensewear hr armband for measuring heart rate and energy expenditure*: Pennsylvania State University; 2003.
19. Ainsworth BE, Haskell WL, Herrmann SD, Meckes N, Bassett Jr DR, Tudor-Locke C, et al. Compendium of Physical Activities: a second update of codes and MET values. *Medicine & Science in Sports & Exercise*. 2011;43(8):1575-1581.
20. Nelms MN, Scher KP, Lacey K, Long Roth S. *Nutrition Therapy and Pathophysiology*. Belmont, CA: Thomson; 2010.
21. Brusseau TA, Hannon JC. Impacting Children's Health and Academic Performance through Comprehensive School Physical Activity Programming. *International Electronic Journal of Elementary Education*. 2015;7(3):441-450.
22. Haapala HL, Hirvensalo MH, Laine K, Laakso L, Hakonen H, Lintunen T, et al. Adolescents' Physical Activity at Recess and Actions to Promote a Physically Active School Day in Four Finnish Schools. *Health Education Research*. 2014;29(5):840-852.
23. Woods AM, Graber KC, Daum DN. Children's Recess Physical Activity: Movement Patterns and Preferences. *Journal of Teaching in Physical Education*. 2012;31(2):146-162.
24. Stellino MB, Sinclair CD, Partridge JA, King KM. Differences in Children's Recess Physical Activity: Recess Activity of the Week Intervention. *Journal of School Health*. 2010;80(9):436-444.

Information about the author:

Kretschmann Rolf; http://orcid.org/0000-0002-3272-9213; rolf.kretschmann@uni-dortmund.de**;** TU Dortmund University; 44221 Dortmund, Germany.

Cite this article as: Kretschmann Rolf. Comparison of 9th grade students' physical activity levels during recess and regular class periods using objective measurement. *Pedagogics, psychology, medical-biological problems of physical training and sports*, 2016;4:59–63. doi:10.15561/18189172.2016.0409

The electronic version of this article is the complete one and can be found online at: http://www.sportpedagogy.org.ua/html/arhive-e.html

Received: 05.07.2016
Accepted: 26.07.2016; Published: 30.08.2016

SUBMISSION OF MANUSCRIPTS

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

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.

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

Address of editorial office (Europe):
Sport str. 2, of.209, 85-064 Bydgoszcz, Poland
Deputy Editor: Mirosława Cieślicka,
e-mail: cudaki@op.pl

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. 2016;4:68.

---

designer – Iermakov S.S.

editing – Yermakova T.

designer cover – Bogoslavets A.

administrator of sites – Iermakov S.S.

————————————————————————

passed for printing 30.08.2016.

Format A4.

Red Banner str., 8, Kharkov, 61002, Ukraine.
PRINTHOUSE (B02 № 248 750, 13.09.2007).
61002, Kharkov, Girshman, 16a.