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**Address of editorial office:**

Box 11135, Kharkov-68, 61068, Ukraine,

Tel. 38 099 430 69 22

e-mail: sportart@gmail.com

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# The problems of students' physical training individualization

Druz V.A.<sup>1</sup>, Iermakov S.S.<sup>2</sup>, Nosko M.O.<sup>3</sup>, Shesterova L.Ye.<sup>1</sup>, Novitskaya N.A.<sup>1</sup>

<sup>1</sup>*Kharkov State Academy of Physical Culture*

<sup>2</sup>*Kazimierz Wielki University, Poland*

<sup>3</sup>*Chernigiv National T.G. Shevchenko Pedagogical University*

## Abstract

**Purpose:** to assess physical health and biological age of 1st 2nd year girl students, depending on their physical activity, as well as to work out system of control over students' health.

**Material:** in the research 1st and 2nd year girl students (n=120) participated.

**Results:** students' busy in their working day was analyzed as well as student's understanding of healthy life style during working day. We also paid attention to reasons of sharp weakening of students' physical fitness and determined integral indicator of healthy life style conception as well as significance of every its component. The following concepts are introduced: physical health, including individual level of physical condition; physical fitness and physical state. We found normal level for every component of physical health and correlation between population, regional and individual norms.

**Conclusions:** For students' healthy life style formation it is necessary to observe norm requirements to all its components. Violation of any component's norm results in worsening general final result.

**Keywords:** norm, physical condition, biological age, chronological age, individual growth.

## Introduction

Progress of higher school is connected with periodic reformation of education, determined by continuous evolution of society, Emersion of new information in every field of knowledge results in re-structuring of educational programs. In its turn it results in reviewing of academic plans and education's structure. Change of equity significance of time for fundamental disciplines is solved at the cost of secondary disciplines. To the largest extent it concerns physical education. Secondary role of this discipline in structure of students' teaching and insufficient understanding significance of students' physical fitness have already resulted in sharp worsening of students' health. Besides, students also do not understand completely significance of normal physical growth and its individual aspects. As a result Ukraine has become one of first in Europe by population mortality.

Refusal from physical culture discipline and testing for physical fitness lead to full loss of control over students' physical condition. Such approach does not permit to correct the required physical loads, which are sufficient for students' health.

In publications, devoted to this age, exclusive significance of physical education is noted, which means its health related influence [16, 33]. Just this role of physical training determines the requirements to it. They imply ensuring of high health level as indicator of individual age viability. Refusal of old control criteria dictates searching new forms of assessment of students' physical fitness. Such forms of control shall comply with age standards and individual aspects of biological maturing of organism's morphological functional systems. Solution of this problem requires determination of individual's biological age. But there is no single

criterion for its assessment, which would ensure solution of this problem. It results in different results of biological age assessments, made by different criteria.

New requirements to criteria for individual motor abilities' norms significantly changed the usage of the existing criteria for mean statistic evaluation of physical condition and physical fitness. Mean statistic criteria did not loose their significance. They shall be used as standard, in respect to which individual motor abilities and different criteria for biological age shall be found. Such criteria for physical health assessment permit to determine the components of physical condition and physical fitness, required for ensuring proper professional and domestic workability. The system of physical state and biological age multi-parametric assessment generates a peculiar barcode. Such code permits to find similarity of the compared object as well as to distribute indicators into groups of admissible communality (with pre-set tolerance of comparison) [5, 6, 22].

From the above said it follows that control over students' physical fitness shall be based on individual features of physical growth. Such features determine feasible level of physical fitness potentials. They ensure preservation of health, sufficient for professional and domestic workability [3, 31-33].

*Hypothesis:* effectiveness of specialists' professional training implies formation of the most optimal students' environment, in compliance with their intellectual and social conditions. Creation of such conditions in any organized collective is the most effective and fruitful process from economic point of view. For realization of this purpose it is necessary to have systemized certification of every collective member's individual potentials by their physical condition, physical fitness and physical state. It will permit to form maximally homogenous groups and determine homogeneity of educational medium's

components as well as conditions of students' healthy life style. It will also ensure highly effective final result of future specialist's professional fitness. Individualization of students' potentials requires adequate individualization of educational medium's influence by all its components.

*The purpose of the research:* is to assess physical health and biological age of 1<sup>st</sup> 2<sup>nd</sup> year girl students, depending on their physical activity, as well as to work out system of control over students' health.

### Material and methods

*Participants:* in the research 1<sup>st</sup> and 2<sup>nd</sup> year girl students (n=120) participated. They were from Kharkov national medical university and National University, named after V.N. Karazin.

*Organization of the research:* we determined the girl students' biological age, physical health level. Motor activity level. All participants were being observed during two years in every academic semester (2014-2016).

Physical health level was assessed by express-method of G.A. Apanasenko [4]. Biological age was determined by method of G.A. Voytenko [11]. Physical activity was found with the help of questionnaire IPAQ [35]. Besides, questioning and anthropometrical measurements were fulfilled by M. Ya. Breitman [8].

Biological age was found with the help of "tests battery" of different complexity [11]. Speed of biological ageing was determined by the following stages: on the first stage actual biological age of an individual was found on the base of clinical biological indicators; than, by calendar age, his/her proper value of biological age was determined; after it – comparison of proper and actual biological age was fulfilled. The received results were presented in normalized space. Deviation from proper biological age was measured in portions of signal deviations from the found norm.

Physical fitness's influence on organism's viability potential was assessed by registration of girl students' physical activity in regime of their working day.

Girl students' physical activity was evaluated with standardized questionnaires (Global Physical Activity Questionnaire - GPAQ or International Physical Activity Questionnaire - IPAQ). Data processing implied calculation of energy losses in physical work, i.e. the value of metabolic equivalent of task. The conducted calculations permitted to find physical activity levels. High level of physical activity corresponds to one of two criteria: intensive physical activity with energy losses, corresponding to 1500 meters/minute in a day, during three or more days a week; or seven days with combination of walk with energy losses of not less than 3000 meters (minimum)/ week.

Moderate level of physical activity (corresponds to one of three criteria): three or more days a week of energetic physical activity (20 minutes a day); five or more days a week of moderate physical activity, or walking during 30 minutes a day; five or more days a week with combination of walking from moderate to intensive with energy losses of not less than 600 meters/ minute in a week.

*Statistical analysis* was fulfilled with the help of Excel program.

### Results

We have evaluated significance of physical fitness as a regulator of students' required level of viability. It is explained by the fact that the reasons of human irresponsible attitude to own health are: absence of knowledge about physical growth of own organism; non observation of healthy life activity conditions; absence of skills in feasible diagnostic and physical state correction methods. Regulation implies increase or decrease of influence of the factor, which is regarded as regulator of certain balanced state. With it, it is necessary to consider: the range of regulation (its fluctuations in respect to balanced condition); the level of stable state. Such state reflects potential of current viability. Besides, it reflects duration of regulation regime's deviation from initial stable state. Violation of these conditions results in de-synchronizing of morphological functional formations' inter-support and weakening of organism's viability (too early biological ageing). Actually potential of balanced state's operative adaptation plays the role of compensatory mechanism, which preserves organism's balance in unstable state. It should be also considered that physical fitness level is not the only compensatory factor of balance state's preservation. Separately it is necessary to pay attention to equity demand in potential energy, which is spent for other components of operative adaptation compensation.

When determining girl students' biological age, we found that the range of variations was 9 years to each side from biological age norm. The ranked assessment of health was determined by remoteness from population standard. The structure of it is shown in fig. 1.

I and V ranks' students shall be regarded as having threatening health condition. There were four variants of biological age determination, which differed by complexity and were used depending on opportunities of laboratory. The presented here range of biological age variation relates to 2010. The same researches in 2015 and 2016 showed reduction of biological age general indicator to the side of slowing. It reflects weakening of organism's resistance and acceleration of its wear out. It can be assumed that in this case important role is played by worsening of social factor of population's life.

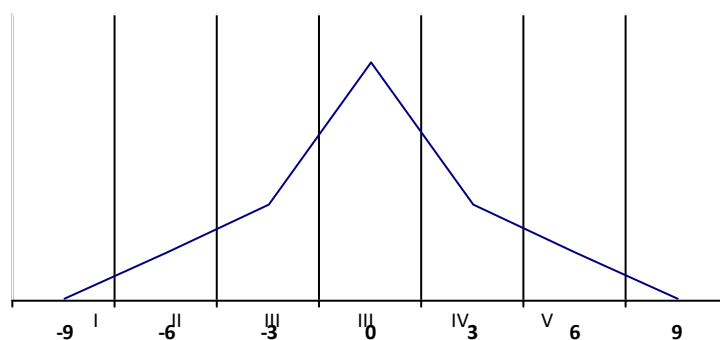
We also analyzed separate aspects of physical activity. In fig. 2 we present the data of physical activity in working day and day off. The quantity of the tested was 21 girl students.

In fig. 3 we give distribution of time, spent for fulfillment of intensive or moderate physical activity in free time.

Assessment of physical activity of Kharkov national university, named after V.N. Karazin girl students showed that 71% of them have hyperkinesias.

The study of students' physical activity showed characteristic for most of them hyperkinesias. Analysis of time distribution into different activities during

N, frequency



Deviations in equities  $\sigma$

**Fig. 1.** Histogram of ranked assessment of biological age: I-V-rank.

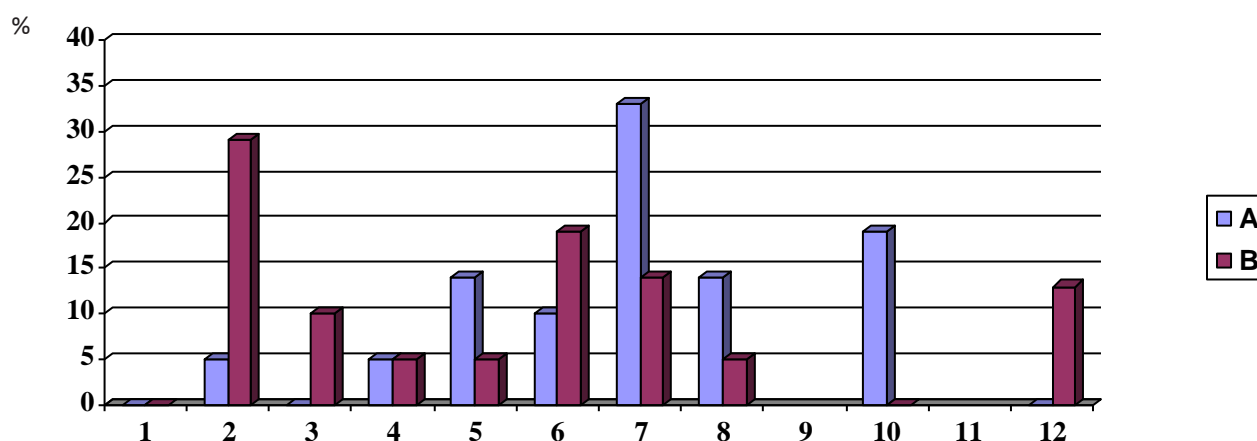
**I rank** is maximally slowed growth.

**II rank** reflects moderate delaying of growth.

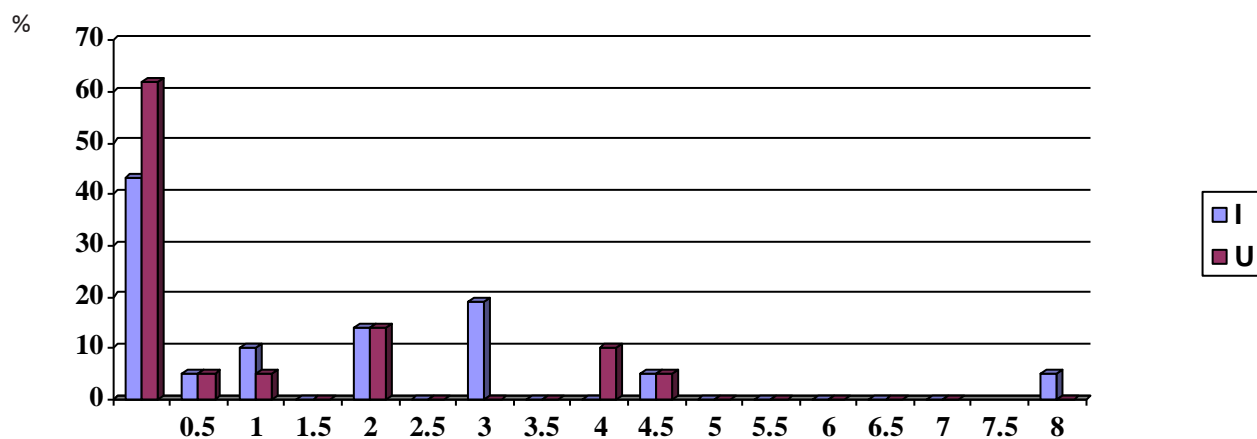
**III rank** – corresponds to zone of functionally optimal biological growth.

**IV rank** reflects zone of moderate forestall of biological growth.

**V rank** means extremely accelerated forestall of biological growth (-9, -6, -3, 0, 3, 6, 9) deviations of biological age from passport age in years.



**Fig. 2.** Sitting hours in working day and day off: A – working day; B – day off; t – time in hours; on X-axis – percents from the number of participants.



**Fig. 3.** Quantity of hours in free time, spent for intensive or moderate physical activity: t – hours; D – no physical activity; I – intensive; U – moderate.

working day and in day off shows extremely high time deficit, which exceeds day limit by 3-4 hours. It results in compensatory time saving at the cost of its physical activity, rest and sleep as well as reduction of time for home task. In its turn it reduces the quality of professional training and accelerated weakening of physical potential of girl students' organism's viability. Generalized assessment of girl students' somatic health was fulfilled by sum of five indices (method of G.A. Apanasenko) (see table 1).

We tested physical health in 41 girl students of Kharkov national medical university. No girls, having high level of physical health, were found (see fig. 4).

Besides, we found aerobic threshold of energetic potential, below which disorders in different organism's functional systems become possible. It results in formation of endogenous risk factors and beginning of chronic pathological process. Such threshold is called "dangerous" level of somatic health. It can be evaluated quantitatively, in indicators of maximal energetic potential (MEP) or maximal oxygen consumption per 1 kg of

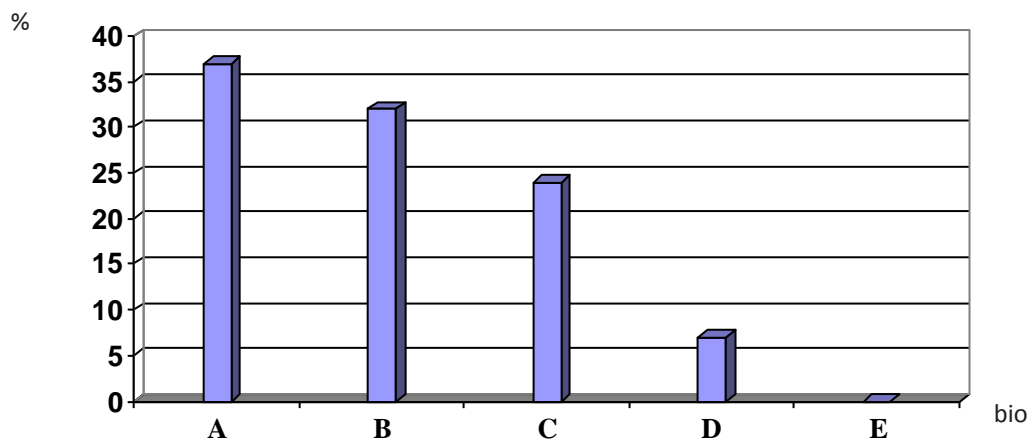
body mass (MOC). It can also be presented in indirect indicators: physical workability, general endurance or health levels. Safe health level includes high and above average physical health levels. Only 7% of girl students related to this level. The rest 93% were at the border of "dangerous" level. From this level endogenous risk factor can start to form and bring to pathological processes of definite nosological form. Quantitative characteristic of safe health level for 1<sup>st</sup> - 2<sup>nd</sup> year girl students by MOC indicators was 33 mol/min/kg; ergometer load power - 2 W/kg; time of 2 km distance covering shall be not more than 10 minutes 30 sec. In points it corresponds to level higher than 11. Express assessment of physical health by G.A. Apanasenko permits to detect "weak points" in organisms of the tested. Results of physical health testing in 41 girl students of Kharkov national medical university are given in table 2.

Mean statistic indicators of group body mass index was within norm (18,50 – 24,99 kg/m<sup>2</sup>). However, individual values of body mass index in 5% of girl students have insignificant defect. In 2% girl students,

**Table 1.** Scale of assessment of physical health for women

Indicators	Result in points				
	Low	Below average	Average	Above average	High
Body mass index / (height) <sup>2</sup> kg/m <sup>2</sup>	- 2 ≤ 16,9	- 1 17,0 – 18,0	0 20,1 – 25,0	- 1 25,1 – 28,0	- 2 ≤ 28,1
Life index VCL /body mass. mol/kg	- 1 ≤ 40	0 41 – 45	1 46 – 50	2 51 – 56	3 ≤ 57
Power index – hand's strength /body mass %	- 1 ≤ 40	0 41 – 50	1 51 – 55	2 55 – 60	3 ≤ 61
Time of HBR restoration after 20 squats up to 30 sec. min, sec.	- 2 ≥ 3	1 2 – 2,59	3 1,30 – 1,29	5 1,0 – 1,28	8 ≥ 0,59
Robinson's index. HBR x BP syst. / 100 conv.un.	- 2 ≥ 111	- 1 95 – 110	0 85 – 94	3 70 – 84	5 ≥ 69
Total points	≤ 3	4 – 6	7 – 11	12 – 15	≤ 16 – 18

**Notes:** kg – kilograms; body length – meters; VCL – vital capacity of lungs; mol – milliliter; HBR – heart beats rate; BP syst. – systolic blood pressure, to be measured in milliliters of mercury column.



**Fig. 4.** Distribution of physical health level in percents (%) of 41 Kharkov national medical university girl students: A - low; B – below average; C - average; D – above average; E – high;; Bio – biological level of health.

body mass index corresponded to pre-obesity level. The rest 93% girl students corresponded to normal level. Life index (reflecting external breathing function) determines ratio of lungs' vital capacity (VCL) to body mass. This indicator is less than norm in 5 girl students (11%). Group power index was significantly lower than norm. Robinson's index (reflecting efficiency of cardio-vascular system's work) was within norm in the whole group. Restoration index (by test of Martinet-Kulishevskiy) exceeds upper limit of norm more than by 1.5 minute in 30% of the tested.

We analyzed indicators of girl students' biological age by five-rank scale in respect to their calendar age. We found that 54% girl students are in the 3<sup>rd</sup> rank. It corresponds to the norm of population standard. Accelerated ageing was detected in 15 girl students from 43 (35%). 9% and 2% of girl students were in second rank. The structure of such distribution is shown in fig. 5.

Calendar age of the tested girl students is  $17,6 \pm 0,3$  years. Group biological age is  $23,2 \pm 0,7$  years. It exceeds population norm by 6 years.

The fulfilled factorial analysis of the received data

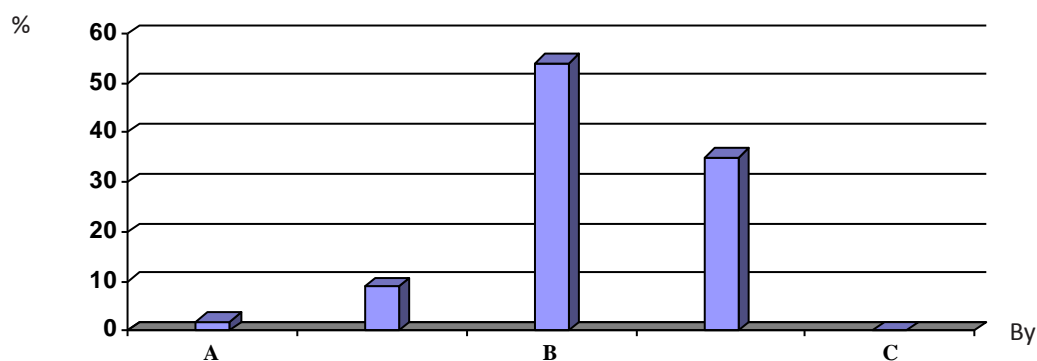
permitted to find the structure of students' physical health integral indicators' structure. We found three main factors, which contributed 69.3% to general dispersion of sample (see table 3, fig. 6). The first factor (27,6%) included body mass index and Robinson's index. The second factor (21,2%) included indicators of students' biological age and life index. The structure of third index (20,5%) included indicators of power index and restoration time after standard dozed load by test of Martine- Kushelevskiy.

### Discussion

The regarded period of student's age is characteristic by the fact that vegetative reactions' level is high; assessment of interceptive and proprioceptive information about organism's physical condition and all main mechanisms of motor regulation have been practically completely formed. Characteristic feature of this girls' period is high sensitivity to fatigue. In the whole it is a period of physical strength peak, providing all requirements, necessary for growing organism are ensured. Organism's resistance is maximal. In this age girls have rather good physical fitness; they can successfully train and master exercises

**Table 2.** Indicators of 1<sup>st</sup> – 2<sup>nd</sup> year girl students' physical health (KNMU)

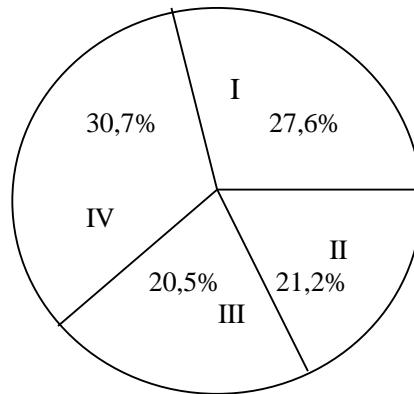
Indicators	$x \pm m$
Body mass index kg/m <sup>2</sup>	$20,9 \pm 0,3$
Life index mol/kg	$55,6 \pm 1,1$
Power index %	$28,2 \pm 1,1$
Robinson's index, conv.un.	$86,6 \pm 32$
Time of HBR restoration after test of Martinet-Kushelevskiy, sec.	$95,6 \pm 5,1$



**Fig. 5.** Distribution of biological age in % of Kharkov national medical university girl students: By – biological age; A – very slow process; B – corresponds to population standard; C- very quickly.

**Table 3.** Factorial structure of integral indicators of 1<sup>st</sup>-2<sup>nd</sup> year girl students

Description of indicators	I factor	II factor	III factor
Body mass index kg/m <sup>2</sup>	0,77		
Life index mol/kg	- 0,84		
Power index %		0,78	
Robinson's index, conv.un.		- 0,82	
Time of HBR restoration after test of Martinet-Kushelevskiy, sec.			- 0,82
			0,75



**Fig. 6.** Diagram of structure of 1<sup>st</sup> – 2<sup>nd</sup> year girl students' physical health's integral indicator;  
**I** – factor of general dispersion (body mass index and Robinson's index);  
**II** – factor of general dispersion (biological age and life index);  
**III** – factor of general dispersion (power index and restoration time after load by Martinet-Kushelevskiy's test);  
**IV** – factor of general dispersion (medium components, which were not taken into account).

with complex coordination. In respect to motor skills' development, increase of all muscular groups' strength is observed and motor quickness reaches maximal value. Progress and development of general endurance and dexterity is continuing. Comparing with adolescents' age weakening of flexibility is observed [25].

Sustaining of required general physical fitness for obtaining the required health related effect from physical culture practicing requires attentive attitude and control over anatomic physiological parameters of woman's organism [17]. The embedded in this period health and healthy life style practicing is the basis of further young people's self-organization, their active working longevity, ability for procreation and building family; social and creative activity [18]. Health ensures organism's adaptation to changing internal and external medium; preserves and expands organism's functional systems' reserves. That is why organism's adaptation potentials can be regarded as a measure of health. Well organized control over health ensures possibility of pre-nosological diagnostic and timely prophylaxis [9, 14].

However, at present students' health troubles pedagogic community. In specialists' opinion students belong to category of population with increased risk of diseases. At present time we observe steady reduction of indicators of organism's functional systems and students' physical workability from junior to senior years of study [1, 24].

In assessment of physical health organism's biological ageing is an important criterion. It is rather accurate and early indicator of pre-morbid states, quantitative characteristic of health and effectiveness of adaptation to unusual ecological and professional conditions [7, 10, 15, 27].

For growing organism delaying and advancing of biological age is an indicator of health's worsening. Two persons of the same calendar age can greatly differ by intensity of physiological functions' wear out. Determination of students' biological age can facilitate

their re-orientation on healthy life style. In its turn it will facilitate more successful professional training [20, 28-30].

By data of different authors students' biological age is in average 30-35 years. At present the discrepancy between biological and passport age is 10-15 years. 15-20 years ago this indicator was 4-5 years [19, 21].

Study of the problem of physical training individualization brings to demand in regarding the components, which determine it: physical health; healthy life style; social-domestic norms of life activity environment. To regard any component as separate would not be a correct decision [12, 26, 36, 37].

For long time not solved problem of norm's assessment have not permitted to form the conception "physical health" itself. This problem was solved only by introduction of indicative semantic spaces with single measure of the used attributes measurements [6, 22]. It permitted to find common features, intrinsic to normal human condition. On the base of the received results there appears possibility to assess individual aspects of norm's manifestation [2]. Commensurability of all components is realized in parts of signal deviation. In this case any deviation both to hypo or hyper sides from balanced state of inter-conditioned relations are quantitative and qualitative indicators of health worsening [13].

One of regulating factors of required students' viability sustaining is quantitative and qualitative structure of students' physical fitness. It determines demand in individualization of this process.

### Conclusions

1. Physical health is an indicator of students' viability. That is why organization of mass health related physical culture requires the following: consideration of physical condition's individual norm; initial level of physical fitness; feasible physical loads. Controlling students' physical condition, it is necessary to register individual

aspects of their development and corresponding to them individual norm of students' state. The received control data shall be accumulated in data base for all period of students' study for analyzing, if required.

2. Mass health related physical training in higher school shall be based on appropriate volume of motor functioning, its orientation and intensity. All these shall correspond to age level of students' individual physical condition. The structure of group physical culture training shall be based on a number of indicators, reflecting homogeneity of group members. They are: load volume; arsenal of means; regime of load's distribution during day; individual features of students' physical condition; current physical condition; initial fitness. On the base of these criteria of contingent's similarity the size of group is determined. Interest in the offered physical activity shall be additional and compulsory criterion of group's formation. With it, the limits of the required minimal and maximal physical fitness for definite age and shall be determined. It is dictated by individual approach to training.

3. For effective coordination of mass health related physical culture it is necessary to find means and keep records of required physical fitness. Then, on the base of the accumulated data, it is necessary to determine regional and population age norms for mass health related physical culture. It will permit to create single coordinated system of this process's provisioning.

4. Students' physical health is an integral indicator of their viability. It includes: physical condition, physical fitness, current physical condition. It is the essence of physical culture, which, in its turn, is an integral part of general culture of society. That is why physical fitness and physical health can not compensate reduction of other factors' requirements, which are components of students' healthy life style final result. For cultivation healthy life style in students it is necessary to observe the requirements of all its components. Violation of any component's requirements will fail final result.

#### Conflict of interests

The author declares that there is no conflict of interests.

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**Information about the authors:**

**Druz V.A.;** <http://orcid.org/0000-0002-4628-6791>; [valeriidruz@gmail.com](mailto:valeriidruz@gmail.com); Kharkov State Academy of Physical Culture; Klochkovskaya str. 99, Kharkov, 61022, Ukraine.

**Iermakov S.S.;** <http://orcid.org/0000-0002-5039-4517>; [sportart@gmail.com](mailto:sportart@gmail.com); Kazimierz Wielki University; Sport str. 2, of.209, 85-064 Bydgoszcz, Poland.

**Nosko M.O.;** <http://orcid.org/0000-0001-9903-9164>; [prymalna214chnpu@meta.ua](mailto:prymalna214chnpu@meta.ua); Chernigiv National T.G. Shevchenko Pedagogical University; Str. Polubotko Getman, 53, Chernigov, 14000, Ukraine.

**Shesterova L.Ye.;** <http://orcid.org/0000-0001-6149-1980>; [shesterova1@mail.ru](mailto:shesterova1@mail.ru); Kharkov State Academy of Physical Culture; Klochkovskaya str. 99, Kharkov, 61022, Ukraine.

**Novitskaya N.A.;** <http://orcid.org/0000-0001-5412-8016>; [Novisha71@mail.ru](mailto:Novisha71@mail.ru); Kharkov State Academy of Physical Culture; Klochkovskaya str. 99, Kharkov, 61022, Ukraine.

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# Confidence, cognitive and somatic anxiety among elite and non-elite futsal players and its relationship with situational factors

Hassan Habibi<sup>1</sup>, Amir Moghaddam<sup>2</sup>, Hossein Soltani<sup>3</sup>

<sup>1,2</sup>Department of Physical Education and Sport Sciences, Mashhad Branch, Islamic Azad University, Mashhad, Iran.

<sup>3</sup>Department of Physical Education and Sport Sciences, Torbat-e Heydarieh Branch, Islamic Azad University, Torbat-e Heydarieh, Iran.

## Abstract

**Purpose:** The aim of this study was to compare confidence, cognitive and somatic anxiety among elite and non-elite futsal players and its relationship with situational factors.

**Material:** 130 non-elite and 70 elite male futsal players participated in the study. Competitive State Anxiety Inventory-2 and situational factors Inventory were applied. Data was analyzed using one way ANOVA and product moment correlation.

**Results:** Results showed there was significant difference between competitive state anxiety subscales (cognitive anxiety somatic anxiety & self-confidence) and situational factors among elite and non-elite futsal players but there was no significant correlations between situational factors subscales among elite and non-elite futsal players.

**Conclusions:** Competitive state anxiety is part of sport competition and it seems elite athletes can manage and interpret anxiety well with respect to their experiences and psychological intervention and then consider anxiety and situational variables as facilitative factors for his or her competition.

**Keywords:** competitive state, anxiety, situational factors, elite players.

## Introduction

Nowadays, due to lack of attention to sport psychology, athletes may face several failures which bring irreparable damages to them and the sport community. Therefore, paying attention to psychology and the variables related to athletes' performance can have beneficial results. There are important components in psychology that are related to sport performance, one of which is state anxiety [9]. There are so many factors that can cause an athlete to experience stress or anxiety. The elements which can raise stress and anxiety are: physical needs, psychological needs, environmental needs, expectations and pressure to perform to a high level, significant other stressors, relationship issues and life direction concerns [14]. Woodman and Hardy (2001) stated that anxiety is generally known as being an unpleasant emotion [18]. In addition, anxiety is seen as an emotion characterized by negative affect that can have a debilitating effect on performance [5]. Early investigations viewed anxiety as one-dimensional, whereas more recent research has suggested that anxiety is multidimensional [6]. Comprising of both: mental component and physiological component. The mental part of anxiety has been referred cognitive anxiety and the physiological part termed physiological arousal or somatic anxiety. Morris, Davis and Hutchings (1981) defined cognitive anxiety as "the cognitive components of anxiety, such as fear of result and cognitive concerns about oneself and competition and somatic anxiety as "one's perception of the physiological-affective elements of the anxiety experience, that is, indications of autonomic arousal and unpleasant feeling states such as nervousness and tension [12]. In the last century, scholars have paid great attention to the relationship between anxiety and sport performance [7]. In competitive sports,

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anxiety and self-confidence are considered two essential factors affecting the athlete's performance [11]. The effects of anxiety and self-confidence levels on sport performance are a major concern of athletes and coaches involving in different sports. Successful coaches often know that in competitive sports, the competitors' level of skill is similar to each other and the difference is in their mental readiness [3]. It is for this reason that they prepare the athletes for effective confrontation with high levels of anxiety and stress. If they are not ready, they may be weakened and surrendered by the pressures of the competition. As a factor related to mental energy, anxiety has been always taken into account in athletes' mental health. It is clear that when an athlete faces a special condition such as that of a competition and is observed by spectators, in the first stage he compares what is expected from him with his own level of skill. If he is concerned with requirements and expectations, he will definitely experience the stress resulting from his anxiety. The point is that even if he feels that his abilities and skills are higher than the requirements of a competition, he will still have stress because stress originates from incompatibility and asymmetry between wishes and qualifications. So it is clear that tranquility and relief are obtained through concordance and compatibility between these two factors. On the other hand, being away from the surrounding events may result in stress because this is also considered a kind of mental pressure [2]. The important mental challenge of the athlete may be his lack of understanding the difference between the two concepts of mental energy and stress. This challenge will overcome both the athlete and his coach because their main problem is to find the optimum and desirable level of these two factors. One of the inherent aspects of sport competitions is the players' need to meet the requirements of the competition and show

satisfactory performance under the competition pressures. Feeling an essential inconsistency between environmental needs and reactivity or responsiveness capabilities under the conditions in which failure in meeting the competition expectations brings significant consequences, increases competitive state anxiety. Some of the scholars concluded that situational factors have an important role in adjusting athletes' competitive state anxiety before the competition. In order to have desirable performance in sport races, it is necessary to identify factors that affect anxiety. Some scholars whether inside or outside of the country have studied anxiety of different skill players and its relationship with situational factors. Additionally, studies conducted on anxiety levels in different sports have had contradictory results [2]. Martens (1990) proposed this hypothesis that the origin of anxiety and self-confidence is environmental factors which are related to athlete's expectations from the status of the competition and primarily include the understanding of one's own abilities based on previous competitive experiences and of competitor's ability and strength. As a result, when expectations are irrational, the athlete will experience increase in his anxiety and decrease in his self-confidence. Signs that cause physical anxiety mainly include conditional responses to stimuli in a sport environment, such as changing the lockers, common warm-ups before the competition, significance of the game, and populace of spectators [10]. Smith (1990) states that situational factors include the significance of the sport race, competitor's ability and strength, presence of VIPs, and the degree to which social support is perceived by the coach, teammates, parents and fans [15]. In this study, situational factors refer to performance expectations from the team, performance expectations from the individuals, competitor's ability and strength, the importance of the result for the team, previous performances, mental readiness of the individuals, and physical readiness of the individuals. Therefore, since futsal has gained special value and popularity as one of the attractive and hot sports in the world and in Iran, and children, teenagers, the youth and even adults are extensively attracted by it, it is necessary to study the psychological factors affecting the behavior of athletes of this sport based on the results of the conducted studies, the significance of anxiety and its role in athletes' performance, and lack of required research in this field. Hence, by investigating the comparison of competitive state anxiety of young elite and non-elite futsal players according to situational factors, the author attempts to help athletes interested in this sport to reach the elite level.

### Material and Methods

The research methodology used in this study was descriptive comparative and *correlation*.

#### Participants

The statistical population used in this research was 560 futsal players (160 elite futsal player & 400 non-elite futsal player) in Iran. By using Morgan table 130 non-elite futsal and 70 elite futsal, players were considered as sample size randomly. Samples were male futsal

players who had competed in the league and super league competitions of Iran (Khorasan Razvi State) in 2014 year. In this research skill level (elite & non-elite) and situational factors (performance expectations team, performance expectations individuals, opponent's ability, the importance of the result for the team, previous performances, mental readiness and physical readiness of the individuals have been considered as independent variables and competitive state anxiety subscales (somatic anxiety, cognitive anxiety and self-confidence) were dependent variables'.

#### Measures

Situational factors Inventory (Swain, 1990).

This inventory contains 8 questions utilizing a 9-point Likert scales from 1 (low) to 9 (high) regarding performance expectations of the team, performance expectations of the individuals, opponent's ability and strength, the importance of the result for the team, previous performances, mental readiness and physical readiness of the individuals.

Competitive State Anxiety Inventory-2 (Martens, Vealey and Burton, 1990)

This measurement tool is often used in research studies in order to estimate the participants' cognitive and somatic types of anxieties, as well as their self-confidence (Martens et al., 1990). The test requires the subjects to choose the answer that corresponds with how they feel at this point in time, right now. Cognitive anxiety items are numbers 1, 4, 7, 10, 13, 16, 19, 22, and 25. Somatic anxiety items are numbers 2, 5, 8, 11, 14 (reverse), 17, 20, 23, and 26. Self-confidence items are numbers 3, 6, 9, 12, 15, 18, 21, 24, and 27.

According to Martens et al. (1990) the scoring of the CSAI-2 was achieved in the following way. Persons rated how they were feeling right at that moment by circling one of the presented answers. The four-presented answers included: not at all (1), somewhat (2), moderately so (3) and very much so (4). The final scores for each subscale ranged from 9 to 36, with 9 indicating low anxiety/confidence and 36 indicating high anxiety/confidence. The reliability was measured by Alpha Cronbach ( $\alpha=0.89$ ). Also, internal reliability of this questionnaire was reported by Peter *et al.* (2003) as 85.75, and 0.83 respectively.

#### Procedures

At first, the researcher visited coaches from the various teams that had been selected as sample and explained the nature of the study. In the second stage the researcher distributed materials containing a letter describing the study and informed-consent forms. At the third stage Personal Information Questionnaire, state Competitive Anxiety Inventory (CSAI-2) and Situational factors Inventory for both elite and non-elite futsal players were administered to the subjects within 30 minutes prior to the start of the competition and the nature of study was described at the top of the questionnaire to the subjects. Each questionnaire took approximately 5 minutes to complete.

#### Statistical Analysis

In order to calculate measures of central tendency

and variability, descriptive statistics was utilized. At first *Levene's test* checked homogeneity of variances between sets of scores. Homogeneity of variance for participant samples was observed. Finally One way analysis of variance was conducted for between group's comparisons, then the hypotheses were examined at  $P < 0.05$ .

**Results**

Table1 shows that there is significant difference between competitive state anxiety subscales (cognitive anxiety somatic anxiety & self-confidence) and situational factors among elite and non-elite futsal players ( $P < 0.05$ ). Table 2 showed there is no significant correlations between situational factors subscales factors among elite and non-elite futsal players ( $P < 0.05$ ).

**Discussion**

Results of one-way analysis of variance concerning the first and second purposes of this research showed that elite futsal players experienced lower levels of physical and cognitive anxiety than non-elite players. Statistically, there was a significant difference between the levels of cognitive anxiety and physical anxiety of elite and non-elite futsal players. Findings of this study regarding these three variables highlight the multidimensional theory of state anxiety [12] and confirm this theory because there

was a negative linear relationship between the levels of cognitive anxiety of elite and non-elite players. In fact, the higher the level of cognitive anxiety, the weaker the performance will be. On the other hand, according to this theory, the relationship between physical anxiety and performance is like an upside-down U. Results of this research showed that elite players experienced higher levels of physical anxiety compared to cognitive anxiety. This indicates that all players in all levels should experience an optimum level of anxiety so that they can have better performance. In fact, physical anxiety affects performance less than the cognitive anxiety. There are different theories about anxiety and sport performance; and regardless of the acceptance or rejection of a theory, anxiety definitely affects athletes' performance in different forms. In this research, both elite and non-elite futsal players experienced anxiety. Of course, considering the athletes' personality traits, average levels of anxiety seem to be necessary, and the difference between elite and non-elite athletes is in their controlling and managing of stressors, in a way that it seems that this group of athletes considers stress and anxiety produced before the competition as a facilitating factor in performing the sport competitions. In contrast, non-elite athletes consider stressors as a prohibitive factor. In addition, since elite players have more experience than non-elite athletes and

**Table 1.** Comparison of competitive state anxiety subscales and situational factor among elite and non-elite futsal players

Variable	Skill level	N	M	SD	F	Sig.
Cognitive Anxiety	Elite players	70	14.74	2.86	5.36	0.000*
	Non-elite players	130	18.30	3.63		
Somatic Anxiety	Elite players	70	15.94	2.72	16.91	0.000*
	Non-elite players	130	17.91	3.47		
Self-confidence	Elite players	70	17.90	2.40	49.12	0.000*
	Non-elite players	130	15.33	2.49		
Situational Factors	Elite players	70	52.98	5.91	152.12	0.000*
	Non-elite players	130	40.70	7.69		

**Table 2.** Correlation of competitive state anxiety subscales and situational factor among elite and non-elite futsal players

Variables	Skill level	N	r	Sig.
Situational Factors	Elite Players	70	0.053	0.665
Cognitive Anxiety				
Situational Factors	Elite Players	70	0.022	0.854
Somatic Anxiety				
Situational Factors	Elite Players	70	0.068	0.576
Self-confidence				
Situational Factors	Non-elite Players	130	0.017	0.844
Cognitive Anxiety				
Situational Factors	Non-elite Players	130	0.057	0.520
Somatic Anxiety				
Situational Factors	Non-elite Players	130	0.095	0.284
Self-confidence				

have participated in more races in their life time, it is obvious that they can deal with the produced stress and anxiety more easily. Also, these athletes have been more trained by experienced and expert coaches. Considering that training mental skills and strategies of overcoming stress is part of the elite players' practices, it seems that these players experience lower levels of anxiety. The results of this hypothesis (significance of the levels of cognitive and physical anxiety among elite and non-elite players) conform to the results of studies conducted by Soltani, 2003; Anshel et al., 2001 & Jones et al., 1994). Jones reported that elite players consider anxiety as a facilitating factor in performance, while non-elite athletes are affected by adverse effects of anxiety.

The third purpose of this research was to compare the self-confidence of elite and non-elite futsal players. The results of one-way analysis of variance showed that elite futsal players had higher average self-confidence compared to non-elite futsal players. In other words, there is a significant difference between average self-confidence of elite and non-elite futsal players ( $P < 0.05$ ).

It seems that relatively high levels of self-confidence in elite players is attributed to high levels of experience, mental skills, more success in competitive races and playing logical mental games. It seems that elite athletes develop and maintain their self-confidence through mental readiness practices. In addition, when running races, they do not allow intervening, negative and unrelated thoughts to influence their self-confidence. Elite athletes view mistakes in competitive games as part of the human's mistakes. Additionally, exposing athletes to the programs of intellectual and mental practices from childhood makes this possibility that it exerts positive effects on their self-confidence level and this can be transferred to sport experiences in adulthood [13]. The results of this hypothesis conform to the results of studies conducted by Soltani (2013), Esfahani (2010) and Bahram (2004).

The fourth purpose of this research is to compare situational factors of elite and non-elite futsal players, in which the one-way analysis of variance showed that there is a significant difference between the average score of situational factors of elite and non-elite players. Since elite players have been more exposed to psychological training and mental skills practicing for the sake of achieving high levels of competition, it seems that they are more compatible with situational factors and environmental conditions of the competition including performance requirements of individuals and the team, competitor's ability and strength, significance of the results for the team, previous performances, importance of the event, etc. In other words, they are well aware of the strategies of confronting critical conditions and stressors. They also do not allow anything that negatively affects their self-confidence in competitive situations. The results of the first, second and third hypotheses of this research confirm this assumption. Moreover, exposing athletes to the programs of intellectual and mental practices from childhood makes this possibility that it exerts positive effects on their self-confidence level and this can be transferred to sport

experiences in adulthood [13]. Conducting more studies about the purpose of this research seems to be necessary because of the inadequate literature review.

The fifth, sixth and seventh purposes of the present research were to determine the relationship between competitive state anxiety (cognitive anxiety, somatic anxiety and self-confidence) and situational factors in elite futsal players. Pearson's correlation coefficient showed that there is no significant correlation between cognitive anxiety, physical anxiety and self-confidence of elite players and situational factors.

Considering the negative, weak relationship between the intended situational factors of this study and physical and cognitive anxiety, it seems that even the high average scores and positive situational factors do not lead to increase or decrease of anxiety levels, or they do not have any cause and effect relationship with anxiety reduction. It seems that changes in cognitive and physical anxiety levels are more related to personality traits, individual differences and or trait anxiety levels. Since there is little literature regarding the results of these hypotheses outside of our country and there is no literature about this topic inside our country, conducting more studies on this subject seems to be necessary.

The eighth, ninth and tenth purposes of the present research were to determine the relationship between competitive state anxiety (cognitive anxiety, physical anxiety and self-confidence) and situational factors in non-elite futsal players. Pearson's correlation coefficient showed that there is no significant correlation between cognitive anxiety, physical anxiety and self-confidence of non-elite players and situational factors. Although the researcher predicted that there should be a strong relationship between high levels of anxiety in non-elite futsal players and situational factors – because non-elite athletes do not have enough and the required experience in many of the sport events, are not matured mentally, are excessively excited and anxious when facing environmental conditions of the competition, and consider anxiety as a prohibitive factor the researcher found a very weak relationship between competitive state anxiety and situational factors. This assumption is reinforced that each individual's personality essence and trait anxiety, play a decisive role in anxiety levels.

#### **Conclusion:**

Although competitive state anxiety is part of sport competition, the levels of state anxiety subscales in elite and non-elite athletes was different in the present study. Elite athletes experienced lower levels of cognitive anxiety and average levels of somatic anxiety compared with non-elite players. It seems elite athletes can manage and interpret anxiety well with respect to their experiences and more physical and psychological intervention so consider anxiety and situational variables as facilitative factors for their competition.

#### **Conflict of interests**

The authors declare that there is no conflict of interests.

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### Information about the authors:

**Hassan Habibi**; <http://orcid.org/0000-0002-5827-398X>; [hsn\\_habibi55@yahoo.com](mailto:hsn_habibi55@yahoo.com); Department of Physical Education and Sport Sciences, Mashhad Branch, Islamic Azad University; Mashhad, Iran.

**Amir Moghaddam**; <http://orcid.org/0000-0002-6324-2758>; [moghaddam.a@mshdiau.ac.ir](mailto:moghaddam.a@mshdiau.ac.ir); Department of Physical Education and Sport Sciences, Mashhad Branch, Islamic Azad University; Mashhad, Iran.

**Hossein Soltani**; <http://orcid.org/0000-0003-3985-2385>; [soltani\\_hn@yahoo.com](mailto:soltani_hn@yahoo.com); Department of Physical Education and Sport Sciences, Torbat-e Heydarieh Branch, Islamic Azad University; Torbat-e Heydarieh, Iran.

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# Classification of 11-13 yrs girls' motor fitness, considering level of physical exercises' mastering

Ivashchenko O.V.

*H.S. Skovoroda Kharkiv National Pedagogical University*

## Abstract

**Purpose:** to determine the prospects of classification of 11-13 yrs girls' motor fitness, considering level of physical exercises' mastering.

**Material:** in the research 11 yrs girls (n=51), 12 years (n=54) and 13 years girls (n=63) participated.

**Results:** first function explains results' variation by 76.7%, second – by 23.3%. It witnesses that it is possible to classify girls' age distinctions, basing on motor fitness testing, considering level of physical exercises' mastering. Structural coefficients of first canonic discriminant function points that substantial difference between 11 and 12-13 yrs girls is observed in levels of speed, dynamic and static power; in motor coordination and level of acrobatic exercises' mastering.

**Conclusions:** analysis of canonic discriminant function's coefficients showed that system of children and adolescents' physical education has hierarchic structure. In this system, training of motor abilities depends on formation of motor skills.

**Keywords:** motor abilities, level of mastering, discriminant analysis, girls.

## Introduction

The problem of schoolchildren physical education's optimization has been remaining relevant during recent decades. Demand in seeking new approaches to physical culture planning in comprehensive educational establishments is pointed at by researches of scientists [9]. The authors found tendencies of pupils' functional state changes, depending on systemic character of physical culture trainings and motor functioning in vacations. It was determined that planning of educational process requires certain periodizing of pupils' physical training according to their adaptation potentials [9]. I. Bondar points at relevance of integrative physical education of different health groups' pupils [1]. Yu. Vaskov regarded theoretical aspects and conditions of implementation in educational process such innovative approaches as cultural, competence, synergetic, axiological and achmeological. The author opened ways of the mentioned approaches' implementation in real educational process. The author proved, that implementation of innovative approaches facilitate improvement of educational process's organization on the base of personality-oriented approach to pupils [2].

In schoolchildren's physical education there are other directions, connected with study of the following: training of strength [5, 7]; schoolchildren's functional and coordination fitness [6] gymnastic exercises' training [17]; mastering of gymnastic and light athletic exercises [20, 28]. The authors found: special aspects of functional, coordination and power fitness of children and adolescents [4, 11]; they determined dependence of power loads' training effects on regimes of exercises' fulfillment and rest [18, 23]. The process of motor actions training was studied from positions of inter-disciplinary connections. Influence of training methodic for skills and abilities with application of inter-disciplinary connections on motor

fitness in light athletic was found [12, 13]. In other studies it was determined: special aspects of verbal information influence on formation of children's and adolescents' motor skills [14]; formation of motor competence [15]; formation of meta-cognitive behavior [16]; verbal perception in the process of sport movements' mastering [19]; optimization of exercises' repetition regimes and rest intervals in motor skills' formation [20, 26, 28].

In available scientific literature there are a few data about wholeness of motor skills' training and education of children and adolescents [27, 29]. Thus, study of prospects of classification of 11-13 yrs girls' motor fitness, considering mastering level of physical exercises, is rather relevant.

*The purpose of the research* is to study the prospects of classification of 11-13 yrs girls' motor fitness, considering level of physical exercises' mastering.

## Material and methods

**Participants:** in the research 11 yrs girls (n=51), 12 years (n=54) and 13 years girls (n=63) participated.

**Organization of the research:** we registered: body height, body mass, vital capacity of lungs, right and left hand dynamometry. Results of the following tests were registered: "Pressing ups in lying position, times", "Chin ups in lying position, times", "Legs' rising on wall bars, times", "Angle, resting on parallel bars, sec.", "Torso rising in sitting position from lying position during 1 min., times", "Forward torso bending from sitting position with legs apart, cm", "Hanging on bent arms, sec.", "Torso rising from lying on abdomen position during 30 sec., times", "Long jumps from the spot, cm", "Throw of filled ball (1 kg) from sitting position, cm", "Shuttle run 4x9 m, sec" [25].

Mastering of gymnastic exercises was found with the following: "Forward roll", "Backward roll", "Vault", "Rope climbing, three times", "Bridge", "Stance on

shoulder blades” [27].

*Statistical analysis:* processing of the research material was carried out with the help of IBM SPSS 20 program. Discriminant analysis helped to create prognostic model of belonging to group. This model builds discriminant function (or set of discriminant functions, if they are more than two) in the form of predictors-variables linear combination. It ensures the best groups’ distribution. These functions are built basing on set of observations, belonging to groups of which is known. Further, these functions can be applied to new observations with known predictors-variables and unknown group belonging.

For every canonic discriminant function we calculated own value, dispersion percentage, canonic correlation, Wilks’ Lambda,  $\chi^2$ - Chi-square.

### Results

Results of the research are presented in tables 1-5.

The first canonic function explains variation of results by 76.7 %; the second – by 23.3 %. It witnesses about high informational potential of first and second canonic functions ( $r_1 = 0.919$ ;  $r_2 = 0.789$ ) (see table 1). In table 2 we give material of canonic functions’ analysis. The first line contains value  $\lambda=0.059$  and statistical significance  $p=0.001$  for all set of canonic functions. The second line contains the data after excluding first function ( $\lambda=0.378$ ;  $p=0.001$ ). The first and the second functions have high discriminant potential and meaning in interpretation in respect to general communality.

In table 3 normalized coefficients of canonic discriminant function are given. In the first canonic function with the highest contribution variables, which characterize physical condition, dynamic and static strength, are included. In the second canonic function with the highest contribution variables, which characterize speed-, dynamic and static strength, motor coordination and level of acrobatic exercises’ mastering, are included.

Structural coefficients of first discriminant function (coefficients of variables’ correlation with function) witness that this function is most of all connected with the following variables: physical condition; speed-, dynamic and static strength; level of physical exercises’ mastering. Structural coefficients of second discriminant

function points that this function is mostly connected with flexibility and level of “Stance on shoulder blades” mastering (see table 3).

In table 4 we present results of classification of girls’ motor fitness, considering level of physical exercises’ mastering: 95.8 % of outcome grouped observations are classified correctly. Thus, canonic discriminant function can be used for determination of special aspects of control over training process and development of children’s and adolescents’ motor skills.

Diagram in fig. 1 witnesses about density of objects inside every class and about expressed boarder between classes. On positive pole of first function there are centroids of 13 yrs girls’ state; on negative pole - there are centroids of 1q yrs girls’ state. It shows that classification of 11-13 yrs girls’ motor fitness, considering the level of physical exercises’ mastering, permits to regard system of children’s and adolescents’ physical education as a hierarchic system. In this system development of motor abilities obeys to the process of motor skills’ formation (see fig. 2).

### Discussion

In the present research we regarded assumption about wholeness of motor abilities’ development and training from positions of systemic approach [3, 8].

Earlier it was found that results’ variation in total dispersion of 11-13 yrs girls by 81.259%, 79.353%, and 71.019% depends on motor fitness and level of physical exercises’ mastering. In factorial structure level of physical exercises’ mastering contributes 16.435% (11 yrs), 27.963% (12yrs) and 17.010% (13 years). Analysis of communalities showed that in 11-13 yrs girls development of motor abilities is effective [31]. The given results characterize connections of functioning (by terminology of systemic approach) [3].

The received data characterize connections of development and point that system of children’s and adolescents’ physical education has hierarchic structure. In this system motor abilities’ development obeys to process of motor skills’ formation (see fig. 2).

The mentioned data supplement results of Xu X. [30] and Ye. Repko about influence of physical characteristics on motor skills’ formation in primary schoolchildren [10];

**Table 1.** Canonic discriminant function. Own values

Function	Own values	% of explained dispersion	Cumulative %	Canonic correlation
1	5.430	76.7	76.7	.919
2	1.645	23.3	100.0	.789

**Table 2.** Canonic discriminant function. Wilks’ Lambda,

Functions’ check up	Wilks’ Lambda,	Chi-square.	Degrees of freedom	p
from 1 to 2	.059	437.819	44	.000
2	.378	150.297	21	.000

**Table 3.** Coefficients of canonic discriminant function

№		Normalized coefficients		Structural coefficients	
		Function 1	Function 2	Function 1	Function 2
1	Body height, cm	<b>.341</b>	-.152	.444*	-.022
2	Body mass, kg	-.123	-.117	.262*	-.011
3	Vital capacity of lungs (VCL) cm <sup>3</sup>	.102	.232	.258*	-.056
4	Right hand dynamometry, kg	.159	.000	.316*	-.080
5	Left t hand dynamometry, kg	-.088	-.109	.268*	-.130
6	Pressing ups in lying position, times	-.472	.081	.222*	-.092
7	Chin ups in lying position, times	.245	<b>-.446</b>	.436*	-.085
8	Legs' rising on wall bars, times	-.244	<b>.688</b>	.213*	.049
9	Angle, resting on parallel bars, sec.	<b>-.536</b>	<b>-.406</b>	-.070*	-.200
10	Torso rising in sitting position from lying on back position during 1 minute, times	<b>.455</b>	-.379	.298*	-.234
11	Forward torso bending from sitting position with feet apart, cm	.008	.513	-.017	.362*
12	Hanging on bent arms, sec.	<b>.469</b>	.159	.390*	.050
13	Torso rising from lying on abdomen position during 30 sec., times	.548	-.149	.405*	-.271
14	Long jump from the spot, sm	.059	<b>.554</b>	.369*	.343
15	Throw of filled ball (1 kg) from sitting position, cm	<b>.490</b>	.354	.519*	.243
16	Shuttle run 6ir 4x9 m, sec.	-.181	<b>.471</b>	-.231*	.249
17	Forward roll, mastering level	-.184	<b>.579</b>	.198*	-.052
18	Backward roll, mastering level	.184	<b>-.446</b>	.260*	-.162
19	Vault, mastering level	-.060	-.138	.288*	-.023
20	Rope climbing three times, mastering level	-.133	.188	.224*	-.078
21	Bridge, mastering level	<b>-.464</b>	.068	-.016*	-.109
22	Stance on shoulder baldes, mastering level	.042	-.366	.249	-.300*

**Table 4.** Results of classification

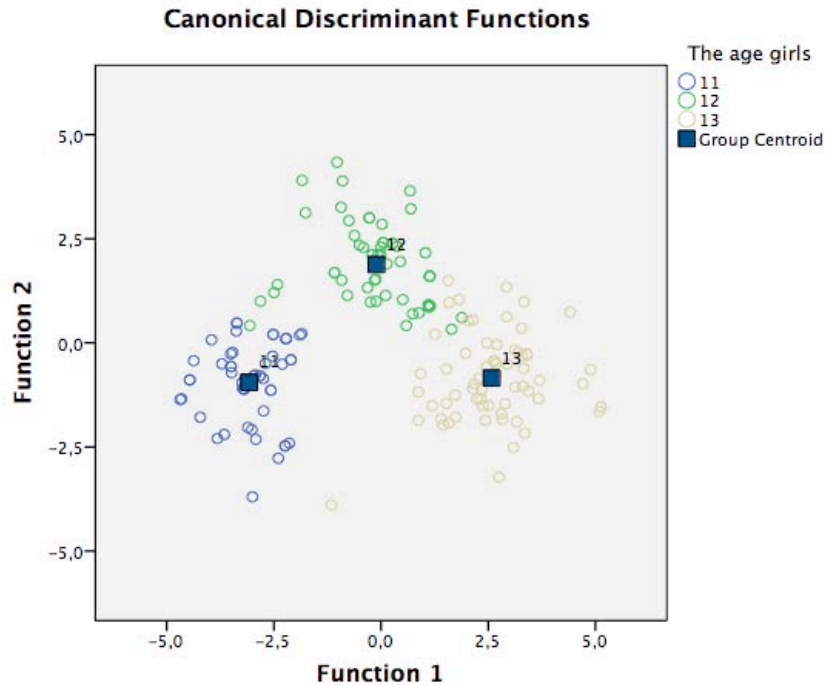
	Age	Predicted belonging to group			Total	
		11,00	12,00	13,00		
Outcome data	Frequency	11.00	51	0	0	51
		12.00	2	50	2	54
		13.00	1		2	63
		11.00	100.0	.0	.0	100.0
	%	12.00	3.7	92.6	3.7	100.0
		13.00	1.6	3.2	95.2	100.0

Khudolii O.M. about factors, influencing on effectiveness of gymnastic exercises' mastering [28].

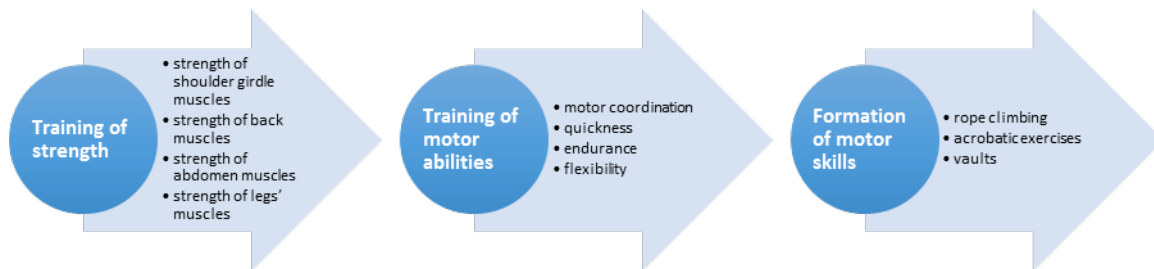
The fulfilled discriminant analysis permitted to regard the processes of motor abilities' development and training as one. It supplements the data of other authors [21, 22] about effectiveness of multi-dimensional analysis application in physical education. Analysis of canonic function's normalized and structural coefficients permitted to find the role of one or another indicator in the structure of the process. It points at need in application of multi-dimensional methods of mathematical statistic in studying laws of children's and adolescents' physical education [24, 25].

Analysis of first and second canonic functions showed that in classification of 11-13 yrs girls' motor fitness it is necessary to consider the level of physical exercises' mastering. In table 5 we present point-by-point statistics of classification of 11-13 yrs girls' motor fitness. These data witness that 95.8% of outcome grouped observations were classified correctly.

So, discriminant analysis permitted to answer the question: how confidently it is possible to separate one class from other basing on set of offered variables; which of these variables influence the most substantially on recognition of classes; to which class object belongs on the base of discriminant variables.



**Fig.1** Canonic discriminant functions. Diagram of results of classification of 11-13 yrs girls’ motor fitness, considering the level of physical exercises’ mastering



**Fig. 2.** Diagram of motor abilities’ development and process of motor skills’ formation in 11-13 yrs girls

**Table 5.** Point-by-point statistics

Observation number	Actual group	The most confident group		P(G=g   D=d)	Square of Mahalanobis distance to center
		Predicted group	P(D>d   G=g) p +		
1	11	11	.861 2	1.000	.300
2	11	11	.218 2	.812	3.051
3	11	11	.237 2	1.000	2.879
4	11	11	.995 2	1.000	.010
5	11	11	.404 2	.934	1.810

**Conclusions**

Normalized coefficients of canonic discriminant function permit to find correlation of variables’ contribution in function’s result. The first function explains results’ variation by 76.7% (p<0.001), the second – by 23.3% (p<0.001). It proves that it is possible to classify age distinctions of 11-13 yrs girls, basing on motor fitness testing, considering level of physical exercises’ mastering..

Structural coefficients of first canonic discriminant function point that significant difference between 11 and 12-13 yrs girls is observed in the following: speed-, dynamic and static strength; motor coordination and mastering of acrobatic exercises. Structural coefficients of second canonic discriminant function point that substantial difference between 12 and 13 yrs girls is observed in flexibility and level of “Stance on shoulder blades” mastering.

Analysis of canonic discriminant functions' coefficients shows that the received data characterize correlations of development. System of children's and adolescents' physical education has hierarchic structure, in which development of motor abilities obeys to motor skills' formation.

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#### Conflict of interests

The author declares that there is no conflict of interests.

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**Information about the author:**

**Ivashchenko O.V.;** <http://orcid.org/0000-0002-2708-5636>; [tmfv@tmfv.com.ua](mailto:tmfv@tmfv.com.ua); H.S. Skovoroda Kharkiv National Pedagogical University; Alchevskiyh str. 29, Kharkov, 61002, Ukraine.

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# Influence of physical culture innovative means on functional state of second maturity women

Konakova O.Y.

*Dnipropetrovsk State Institute of Physical Culture and Sport*

## Abstract

**Purpose:** to find influence of physical culture innovative means (combination of “Pilates” – exercises for body and mind – and program “Port de bras” (movements of arms and body)) on functional state of second maturity women.

**Material:** 22 women of age from 50 to 55 were tested; they were divided into main and control groups. Control group practiced health related swimming; experimental group was trained by system “Pilates” and program “Port de bras” with application of special equipment.

**Results:** it was found, that for confident changes in women’s functional systems it was necessary to practice trainings in zone of sub-maximal load (75-85% from maximal oxygen consumption); trainings in zone of low intensity do not give confident health related effect.

**Conclusions:** At low and below average women’s physical fitness it is necessary to practice health related trainings in zone of low intensity (mean heart beats rate -90-115 beats per minute). For increasing trainings intensity it is necessary to raise women’s physical fitness.

**Keywords:** functional state, Pilates, Port de bras, women, maturity

## Introduction

Physical culture plays important role in women’s health improvement, in prevention from too early ageing and maintaining women’s high workability during all life span [3, 6, 10]. Traditional physical education means can not completely ensure high effectiveness of health improvement process for different population strata [20-22]. It forces physical culture establishments to implement innovative physical culture means in trainings. They imply combining of already existing fitness programs of different orientation. In this connection researches, directed at scientific substantiation of health related fitness for different population categories, become still more relevant [7, 8, 10, 17].

Specialists determined positive influence of health related fitness of physical condition of second maturity women:

- “Pilates” (complex of physical exercises, invented by German sportsman Joseph Pilates at the beginning of 20<sup>th</sup> century, is a combination of Yoga, ballet, and isometric exercises and permits to improve external breathing functioning (lungs’ ventilation function) in 36-55 years’ age women [1];

- “shaping” – a kind of rhythmic gymnastic, directed at changing of body shape. It effectively influenced on morphological functional indicators of this age women. Scientific data witness about confident reduction of body mass, fat percentage in organism, waist, thigh and arm circumferences. Blood pressure, heart beats rate in relaxed state significantly reduced. It positively influenced on women’s cardio-vascular system [15];

- athletic gymnastic effectively influenced on anthropometrical and functional indicators of 35-45 years age women. It reflected in reduction of body mass, subcutaneous fat indicators. Vital capacity of lungs confidently increased. Besides, heart beats rate indicators and blood pressure in relaxed state reduced [13];

- power trainings with dump bells and rubber strips of different tension positively influenced on indicators of second maturity women’s physical fitness [14];

- combination of “Pilates” and aqua-aerobic means with application of special equipment in trainings of 36-55 years’ age women permitted to improve their health. It reflected in confident reduction of heart beats rate and blood pressure; in increase dynamometry and respiratory system indicators; in reduction of body mass and circumferences. Besides, physical fitness confidently improved: endurance, flexibility, coordination, strength [16];

- “Pilates” trainings permitted to find positive dynamic of mature women’s health [11, 18];

- exercises of this system permitted to avoid pains in muscular skeletal apparatus, that influenced on mature people’s life quality [19, 25].

In other studies positive influence of “Pilates” and “Port de Bras” trainings (Port de Bras is a term from choreography and means “movement of arm and body”) on some physical fitness indicators was determined [8]. However, we did not find any works devoted to combining of “Pilates” and “Port de Bras” and their influence on functional state of second maturity women. So our researches will permit to assess effectiveness of such kind of fitness.

*The purpose of the research* is to find influence of physical culture innovative means (combination of “Pilates” – exercises for body and mind – and program “Port de bras” (movements of arms and body)) on functional state of second maturity women.

## Material and methods

**Participants:** 22 women of age from 50 to 55 were tested; they were divided into main and control groups.

**Organization of the research:** control group practiced health related swimming during all periods (10 minutes – warming up; general exercises in gym; 40 minutes – main

part: swimming by “breast stroke” style at moderate and slow temp; final part – swimming at slow temp).

Main group was trained by “Pilates” system. In preparatory period they used exercises on floor (Pilates Mat Work – complexes of exercises to be fulfilled on gymnastic mat in lying or sitting position. Such exercises are targeted at different aims: stimulation of cardiovascular system, improvement of oxygen metabolism, improvement of joints’ mobility. In main period: 20% - practiced exercises on floor and 80% – used special equipment (rubber strips, gymnastic sticks, fit balls and functional loops). Program “Port de Bras” was applied in warming up and dancing-choreographic components. All trainings were pointed at cardio vascular system’s training, development of muscular strength, posture correction, improvement of joints’ mobility. The researches were conducted on the base of dance studio of social dances.

Cardio-vascular functional state was determined by heart beats rate indicators (in relaxed state per one minute; recreation time after 20 squatting during 30 seconds). Blood pressure was registered by Korotkov’s method with medical tonometer [2].

On the base of women’s physical condition indicators we offered health related trainings, based on “Pilates” system (with application of special equipment) and “Port de Bras” program. It should be noted that in all women physical fitness (on the base of pedagogic testing) was low or below average. It was the reason of trainings’ practicing in zone of low intensity (mean heart beats rate – 90-115 beats per minute).

The program consisted of two periods: preparatory and main. The quantity of trainings in every period – was twice a week, 60 minutes each. The training consisted of three parts: warming up – 10 minutes with heart beats rate 80-100 bpm; main part – 35 minutes with HBR - 100-115 bpm,; and final part – 15 minutes (heart beats rate 80-90 beats per minutes). Macro cycle lasted 10 months. Fitness training consisted of the following components: warming up, dancing-choreographic, power training, stretching and recreation. In preparatory period (1 month) and in main (9 months) we used “Port de Bras” and “Pilates” systems.

“Port de Bras” exercises (including choreographic and fitness elements) were practiced in two periods and included: arms’ waving, bending, squatting, dancing

step. Exercises with complex coordination were not used. The purpose of such loads was cardiovascular system’s training, improvement of joints; mobility, coordination training. Distinctive feature of preparatory period was that exercises were used without special equipment. Special attention was paid to mastering main principles of “Pilates” system and self-control.

In main period (by “Port de Bras” program) load was increased at the account of exercises’ coordination complexity. “Pilates” exercises were fulfilled with special equipment: rubber strips, gymnastic sticks, fit balls of 55-65 cm diameter (depending on body height) and functional loops. Special attention was paid to correct technique of exercises with equipment.

Rubber strips were used for training back, torso, arms and legs muscles. Balance was trained with ball and exercises for balance. Exercises with functional loops were directed at strength and flexibility training, (in particular flexibility of backbone). Compulsory condition was alternation of exercises: development f strength and stretching with relaxation.

Final part of any period included “Pilates” exercises, pointed at stretching and relaxation. Special attention as paid to breathing exercises. Exercises were selected so that one should smoothly pass to the next. Besides, the exercises were fulfilled without sharp change of position.

*Statistical; analysis:* the processing of the received data was fulfilled with standard Microsoft Excel programs. We found Student’s t-criterion for statistic verification of differences’ confidence between control and experimental groups’ indicators.

## Results

As a result we found that heart beats rate indicators in relaxed state were from 60 to 80 beats per minute; blood pressure– 100/60-120/80 in both groups. It means that indicators of 50-55 years’ age women (see table 1) were within age standard [2, 9, 12]. Indicator of heart beats rate recreation was below average in all women (from 2 to 3 minutes) [2].

Analysis of second mature women’s functional state showed that health related trainings positively influenced on cardio vascular system of both groups’ tested. However, we did not find any confident changes between main and

**Table 1.** Functional indicators of the tested at the beginning of experiment

Description	Main group (n=11)			Control group (n=11)			p
	$\bar{X}$	$\sigma$	m	$\bar{X}$	$\sigma$	m	
HBR in relaxed state (bpm)	71.82	9.07	2.73	73.66	4.81	1.44	≥0.05
BP syst., (mm merc. col)	116.64	11.22	3.38	115.03	8.99	2.71	≥0.05
BP diast., (mm merc. col)	76.91	9.28	2.80	75.90	8.74	2.62	≥0.05
Recreation time after 20 squatting during 30 seconds (min/sec)	2.50	0.98	0.29	2.58	2.06	0.62	≥0.05

*Notes:* HBR, bpm – heart beats rate per one minute; BP syst., mm mecr.col. – systolic blood pressure, millimeters of mercury column; BP diast., mm mecr.col. – diastolic blood pressure, millimeters of mercury column;  $\bar{X}$  – mean arithmetic value;  $\sigma$  – mean square deviation; m – standard error of mean arithmetic.

**Table 2.** Functional indicators of the tested after experiment

Description	Main group (n=11)			Control group (n=11)			p
	$\bar{X}$	$\sigma$	m	$\bar{X}$	$\sigma$	m	
HBR in relaxed state (bpm)	71.09	9.54	2.88	72.80	4.12	1.24	≥0.05
BP syst., (mm merc. col)	114.06	10.67	3.22	114.01	9.89	2.99	≥0.05
BP diast., (mm merc. col)	76.82	10.50	3.16	75.00	10.04	3.02	≥0.05
Recreation time after 20 squatting during 30 seconds (min/sec)	2.44	0.99	1.03	2.38	3.09	0.93	≥0.05

Notes: HBR, bpm – heart beats rate per one minute; BP syst., mm mecr.col. – systolic blood pressure, millimeters of mercury column; BP diast., mm mecr.col. – diastolic blood pressure, millimeters of mercury column;  $\bar{X}$  – mean arithmetic value;  $\sigma$  – mean square deviation; m – standard error of mean arithmetic.

control groups ( $p \geq 0.05$ ). It can be explained by the fact that at the beginning of experiment in all women heart beats rate in relaxed state was within age standard. In such age period it is very important to keep such results.

Besides, substantial factor was also that health related training were conducted in zone of low intensity (mean heart beats value was 90-115 beats per minute) during all period of health related training. It did not permit to assess confidently the changes in women's functional indicators.

### Discussion

The fulfilled research supplements and proves the data of special literature: with age functional reserves of cardio-vascular system reduce in second mature women [5, 6, 9]. It negatively impacts their health [3, 4]. So, in this age it is important not to admit reduction of organism's functional potentials, in particular cardio-vascular system of women [6, 9].

A number of scientists found "Pilates" system's positive influence on physical fitness of second mature and elderly women: increase of flexibility, strength, power endurance and coordination indicators [23, 26, 27].

The results of our work prove scientific literature data: for confident changes in functional systems of second maturity women it is necessary to conduct trainings in zone of sub-maximal loads (75-85% from maximal oxygen consumption); trainings in zone of low intensity do not result in confident health related effect [15, 16, 18].

Thus we may conclude that in our work we developed the data, concerning functional state of second maturity

women [1, 15, 16].

For the first time, we used combination of aerobic and power oriented program "Port de Bras" and "Pilates" system (with application of equipment) at health related trainings of second maturity women. Besides, it was found that combination of such health related programs positively influenced on functional state of 50-55 years' age women.

### Conclusions

Application of physical culture innovative means ("Pilates" system and "Port de Bras" program) with special equipment) positively influenced on second maturity women's functional state. With low and below average physical fitness level of these women it is necessary to conduct health related trainings in zone of low intensity (mean heart beats value - 90-115 beats per minute) for increasing training intensity it is necessary to raise women's physical fitness level.

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### Conflict of interests

The author declares that there is no conflict of interests.

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**Information about the author:**

**Konakova O.Y.;** <http://orcid.org/0000-0003-1786-3147>; [ladc@ukr.net](mailto:ladc@ukr.net); Dnipropetrovsk State Institute of Physical Culture and Sport; Str. Donetsk Highway 2, 123, Dnepropetrovsk, 49080, Ukraine.

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# Potentials of speech disorders correction in 4-6 yrs children by means of ergo and art therapy

Petrenko N.B., Filippov M.M.

National University of Physical Education and Sport of Ukraine

## Abstract

**Purpose:** to work out methodic of speech disorders correction in 4-6 yrs children by ergo and art therapy means.

**Material:** during academic year three groups of children (n=97) were being observed: two groups – with speech disorders (control and main) and one group of healthy children. Psycho-motor and cognitive functions were assessed with the help of tests for motor coordination (speed of their fulfillment, verbal thinking).

**Results:** it was found that characteristic feature of such children is critical estimation of own speech insufficiency and conscious avoiding oral answers. By cluster analysis results increase of homogeneity in psycho-physical condition's positive changes, cognitive functions and dance abilities resulted from dance-correction training program were shown.

**Conclusions:** the worked out dance-correction choreographic trainings helps in the following: developing rhythm sense; strengthening of skeleton and muscles; memory, attention, thinking and imagination simulation. Acquiring of such experience will help a child to further successfully train different art-creative and sports kinds of activities; to master choreography and gymnastic as well as different musical instruments.

**Keywords:** preschool children, speech disorders, psycho-motor qualities, cognitive functions, therapy.

## Introduction

It is known that human speech is one of the most important components of psychic functions for children. It is a basis of consciousness and social adaptation formation. In the age from 4 to 6 years a child accumulates certain motor skills, that creates a foundation for targeted pedagogic influences [7, 28]. Since long ago it has been known, what great potentials are in synthesis of music and movements. Besides, influence of different cognitive and emotional-moral educational means was found: reading [1, 3, 4]; folk tales [4, 12]; music and dances [6, 22]; amateur theatre performances [17]; sports practicing and computer technologies [26]. Musical rhythmic movements are a synthetic kind of activity; they are of special importance for children. Such motor exercises train brain and nervous processes mobility [6, 21, 30]. With it organization of motor functioning with the help of musical rhythm develops children's memory, attention and self-concentration. It facilitates formation of targeted functioning [2, 9, 13, 19].

Especially important and relevant is the problem of children's with speech disorders education. It touches the questions of child's pedagogic and psycho-physical development. It is known that speech defects hinder from cognitive functioning, form neurological disorders, isolation and alienation; restrict communication with peers. [3, 9, 14, 18]. After entering preschool establishments, such children are enlisted in general group. It should be noted that children with speech disorders often suffer from deficit of fine motor skills [23-25, 29]. In other work art-therapy positive influence on adaptation of schoolchildren, living in stress conditions, was determined [16]. Some other authors offer a number of game therapy measures, which can facilitate strengthening of emotional links in families with children of 4-6 yrs age [32]. Game therapy influences on children's progress to the largest extent. It

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is especially important for 5-6 yrs children who live in societies with low economical level [15]. In other study potentials of complex game and work therapy are shown [20]. In all such cases parents play the most important role [27].

All above said permits to assume that for children with speech disorders dance-cognitive choreographic trainings with sport dances elements, role game exercises with objects, dance gymnastic, musical games, breathing exercises, creative gymnastic and so on can serve as promising rehabilitation means. The mentioned above practices ensure training of memory, attention, self-concentration, formation of creativity [2, 9, 19, 28].

*The purpose of the research* was to work out methodic of speech disorders correction in 4-6 yrs children by ergo and art therapy means.

## Material and methods

**Participants:** three groups of children (n=97) were being observed: two groups – with speech disorders (control and main) and one group of healthy children. Control group and group of healthy children were trained by program "Children's choreography", recommended by Ministry of education and science of Ukraine [12]. In main group we conducted trainings with complex of ergo and art therapy means. The word "ergo-therapy" derives from Latin "ergon" – work. Art therapy implies treatment with art means.

**Organization of the research:** psycho-motor and cognitive functions were assessed with the help of tests for motor coordination (speed of their fulfillment, verbal thinking) (methodic of Ya. Yerasyk) [7]; rhythm-motor abilities [6, 22]. Assessment in points was realized in the following way: high level – 9-10 points; above average – 7-8, average – 5-6, below average – 3-4 and low level – 1-2 points [6].

Assessment of speech was carried out in compliance

with legal standards and diagnostic criteria of main speech disorders, presented in “Professional reference book of pre-school educational establishment teacher – logopedist” (№ 1/11-4593 dt. 28.02.13). The following speech components were assessed; grammar (word changing, when counting objects); sounds’ pronunciation (repeating of sentences); phonematic (listening in and finding object in picture); lexis (name of each picture and reasonable generalization of all pictures); syllable structure of words (correct syllables’ pronunciation in words). Assessment was fulfilled with 10-points scale.

The research was conducted in specialized pre-school educational establishments of Kiev: № 61, 110, 653. Moral ethic standards were observed in compliance with Helsinki declaration (2013). Parents gave written consent for pedagogic observations over physical condition and cognitive progress of their children.

*Organization and content of dance-choreographic trainings:* we worked out choreographic trainings program for one academic year (trainings twice a week, 25-30 minutes each). The trainings stipulated exercises with objects (flags, balls, gymnastic sticks and etc.), sport dances, fit-ball dance gymnastic, role tale-therapy, logo-rhythmic, game fitness, breathing exercises. Before trainings we regularly familiarized children with required elements of musical and choreographic knowledge, dance figures, children fitness and movements with singing.

Choreographic trainings were constructed by the following structure:

- 1<sup>st</sup> part – introductory (4-5) minutes: exercises, influencing on all organism;
- 2<sup>nd</sup> – main (10–12 min.): exercises for arms and legs positions. Rhythmic part was conducted in quick, dynamic temp. We used exercises for backbone plasticity, strengthening of back and abdomen muscles as well as legs muscles;
- 3<sup>rd</sup> – final (8–10 min.): choreographic compositions based on earlier mastered and relaxation exercises.

In all parts of training we applied games and exercises

oriented on speech correction: formation of quickness and accuracy of reaction to sound or verbal signals; mastering of different qualities of attention, all kinds of memory, verbal regulation of actions, based on concordance of words and movements; development of ability to realized planed actions by prearranged signal. Depending on mastering of separate elements we complicated: 1) exercises and figures; 2) added concordance of words and movements; 3) realized of planned actions by prearranged signal; 4) improved visual orientation in space; 5) concentrated on expressiveness of image; 6) created situations for mutual actions and creative tasks.

*Statistical analysis:* was fulfilled with the help of “STATISTICA 10.0” programs [8, 31]. Cluster analysis was fulfilled for determination of the tested groups’ homogeneity. On its base we classified the tested objects and variables in the form of tree (dendrogram) and distributed objects into pre-set quantity of distant from each other classes.

### Results

On initial stage of the research we carried out comparative characteristic of children’s physical condition and cognitive functions. 21% of girls and 20% of boys showed results, corresponding to standards. 27% of girls and 32% of boys could not reach standards (see table 1).

Besides, we found that cognitive functions indicators in children with speech disorders were high in 29% of the tested (19% – boys and 10% – girls); above average – in 19% (9% and 10% accordingly), average – in 13% (7% and 6%), below average – in 20% (10% and 10%) and low level – in 19% (9% and 10%). We also found that children with speech disorders lag behind from healthy children by physical condition and verbal thinking.

Pedagogic observations showed that children with speech disorders differed from healthy peers by some emotional reactions. For sick children critical assessment of their speech insufficiency was characteristic. In this connection such children tried to consciously avoid oral

**Table 1.** Psycho-physical characteristics of 4-6 yrs children

Sex	n	Age	Quickness		Accuracy		Endurance	
			Walk (sec.)	“Lie – stand up” (sec.)	Throws (quantity)	Walk by “checkers” (quantity)	“Lie – stand up” (quantity)	Dynamic (quantity)
Children with speech disorders								
Boys	19	4–5	12,36±0,61	4,20±0,02	1,1±0,01	1,94±0,009	1,89±0,01	11,05±0,51
Boys	29	5–6	11,11±0,57	6,72±0,021	2,44±0,012	2,27±0,013	2,41±0,011	23,44±0,82
Girls	21	4–5	13,47±0,42	5,23±0,02	1,28±0,011	2,0±0,011	0,8±0,003	17,14±0,61
Girls	20	5–6	10,72±0,46	7,2±0,022	2,9±0,012	2,35±0,013	2,45±0,001	26,5±0,78
Healthy children								
Boys	5	4–5	38,2±2,1	15,3±0,12	2,0±0,11	15,6±0,78	1,6±0,02	31,8±2,0
Boys	10	5–6	51,1±2,4	21,3±0,27	2,0±0,09	6,73±0,24	1,0±0,01	89,5±3,4
Girls	5	4–5	34,0±1,75	9,1±0,36	0,7±0,01	5,7±0,43	0,8±0,008	33,6±2,0
Girls	10	5–6	52,9±3,1	29,7±0,41	2,8±0,08	12,8±0,61	1,0±0,01	68,0±2,9

Note: n – quantity

**Table 2.** Psycho-motor progress of 4-5 yrs healthy children and children with speech disorders

Indicators	Maun group (n=12)				Control group (n=18)				Healthy children (n=13)			
	Beginning of academic year		End of academic year		Beginning of academic year		End of academic year		Beginning of academic year		End of academic year	
	$\bar{x}$	$\pm m$	$\bar{x}$	$\pm m$	$\bar{x}$	$\pm m$	$\bar{x}$	$\pm m$	$\bar{x}$	$\pm m$	$\bar{x}$	$\pm m$
Walk by checkers	5,92*	0,54	7,25*	0,56	4,67*	0,39	5,56*	0,35	8,23	0,34	8,31	0,32
Lie- stand up	6,25*	0,5	7,08*	0,52	5,06*	0,33	5,5*	0,37	8,23	0,34	8,31	0,36
Accuracy of ball throws	6,0*	0,41	7,08*	0,45	4,17*	0,41	5,06*	0,44	7,85	0,41	8,15	0,35
Jumps on one and two legs	6,17*	0,54	7,33*	0,57	4,56*	0,38	5,28*	0,41	8,08	0,4	8,31	0,3
Keeping arms with closed eyes	6,0*	0,51	6,92*	0,64	4,78	0,4	5,0	0,46	8,08	0,36	8,08	0,32
Test 1: Keeping arms with closed eyes	5,83*	0,53	6,83*	0,64	4,33*	0,41	4,78*	0,47	8,08	0,36	8,15	0,31
Test 2: touching nose	5,83	0,5	6,83*	0,64	4,39*	0,42	4,89*	0,53	7,46*	0,42	8,15*	0,39
Test 3: jumping	6,17*	0,48	7,08*	0,47	4,83*	0,36	5,33*	0,42	8,08	0,36	8,08	0,32
Test 4: picking coins up in box	6,25*	0,56	7,33*	0,49	5,17*	0,28	5,72*	0,29	8,23	0,38	8,38	0,34
Test 5: drawing circles in the air	6,08*	0,52	7,08*	0,52	5,0*	0,36	5,44*	0,39	8,38	0,32	8,46	0,19
Test 6: hand shaking	6,0*	0,48	7,0*	0,53	4,56*	0,37	5,39*	0,43	8,54	0,25	8,54	0,19

Notes: \* -  $p < 0,05$  confident differences after dance-correction program

answers, though they demonstrated sufficient interest and intelligence when fulfilling tasks.

The fulfilled comparison of children's psycho-physical condition changes under influence of dance-correction program showed that in 4-5 yrs children and in 5-6 yrs children (see table 3) motor actions quickness (walk by checkers, lie- stand up) and endurance (jumps on one and two legs) confidently grew. In control group the progress was less.

The received data about psycho-physical qualities, psycho-motor fitness, cognitive functions and dance abilities were used for determination of children group's homogeneity changes (14 persons). By these characteristics we fulfilled cluster analysis. It showed that at the beginning of academic year 50% of children had values of average level and above average, 42% – below average and average, 8% – below average. The analysis showed that at the end of academic year 71% of children had indicators at average and above average level, 21% – average and below average and 8% – below average (see fig. 1).

Results of this part of the research showed that cluster analysis can be used as the method of choreographic classes' effectiveness. It permits to determine homogeneity

of psycho-physical condition, cognitive functions and dance abilities.

We also assessed correction of speech disorders (see table 4). It was found that in 4-5 yrs children speech grammar component increased by 18%, pronunciation of sounds – by 14%, phonetic – by 16%, vocabulary – by 11%, syllable structure of words – by 8% by the end of academic year. In control group positive changes also took place but they were 2-3 times weaker (accordingly: 9%, 8,5%, 1,5%, 4,5%, 4,5%). Healthy children had high level of speech both at the beginning and at the end of academic year.

In 5-6 yrs children of main group positive changes in speech functions turned out to be even more significant than in 4-5 yrs children (17, 2%, 16,6%, 21,9%, 19%, 17%). It can be explained by the fact that older children's attitude to choreography was more responsible.

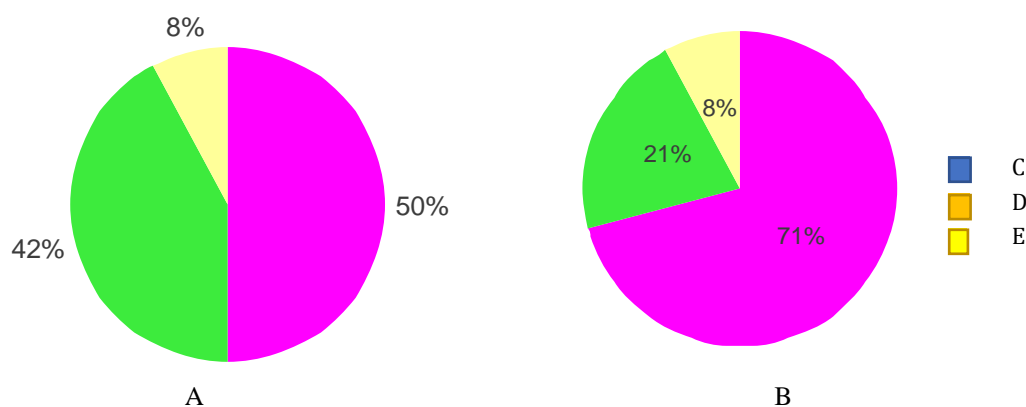
Besides, some positive changes in speech were also registered. At the beginning of academic year it was difficult for children to speak in public. At the end of academic year children were capable to independently realize graduation concert, in which they participated as comperes, song, danced and read poems.

Thus, in 4-6 yrs children with speech disorders we

**Table 3.** Psycho-motor progress of 5-6 yrs healthy children and children with speech disorders

Indicators	Main group (n=14)				Control group (n=16)				Healthy children (n=24)			
	Beginning of academic year		End of academic year		Beginning of academic year		End of academic year		Beginning of academic year		End of academic year	
	$\bar{x}$	$\pm m$	$\bar{x}$	$\pm m$	$\bar{x}$	$\pm m$	$\bar{x}$	$\pm m$	$\bar{x}$	$\pm m$	$\bar{x}$	$\pm m$
Walk by checkers	7,1	0,41	7,4	0,3	6,69	0,45	6,75	0,47	8,21	0,29	8,25	0,31
Lie- stand up	6,9	0,44	7,6	0,14	7,0	0,33	7,25	0,36	8,17	0,3	8,42	0,25
Accuracy of ball throws	5,4*	0,49	6,7*	0,41	6,63	0,46	6,69	0,44	7,42	0,35	7,88	0,28
Jumps on one and two legs	6,6*	0,42	7,6*	0,18	7,31	0,32	7,31	0,34	8,21	0,28	8,33	0,25
Keeping arms with closed eyes	5,8*	0,67	7,1*	0,43	6,75	0,36	7,06	0,39	7,67	0,35	8,04	0,27
Test 1: Keeping arms with closed eyes	6,4	0,55	6,9	0,47	6,88	0,35	7,06	0,37	7,42	0,36	7,63	0,3
Test 2: touching nose	5,6*	0,55	6,8*	0,45	6,56	0,48	6,88	0,44	7,17	0,38	7,33	0,36
Test 3: jumping	6,9	0,37	7,3	0,3	6,75	0,44	6,75	0,46	8,33	0,24	8,42	0,22
Test 4: picking coins up in box	6,9	0,43	7,6	0,14	7,25	0,27	7,38	0,26	7,88	0,3	8,17	0,26
Test 5: drawing circles in the air	6,8	0,39	7,4	0,21	6,69	0,49	6,81	0,41	8,33	0,24	8,38	0,24
Test 6: hand shaking	6,1*	0,4	6,9*	0,4	6,38	0,5	6,44	0,44	8,33	0,24	8,38	0,24

Notes: \* - p < 0,05 confident differences after dance-correction program



**Fig.1.** Change of children’s distribution by homogeneity of the analyzed characteristics (by cluster analysis). A – at the beginning of academic year; B – at the end of academic year; C – average values and above average; D – average values and below average; E – values below average.

registered positive speech changes and favorable psycho-physical progress under influence of the worked out dance-correction program.

**Discussion**

The received results proved relevance of non traditional means and methods application for children’s

musical and aesthetic education. Such approach permits to fill educational process with positive emotions. It enriches to large extent emotional and intellectual progress of a child [3, 9, 17, 30]. Formation of character, cultivation of initiative, and will, manifestation of natural bents are an important factor of children’s somatic health and physical growth [1, 2, 3, 9].

**Table 4.** Speech diagnostic of 4-6 yrs children with speech disorders and healthy

Speech parameters	Main group 4–5 yrs				Control group 4–5 yrs				Healthy children 4–5 yrs			
	Beginning of academic year		End of academic year		Beginning of academic year		End of academic year		Beginning of academic year		End of academic year	
	$\bar{x}$	$\pm m$	$\bar{x}$	$\pm m$	$\bar{x}$	$\pm m$	$\bar{x}$	$\pm m$	$\bar{x}$	$\pm m$	$\bar{x}$	$\pm m$
Grammar	5,5*	0,66	6,58*	0,71	3,94*	0,42	4,33*	0,47	8,54	0,22	8,85	0,28
Pronunciation	5,58*	0,75	6,50*	0,71	4,06	0,40	4,28	0,45	9,38	0,15	9,38	0,15
Phonetic	5,92*	0,64	7,08*	0,69	4,61	0,46	4,67	0,46	9,15	0,23	9,15	0,23
Vocabulary	6,17*	0,69	6,92*	0,64	4,83	0,47	5,06	0,51	8,62	0,38	8,62	0,38
Syllable structure of words	6,67*	0,82	7,25*	0,76	4,61	0,46	4,83	0,49	9,00	0,26	9,00	0,26

Speech parameters	Main group 5-6 yrs				Control group 5-6 yrs				Healthy children 5-6 yrs			
	Beginning of academic year		End of academic year		Beginning of academic year		End of academic year		Beginning of academic year		End of academic year	
	$\bar{x}$	$\pm m$	$\bar{x}$	$\pm m$	$\bar{x}$	$\pm m$	$\bar{x}$	$\pm m$	$\bar{x}$	$\pm m$	$\bar{x}$	$\pm m$
Grammar	6,21*	0,65	7,50*	0,68	5,63	0,34	5,94	0,42	9,08	0,21	9,33	0,17
Pronunciation	6,14*	0,71	7,36*	0,71	5,00*	0,35	5,50*	0,46	9,29	0,18	9,42	0,15
Phonetic	6,14*	0,56	7,86*	0,70	4,63	0,36	4,94	0,39	9,63	0,10	9,63	0,10
Vocabulary	6,36*	0,55	7,93*	0,65	5,69	0,29	5,94	0,37	9,42	0,17	9,58	0,12
Syllable structure of words	7,00*	0,57	8,43*	0,62	6,19*	0,36	7,13*	0,50	9,92	0,06	9,92	0,06

Notes: \* -  $p < 0,05$  confident differences after dance-correction program

In this aspect the worked out by us dance-correction choreographic classes helped to creatively realize this demand; to develop sense of rhythm and strengthen skeleton and muscles; to stimulate memory, attention, thinking and imagination [7]. Such experience can help a child to successfully master different creative-art and sport kinds of activities, to train choreography and gymnastic; to master musical instruments. Dance-correction exercises facilitate activation of short term and long term memory (cognitive elements) for reproduction dance figures. Such exercises actively influence on motor neurons of cortex and develop motor centers [11, 26, 30]. It is known that music is perceived by both semi-spheres [30]. That is why with correctly organized choreographic trainings in cortex complex functional system of focuses can appear. It is conditioned by interconnected activity in different sensor (hearing, visual, tactile, pro-prioceptive and etc) and in motor and frontal sectors of both semi-spheres. It also relates to Brock's area, which participates in speech formation [6, 30]. Constant changes of dance compositions and rhythms stimulate brain neurons for re-switching and, thus, develop functional mobility of nervous processes [17, 22, 28]. With it specially selected music optimizes brain functioning and facilitates development of verbal and non-verbal intellect.

Thus, it was found that application of the worked out by us means and techniques of correcting orientation ensure achievement of the set target. Such approach contains element of novelty. We supplemented and

expanded results of other scientists. We showed potentials of children's psycho-physical development through including fit ball dance gymnastic, game fitness, logorhythmic in typical program of children choreography [3, 9, 13]. Besides, we supplemented information about positive changes in static and dynamic coordination [7]. Results of a number of authors about need in complex and rational correction methods' application in preschool education were supplemented. Such approach results in increase of cognitive functions, physical qualities and psycho-physical condition effectiveness in preschool children with speech disorders.

The presence of preschool children's certain motor skills creates a basis for targeted pedagogic influences. Musical-rhythmic movements train brain, increase mobility of nervous processes. We can surely assume that dance-choreographic classes with application of ergo and art therapy can become an efficient rehabilitation mean for children with speech disorders.

It is assumed that correctly organized dance-correction work with preschool children will permit them to master successfully different creative-art and sport activities in the future; will help them to further master choreography, gymnastic, musical instruments and etc.

#### Conclusions:

1. The fulfilled comparison showed that physical condition and psycho-physical growth of preschool children with speech disorders lagged behind healthy

children. Characteristic feature of such children is critical attitude to own speech insufficiency and conscious avoiding oral answers.

2. Positive changes in 4-6 yrs children with speech disorders under influence of choreographic classes, base on dance-correction program, were registered.

3. Cluster analysis showed increase of homogeneity in positive changes of psycho-physical condition, cognitive functions and dance abilities in children with speech

disorders under influence of dance-correction program of trainings.

4. Positive changes in speech functions under influence of the worked out dance-correction program were registered.

### Conflict of interests

The authors declare that there is no conflict of interests.

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#### Information about the authors:

**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.

**Filippov M.M.;** <http://orcid.org/0000-0001-5096-7445>; filmish@ukr.net; National University of Physical Education and Sport of Ukraine; Fizkultury str. 1, Kiev, 03680, Ukraine.

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## The impact of classical massage on spine mobility

Radziwińska Agnieszka<sup>1</sup>, Weber-Rajek Magdalena<sup>1</sup>, Lulińska-Kuklik Ewelina<sup>2</sup>, Piecka Paulina<sup>1</sup>, Moska Waldemar<sup>3</sup>

<sup>1</sup>*Nicolaus Copernicus University in Toruń, Collegium Medicum in Bydgoszcz, Department of Physiotherapy, Division of Principles of Physiotherapy, Bydgoszcz, Poland*

<sup>2</sup>*Academy of Physical Education and Sport in Gdańsk, Department of Mass Sport, Gdańsk, Poland*

<sup>3</sup>*Academy of Physical Education and Sport in Gdańsk, Department of Tourism and Recreation Management, Gdańsk, Poland*

### Abstract

**Purpose:** Irregularities in movable property of the spine affect a large part of society and the problem affects the people at an increasingly younger age. Classical massage is a form of mechanotherapy that affects the regulation of the work of muscles, joints, tendons and ligaments. The purpose of this study was to evaluate the efficacy of classical massage section of thoracolumbar spine to increase the mobility in these segments.

**Material:** The study was carried out on 36 healthy volunteers (20 women and 16 men) aged 21 to 27 years old (average age - 23.8) who were subjected to a series of five classical massages (according to strictly established protocol). In order to objectify the effects in all subjects before and after a series of treatments the following measurements were made: the fingers-floor test; the Otto -Wurna test; the straightening of the spine; lateral flexion of the spine; twist of the spine.

**Results:** A statistically important difference has been shown in the results of all tested variables before the first and after the last treatment of classical massage.

**Conclusions:** The results of personal research apply to young, healthy volunteers. It is worth to continue research into the effects of this form of therapy in the case of restrictions of movable tangible property, resulting from spinal pain syndromes.

**Keywords:** therapeutic, massage, mobility, spine, disorders, spinal pain.

### Introduction

According to the Global Burden of Disease 2010 study, musculoskeletal loads are the fourth-rate health problem in the world and constitute 20-50% of the population. This problem affects most often: the lower spine, the cervical spine, shoulders and knees [1, 2].

Overloading of the spine can lead to disorders of its movable assets. Irregularities in movable property of the spine affect a large part of society and the problem affects the people at an increasingly younger age. The cause of their occurrence may be lifestyle, which unfortunately still prevails in our society. We are talking about chronic stress, sitting lifestyle and the lack of making physical activity, which in the first phase leads to disorders in the tension of muscles. Long-lasting muscle imbalance causes morphological and structural, that as a result, may lead to pathological static and dynamic stereotypes [3-7]. The muscles subjected to a long-term tension under static conditions become weaker over time, shortened and undergo painful contractures. In their area, some trigger points - places with high touch sensitivity may appear [8-10].

Ottawa Panel defined massage as "soft tissue and joint manipulation using the hands or a handheld device" [11, 12]. Massage improves blood circulation in the tissues, which streamlines the process of removing accumulated waste products and accelerates the regeneration processes. Increasing the activity of the receptors of the skin and the muscle contributes to increased pulsation and cerebral cortex, which normalizes the function of organs. Massage causes the normalization function of vegetative system

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and increase the secretion of certain hormones such as endorphins and/or cortisol. An important aspect of the massage is its positive impact on the psyche of the patient, among others by toning effect on the nervous system [13-18].

*The purpose* of this study was to evaluate the efficacy of classical massage section of thoracolumbar spine to increase the mobility in these segments.

### Material and Methods

**Participants:** The study was carried out on 36 healthy volunteers (20 women and 16 men) aged 21 to 27 years old (average age - 23.8) who were subjected to a series of five classical massages (according to strictly established protocol). Time of a single treatment was 25-30 minutes.

**Research Design:** In order to objectify the effects in all subjects, before and after a series of treatments, the following measurements have been made:

- The fingers-floor test (Thomayer). The purpose of this test is to determine the global ability to perform in front of the slope in the sagittal plane. The examined patient is instructed to stand on the platform, then asked to bend down with the straight knee joints. Then the distance from the third finger to the ground is measured.
- The Otto-Wurna test is used to measure the mobility of the thoracic spine. In order to perform the test, you must specify the location of the Th1, and then measure 30 cm (up to Th12). The patient performs the maximum bend down in front with straight knee joints. The difference, expressed in centimeters is a measure of the movable property of the test section of the spine.

- Straightening the spine. The test is performed in a standing position. The measurement must be made by measuring the distance from the end of the xiphoid process to the pubic tubercles around the pubic bone. Then it is recommended to perform the maximum reaching of the trunk back with outstretched legs in the joints of the knee. In the marginal position the distance between the above-mentioned bone points is measured. The difference, expressed in centimeters is a measure of the movable property of the test section of the spine.
- The lateral flexion. The examined person is in a free position, with the upper limb of the test side reached back at the shoulder joint up to 90 degrees), hand based behind the head. The distance is measured from the top of the armpit to the highest place hip bone plate on the same side. After making a motion precisely in the frontal plane the distance shall be measured again. The difference in distance between the first and second measurement is a measure of the mobility of this section.
- Twists of the spine. The person is in the free position. The distance is measured from the end of the xiphoid

process to the spike of the front upper hip. The tested person performs a twist of the trunk in the other side and the measurement shall be carried out again. The difference in distance between the first and second measurement is a measure of the mobility of this section.

*Statistical Analysis:* A statistical analysis of the collected material was carried out in PQstat program. The compliance of the variables schedules with normal distribution has been validated by test of Shapiro-Wolf. For the analysis of variables, a nonparametric test was used. Descriptive statistics were calculated for all variables. For the variables in the internal scale, which did not comply with the conditions of the normal distribution, the arithmetic average, minimum, maximum, median and upper and lower quartile were calculated. To evaluate the variability for dependent groups the Wilcoxon test was applied. For the level of statistical significance  $p < 0,05$  was adopted.

### Results

Table 1 presents the descriptive statistics and the statistics value Z for the comparison of the results of all

**Table 1.** The test statistics values and p-value obtained in the test, Wilcoxon test at significance level  $\alpha = 0.05$  for all variables tested before the first and after a series of massages in the whole tested group.

Variable		Descriptive statistics						Test of Wilcoxon Statistics Z
		$\bar{x}$	Min.	Max	Me	Q 1	Q 3	
The fingers-floor test	Before the massage	0,04	-18,0	12,0	1,5	-4,75	3,63	5,22
	After a series of massages	6,00	-12,0	27,0	5,75	1,75	9,50	
The Otto-Wurna test (bending)	Before the massage	2,03	0,50	5,00	2,00	1,00	3,00	5,12
	After a series of massages	3,21	1,50	6,00	3,00	2,00	4,13	
Straightening up	Before the massage	6,28	3,00	13,0	6,00	4,88	7,00	5,16
	After a series of massages	8,89	4,50	15,50	7,50	7,50	11,00	
Lateral flexion in the right	Before the massage	7,69	3,00	11,0	8,00	6,00	9,00	5,24
	After a series of massages	9,26	7,00	15,0	9,75	9,00	11,25	
Lateral flexion in the left	Before the massage	7,92	5,00	12,00	8,00	6,38	9,00	5,24
	After a series of massages	10,44	7,00	15,00	9,00	8,88	11,63	
Twisting right	Before the massage	3,46	1,50	6,00	3,50	2,00	4,13	5,05
	After a series of massages	4,88	2,50	9,00	4,50	3,50	6,00	
Twisting left	Before the massage	3,54	1,50	6,00	3,50	2,00	4,13	5,12
	After a series of massages	4,13	3,00	9,00	4,50	4,50	6,25	

Note:  $\bar{x}$  - arithmetic average; Min. – minimum; Max – maximum; Me-the median; Q 1-the first quartile; Q 3-the third quartile; Z – the Wilcoxon test value; p - significance level ( $<0,001$ ).

tested variables before the first or after the last treatment of classical massage.

By comparing the value of Wilcoxon test statistics-based on the significance level of  $\alpha = 0.05$ , it was found that there is a statistically important difference in the results of all tested variables before the first and after the last treatment of classical massage.

### Discussion

In literature, there are few reports on the evaluation of the effectiveness of classical massage in the treatment of spinal mobility. Most of these studies relate to the effectiveness of this form of therapy in the treatment of chronic spinal pain syndromes. The authors of this analysis realize that the results cited in the discussion of the study cannot directly correspond to the results of personal research, which were conducted on healthy young volunteers with no chronic pain disorders of the spine. Nevertheless, the results of personal research are encouraging, so you might want to incorporate in a discussion on assessing the effectiveness of this form of therapy for chronic pain syndrome of the spine, the more that the test results available in the literature are not unambiguous and as mentioned earlier, they are few.

Ćwirlej et al. [19] conducted a study, the purpose of which was to assess the effects of the therapeutic massage in patients with spinal pain, and, in particular, its impact on the reduction of pain intensity and improved ranges of mobility of the spine. To the test group 53 people have been enrolled, who have undergone a series of massage treatments (the examined patients during this time were treated only with this kind of therapy). All the people before and after the therapy have had assessed the severity of spine pain (VAS scale) and the mobility of the spine (a linear measurement, the range of flexion, extension, lateral flexion and twisting of the spine). A clear analgesic therapeutic massage and its positive impact on the improvement of the movable ranges of the spine have been shown.

Zgorzalewicz-Ferguson et al. [20] compared the effectiveness of the two methods: massage and therapy on patients with chronic spinal pain syndrome formed as a result of degenerative changes. The study included 60 patients, who were divided into two groups: in the group I- a classical massage was performed, in the group II – magnetic therapy. In order to objectify the therapy effects applied: scale VAS, mobility measurements and evaluation of the degree of disability of patients on a modified scale Oswestry (ODI). Test results showed no significant differences in the effectiveness of the methods used. After the application of a massage or a magnet therapy primarily pain and disability ailments have significantly decreased and the mobility of the spine has only slightly improved.

Kaluźna et al. [21] the study included a group of 80 patients with chronic pains, ailments of the spine, for whom a series of 10 treatments of classical massage have been carried out. Before and after the therapy in all patients: the Otta, Schober test and pain assessment VAS scale was

performed. Test results have shown the effectiveness of classical massage in the aspect of reducing the level of pain, and improving the range of mobility of the spine.

Hernandez-Reif al. [22] the research took twenty-four people with lumbosacral spine pain syndrome. In all patients, the treatment performed classical massage (30-minute sessions, twice a week for five weeks). In order to objectify efficacy: the severity of the pain, the occurrence of symptoms of depression, anxiety, insomnia and the level of stress hormones were evaluated. Comparison group comprised patients who applied gymnastics. As a result of studies more favorable results have been shown in patients, for whom therapeutic massage was used, compared to a group that was involved in gymnastics. After a series of treatments to therapeutic massage: a decreased pain, reduced severity of symptoms of anxiety and depression, the improvement of sleep quality, increasing the range of motion of flexion of vertebral column, higher levels of dopamine and serotonin have been observed.

Bell [23] evaluated the effectiveness of massage, as a form of therapy that increases the mobility of the spine and reducing the severity of pain in a patient with lower back pains, ailments and symptoms of sciatica (pain radiating to right lower limb). The patient was assigned to 45-minute massage session, once a week, for a period of 10 weeks. Massage treatment was carried out in the area of the spine, pelvis, thighs and crus by orderly protocol. After the therapy a greater patient's activity has been shown, measured by the scale of the ADSL (Activities of daily living).

Kamali et al. [24] compared the effectiveness of therapeutic massage and physical treatments in the treatment of subacute and chronic pain spine L-S. 30 patients were divided randomly into two groups: Group I have had massage performed, Group II physical treatments (TENS, sonotherapy, vibration therapy). The two groups have also undergone stretching exercises for the muscles of the ischiopubic-varicose and paraspinal posture stabilization exercises. In all patients, before and after the therapy: severity of pain by using a numerical scale (Numerical Rating Scale), disability by means of a questionnaire ODI (Oswestry Disability Index), the range of motion of flexion of vertebral column using the Schober test were evaluated. Statistical analysis of the test results showed that the treated group therapy, compared to the group treated physical therapy significantly reduced the intensity of the pain and disability of patients ( $p = 0.015$ ,  $p = 0.013$ ). While no statistically significant differences between the groups in the Schober test results.

Chochowska et al. [25] were testing patients over the age of 65 with chronic pain syndrome in the lumbosacral section. 10 classical back massage (20 min.), and 10 vibration massage 24 drain points (0, 5minx24 = 12 min.) were performed. Before and after the therapy they have studied: the intensity of the pain by using visual analog scale: and pain scale Laitinen; efficiency: by using the Questionnaire of Disability and Roland-Morris Questionnaire of Disability; soft tissue palpation

tenderness; mobility of the thorax and spine; mood: with the Geriatric Depression Scale. After finishing series of 10 treatments we obtained statistically significant pain reduction, improved efficiency, decrease in soft tissue palpation tenderness, improved mood, and a slight increase in the mobility of the spine.

Dr. Andrea Furlan of the University of Toronto, the Coordinator of POWAP (Practice Based on Reliable and Up-To-Date Publications - in Polish.) at the Institute for work and health, reviewed the systematic studies assessing the efficacy of therapeutic massage vs. other therapies in the treatment of chronic spinal pain syndromes. The author reviewed the databases MEDLINE, EMBASE, CINAHL from the beginning of their existence by 2008. The review includes the 13 studies, randomized or quasi-randomized controlled trials, referring to the efficacy of massage in treatment of chronic spinal pain syndromes. As a result of that review, Furlan et al. [26] have drawn the following conclusions:

- massage can be an effective treatment for chronic spinal pain syndromes, especially when combined with exercise and patient education;
- the evidence suggest that the acupuncture massage is more effective than the classical massage, but this requires confirmation;
- There is a need for further research on the effectiveness of this form of therapy.

### Conclusions

1. The findings have shown that classical massage increases the mobility of the spine.
2. The results of personal research apply to young, healthy volunteers. It is worth to continue research into the effects of this form of therapy in the case of restrictions of movable tangible property, resulting from spinal pain syndromes.

### Conflict of interests

The authors declare that there is no conflict of interests.

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**Information about the authors:**

**Radzimska Agnieszka;** <http://orcid.org/0000-0002-3718-6350>; [radzimska@cm.umk.pl](mailto:radzimska@cm.umk.pl); Collegium Medicum in Bydgoszcz, Nicolaus Copernicus University in Torun; ul. Technikow 3, 85-801 Bydgoszcz, Poland.

**Weber-Rajek Magdalena;** <http://orcid.org/0000-0003-4435-9624>; [magdawz@cm.umk.pl](mailto:magdawz@cm.umk.pl); Collegium Medicum in Bydgoszcz, Nicolaus Copernicus University in Torun; ul. Technikow 3, 85-801 Bydgoszcz, Poland.

**Lulinska-Kuklik Ewelina;** <http://orcid.org/0000-0002-3094-7241>; [ewelina.lulinska@awfis.gda.pl](mailto:ewelina.lulinska@awfis.gda.pl); Academy of Physical Education and Sport in Gdansk; ul. Kazimierza Gorskiego 1, 80-336 Gdansk, Poland.

**Piecka Paulina;** <http://orcid.org/0000-0003-4739-5487>; [zpfizjoter@cm.umk.pl](mailto:zpfizjoter@cm.umk.pl); Collegium Medicum in Bydgoszcz, Nicolaus Copernicus University in Torun; ul. Technikow 3, 85-801 Bydgoszcz, Poland.

**Moska Waldemar;** <http://orcid.org/0000-0002-5232-4598>; [waldemar.moska@awfis.gda.pl](mailto:waldemar.moska@awfis.gda.pl); Academy of Physical Education and Sport in Gdansk; ul. Kazimierza Gorskiego 1, 80-336 Gdansk, Poland.

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# Optimization of physical culture lessons in primary school on the base of mobile games' application

Shuba L.V.

Zaporozhye National Technical University

## Abstract

**Purpose:** to improve methodic of mobile games' application for physical culture lessons' optimization in primary school that would facilitate motor fitness increase.

**Material:** in experiment 50 boys (7-9 yrs) from main health group (no health problems) participated. For training strength we chose games, which required short speed-power tensions with at moderate loads. The following objects were used: filled ball, dump bells, benches or partners. In games with overcoming own weight we used: wall bars, beams, vertical rope.

**Results:** peculiar features of the improved methodic are as follows: for preparatory part we worked out ten separate complexes of general exercises in game form; for all parts of lesson mobile games were selected so that they should facilitate maximal development of physical qualities; each training was emotionally positively colored that motivate pupils' wish to attend the lessons.

**Conclusions:** for effective development of physical qualities the decisive factor was consideration of sensitive periods and complex approach to physical education lessons.

**Keywords:** methodic, primary school, development, physical qualities

## Introduction

Comprehensive physical education is one of the most important tasks of society. Formation of strong health and will, high workability and activity in physical culture lessons is the base of human intellectual development and physical perfection [8, 10, 16, 29]. The main purpose of physical culture in educational system is provisioning of harmonious and comprehensive development of pupil's personality with high mental, physical and social activity [5, 17, 28].

Active and persistent physical qualities' trainings accelerate and qualitatively change the process of all organism systems' development. Physical training with high quality is determined by level of main physical qualities fitness. It is the basis of workability in all kinds of educational, labor, applied and sport functioning.

Great number of scientific works is devoted to children's and adolescents' physical education effectiveness increase. Organizational-pedagogic and methodological basement of physical education system improvement for schoolchildren is regarded in scientific works in the following directions:

- Integration of cognitive and motor functioning in system of schoolchildren's teaching and education [3];
- Non traditional mobile games in schoolchildren's physical education [2];
- Systemizing of researches, used for determination of children's and athlete's physical condition, physical fitness and functional state [4];
- Ways of national schoolchildren's physical education system's formation [10];
- Study of motor functioning and its influence on motor abilities' level [13, 15].

The authors state that for 8 weeks it is possible

to improve children's motor fitness with the help of Head Start program [14]. Application of other program (ATLAS) points at the fact that of obesity social-ecologic determinants can be wanted in order to avoid ill attention to adolescents' weight growth in societies with low income [30]. In such cases understanding of physical culture and its components significance is of decisive importance for working out and realization of effective measures among children [20]. Other results permit to assume that steady professional progress can give teacher knowledge and skills, required for increasing pupils' physical activity [33]. For increasing effectiveness of such approach it is necessary to offer the factors, which could support and stimulate teachers [19]. Besides, it is necessary to raise awareness in exercises as potential tool in teaching of movements' analyzing [24]. All these will permit to raise personal and social responsibility of a teacher. To achieve such results teachers shall develop and apply pedagogic strategies on constant base [23]. With it, school can not neglect sports, content and popularity of which is constantly increasing [21].

In other works the following aspects are studied:

- Modern approaches to organization and methodic of health related physical culture work with junior school age children, which could cultivate motivation for physical culture and facilitate increase of children's physical condition [5];
- Influence of general forms, methods and principles on training of motor skills, facilitating junior school age children's motor activity [22].

Application of different kinds of sports in primary schoolchildren's physical education is shown in the following directions:

- Optimization of 7-8 yrs children by light athletic means [1];
- Training of physical qualities of primary comprehensive school pupils (on example of strength

- and endurance) [7];
- Application of Ukrainian folk games in class and out-of-class trainings [9];
- Formation of primary school pupils' motor skills in tennis training [12].

Application of mobile games is of great significance for children's motor skills, comprehensive physical development and health strengthening [6, 13]. The authors proved that in physical education classes (during 5 weeks) with application of different types' tennis rackets, general coordination of arms and eyes improves [18]. For physical activity improvement it is offered to use game approach. It is proved by 7 weeks' observations over throws' motor skills and abilities to take decisions [31]. With it, it is necessary to consider distinctions between girls and boys [24, 32]. It will permit to assess tests' adequacy in respect to schoolchildren's age [25, 27].

Analysis of publications showed that it is necessary to further substantiate influence of games, quantity of repetitions, rest intervals and their interactions on dynamic of primary school age children's motor skills. Solution of this problem will permit to perfect pupils' physical education and ensure their higher motor fitness.

*The purpose of the research* is to improve methodic of mobile games' application for physical culture lessons' optimization in primary school that would facilitate motor fitness increase.

### Material and methods

*Participant:* in experiment 50 boys (7-9 yrs) from main health group (no health problems) participated. They were divided in control and experimental groups.

*Organization of the research:* the study was carried out in 2014 – 2015 academic year in countryside under-filled school. In control group trainings were conducted by traditional methodic, envisaging development only those physical qualities, which are required for successful mastering of motor techniques. In experimental group the trainings were carried out as per improved methodic.

Our experimental methodic was based on main principles of physical culture program for comprehensive educational establishments. The offered by us lessons were conducted by commonly accepted scheme, which consisted of three parts. But mobile games were selected so that they should maximally facilitate physical qualities development and pupils' motivation for regular physical culture practicing.

So, preparatory part was directed at organization of pupils, their familiarizing with content and preparation for main work. We used exercises with gradual increase of amplitude, quickness; with involving all large muscles' groups in work.

For all experiment ten separate complexes of general exercises were planned (with objects and without object), which were fulfilled in game forms. It facilitated stimulation of motivation for training and pupils' attention during exercises' fulfillment.

In main part the following tasks were solved: primary school pupils' physical qualities' improvement during all

experiment. When selecting games by character of motor functioning, the following motor actions were preferred: a walk, run, throws and jumps. Such games were included in physical education system for development of physical qualities (strength, quickness, endurance, dexterity, flexibility) and mental and will moral qualities.

For strength training we chose the games, which required short-term speed-power tensions, moderate by load. The following objects were used: filled ball, dump bells, benches or partners. In games with overcoming own weight we applied wall bars, benches or beams, vertical rope. Such games do not require special equipment. They envisage the following: moving on site resting be hands on floor (in lying position); back hands' resting on floor with jumping). The following games were used: "Who throws farther?", "Pushing the ball", "Keep in circle", "Attack", "Stronger circle", "Tilting doll", "Cockfighting" [7].

For quickness we used the games, which required instant reaction to sound, visual and tactile signals. Besides, we used games with sudden stops and starts; with covering short distances in the shortest possible time. Games for quickness were practiced in the first half of lesson and in little scopes. They were: "Call the number", "Black and white", "Wolf and sheep", "Simple tag", "Catch the ball", "Ball's dribbling by circumference", "Hunting ducks" [12].

For endurance the following games were used: games with repeated actions; with continuous motor functioning, connected with noticeable energy consumption. Children's age and physical fitness were considered. These games were practiced in the second part of lesson. Besides, we used the following games for endurance: "Fishers and fish", "Who is quicker?", "Catching of ball", "Tiger ball", "To push out", "Rugby", "Football on back", "Jumpers", "Catch me up" [7].

Dexterity was trained with the help of games, which force to pass quickly from one kind of actions to other, according to situation. They are: "Attentive eye", "Falling tick", "Ball above rope", "Volleyball players' passes", "Only from below", "and Bombardiers "; "Change of circles" [1, 3].

Flexibility is required in every movement. That is why high elasticity of muscles and ligaments facilitate good participation in game. For dexterity we used the following: "Who pass quicker?", "Who I quicker," "Bench above head", "Bridge and cat" [11].

At the end of game teacher called the best participants: who had the best dexterity, resolution, quickness; that observed rules and did not prevent other pupils from participation in the game. The teacher also called those, who violated rules. Finalizing of game was as usual in interesting form in order to stimulate pupils for even better results next lesson.

In final part of every lesson we practiced calm games, which did not require high attention and do not excite.

At every lesson three main kinds of movements were fulfilled. They were repeated in certain sequence, varying after comparatively short period of time. With it movements' compatibility was very important.

At the beginning and at the end of the research all pupils passed control tests for physical condition and physical fitness.

Dexterity was determined in test “Shuttle run 4x9” (sec.): testing result was the time from start to the moment when participant put cube in start semi-circumference. The time was registered in the best attempt from two.

Quickness was tested with test “30 meters’ run” (sec.): testing result was time of distance covering, fixed with stopwatch. Only one attempt was admitted.

Speed power was registered in test “Long jump from the spot” (m): result was the length of jump in centimeters. The best result from two attempts was registered.

Arm muscles’ strength was tested with “Pressing ups in lying position” (quantity of times). When fulfilling this exercise, the tested shall touch tennis ball by chest. Maximal quantity of touches was the result of test.

Flexibility was found with the test “Forward bend from standing position” (cm). The tested was barefoot (distance between feet was 20-30 cm). Knees shall not be bent. The bent was controlled by other pupil. By command “Go” the tested bent forward trying to stretch arms as far as possible. The bent shall be kept 2-3 seconds, touching mark with fingers.

*Statistical analysis:* we calculated mean arithmetic, mean square deviation, variation coefficient, standard error of mean arithmetic, correlation coefficient. The received data were processed with Microsoft Excel program.

## Results

In modern society we can observe weakening of population’s health and reduction of life span. One of the most promising directions of physical education’s optimization is rational usage of effective means and methods; improvement of school age children’s motor abilities for their physical condition strengthening and their health improvement [13, 15]. In this connection, theory and methodic of physical education in comprehensive school have been progressing rather noticeable recent time. They are supplemented with new data and become still more practical. However, the wanted result can be achieved only under reasonable administrating of pedagogic process, considering physical qualities and motivation for physical culture development. Especially important becomes selection of health related physical education means and methods.

In table 1 we present testing indicators of 7-9 yrs boys’ physical qualities before and after experiment.

Analysis of results showed that the groups are more homogeneous by indicators of the following tests: 30 meters’ run, shuttle run 4x9 m, long jump from the spot, pressing ups in lying position.

Test results after experiment show that in all tested groups there was increment in physical qualities. With it, their values and direction are not the same in different groups. In experimental group all indicators improved. In control groups some indicators improved and some – not.

In test “30 meters’ run” indicators increased more in

experimental group as well as indicators of “Shuttle run 4x9 m”. High results were received also in test “Forward torso bending from standing position”.

It should be noted that for effective development of physical qualities a decisive factor was consideration of sensitive periods and complex approach to physical training. Besides, we analyzed percentage of physical qualities’ indicators increment before and after experiment (see fig. 1).

Analysis of indicators (see fig. 1) permits to say that implementation of improved methodic in physical culture lessons facilitated development of main physical qualities and increased children’s motivation for physical culture.

This analysis also shows that application of mobile games in pupils’ physical fitness training gave higher increment in all groups. Percentage increment in experimental groups was 22.72%; in control groups it was 9.75%. Thus, the received results witness about effectiveness of improved methodic of physical culture lessons for 7-9 yrs boys with preference of mobile games.

## Discussion

Mobile games are rather important for general development of children. Their value is the following: development of children’s natural movements, which are still imperfect in this age; facilitation of children’s higher activity for achievement of success [2, 3, 9, 11]. The authors state that mobile games also stimulate attention, memory and power of observation. Such games are also a peculiar form of world cognition. They satisfy their cognitive, social, moral and aesthetic demands. Thus, mobile games shall take significant place in life of primary schoolchildren. Application of mobile games corresponds to children’s age characteristics.

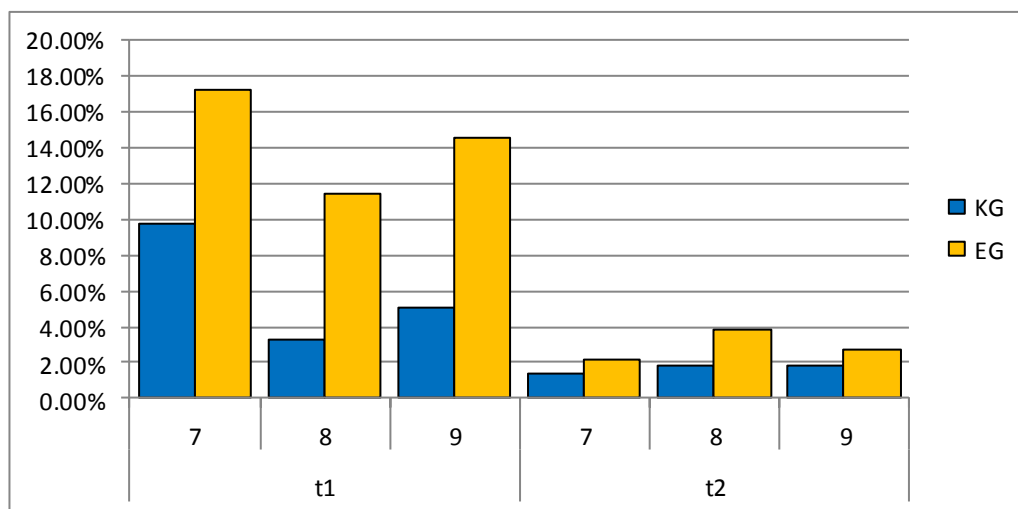
In games children try to act in the most rational way and maximally mobilize all efforts for achievement of the best result. Moral and will qualities are also manifested in such games. Requirements to exact observation of rules facilitate cultivation of discipline, self-restraint and responsibility in children. However, it does not restrict prospects for initiative, activity and inventiveness in mobile games at lessons [9].

At lessons we used different by content mobile games. For trainings we chose story games, relay races and games with elements of sports, in which the players shall be distributed by teams. The game roles were played by children. It activated children’s game actions and facilitated increase of interest in physical culture lessons.

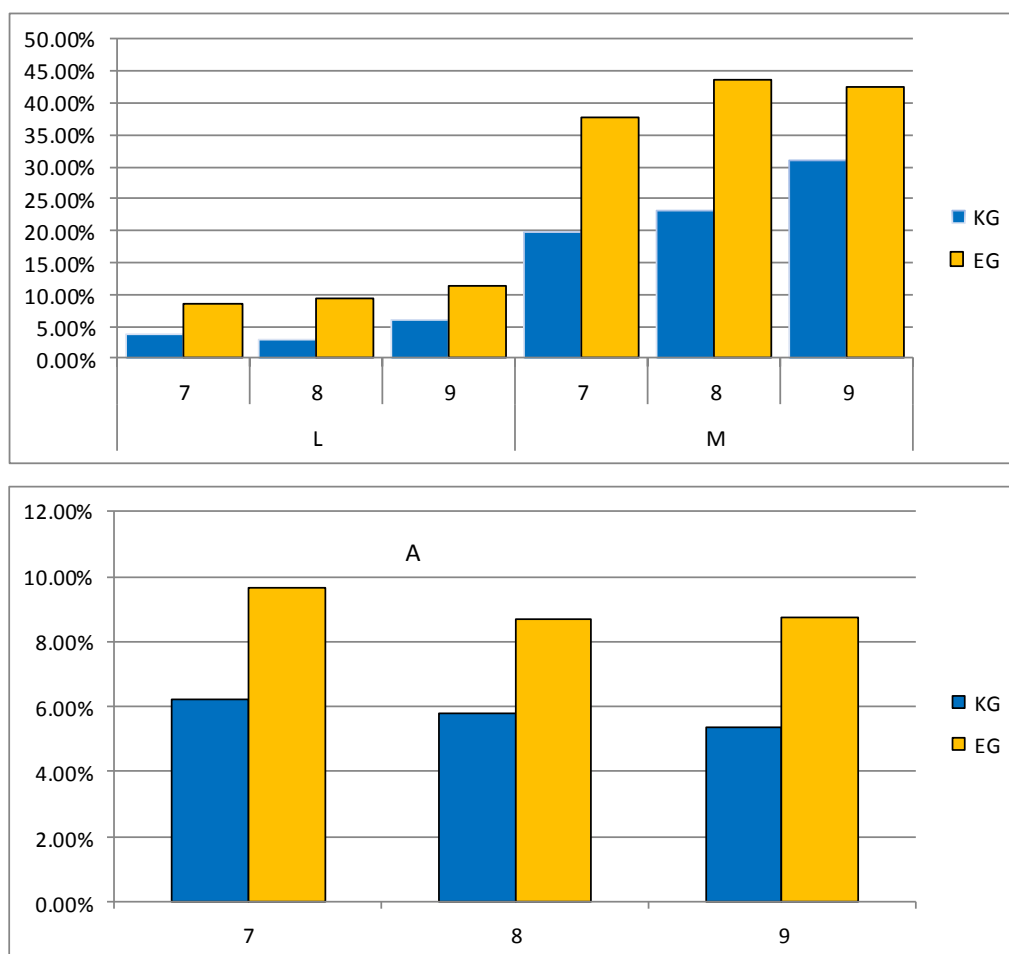
The main task of our improved methodic was provisioning of child’s full fledged development. The methodic included the following: keeping of interconnection and inter-conditioning of all forms of organization and kinds of motor activity; persistent development of all motor qualities; cultivation of children’s responsible attitude to accuracy and correctness of movements; children’s teaching to analyze (control an assess) own movements and movements of their classmates; creativity and motor activity; independent organization of mobile games and exercises; consideration

**Table 1.** Static indicators of 7-9 yrs boys’ motor abilities before and after experiment

Description of tests	Static indicators	Boys control group						Boys experimental group					
		7 years n = 7		8 years n = 8		9 years n = 10		7 years n = 7		8 years n = 8		9 years n = 10	
		Experiment		Experiment		Experiment		Experiment		Experiment		Experiment	
		before	after	before	after	before	after	before	after	before	after	before	after
30 meters’ run sec.	$\bar{x}$	6.87	6.20	6.10	5.90	5.96	5.66	6.89	5.70	6.10	5.40	5.97	5.10
	$\sigma$	0.63	0.53	0.49	0.79	0.35	0.35	0.61	0.51	0.63	0.73	0.40	0.54
	V	9.14	8.13	8.04	8.97	8.91	8.41	8.36	8.16	9.67	8.67	8.34	8.99
	m	0.12	0.10	0.07	0.17	0.04	0.14	0.16	0.14	0.09	0.19	0.04	0.16
Shuttle run 4x9 m. sec.	$\bar{x}$	12.12	12.07	11.63	11.53	11.34	11.24	12.14	12.00	11.73	11.40	11.30	11.10
	$\sigma$	0.74	0.70	0.70	0.79	0.71	0.74	0.49	0.69	0.68	0.71	0.81	0.75
	V	6.10	4.14	6.05	5.05	6.22	5.22	6.70	5.70	5.59	5.93	6.76	5.76
	m	0.14	0.15	0.10	0.16	0.09	0.19	0.13	0.16	0.10	0.11	0.09	0.19
Long jump from the spot, cm	$\bar{x}$	118	133	137	141	141	150	128	140	136	150	140	158
	$\sigma$	5.55	4.55	5.88	4.81	5.61	4.11	5.49	4.39	5.17	4.17	5.08	4.12
	V	9.59	7.51	9.49	7.40	9.18	7.18	9.58	7.48	9.66	7.86	9.26	7.06
	m	2.52	2.42	2.25	2.25	2.26	3.16	3.23	2.13	2.40	2.40	1.80	3.00
Forward torso bending, cm	$\bar{x}$	7	7.1	5.3	6.9	6.0	8.7	5.6	9.0	5.4	10.1	6.1	11.4
	$\sigma$	6.51	6.11	6.30	6.10	6.92	6.12	6.07	6.07	6.49	6.49	6.98	6.38
	V	8.09	5.04	8.25	5.15	8.63	5.33	8.21	5.29	8.12	5.45	8.66	5.56
	m	1.21	1.44	0.89	1.11	0.84	0.95	1.83	1.14	0.91	1.27	0.57	0.77
Pressing ups in lying position, quantity of times	$\bar{x}$	15	16	16	17	17	18	15	18	16	20	17	22
	$\sigma$	4.07	4.17	4.99	4.19	5.22	5.22	4.50	4.02	4.93	4.85	5.56	5.56
	V	6.74	7.76	6.25	7.95	6.71	7.41	6.27	7.72	6.65	7.65	6.89	7.89
	m	1.31	2.13	0.99	0.81	0.10	1.29	1.16	2.14	0.69	0.75	0.73	1.41



**Fig.1.** Percentage increment of physical qualities’ indicators in control (CG) and experimental (EG) groups. 7, 8, 9 – age in years, L – Long jump from the spot (cm); M – Forward torso bending from standing position (cm), CG – control group, EG – experimental group; t1 – 30 meters’ run (sec.); t2 – Shuttle run 4x9 m (sec.); A – Pressing ups in lying position (quantity of times).



**Fig.1.** Percentage increment of physical qualities' indicators in control (CG) and experimental (EG) groups. 7, 8, 9 – age in years, L – Long jump from the spot (cm); M – Forward torso bending from standing position (cm), CG – control group, EG – experimental group; t1 – 30 meters' run (sec.); t2 – Shuttle run 4x9 m (sec.); A – Pressing ups in lying position (quantity of times).

of child's age and individual characteristics; facilitation to positive emotional-psychological climate; formation of ideas about healthy life style; importance of hygienic and motor culture [6, 8, 10].

Analysis of the received data showed that increment of results was in all indicators. The highest increment was in test "Forward torso bending from standing position" and "30 meters' run". It is connected with sensitive period of quickness and flexibility development. These data prove results of other authors [1, 4, 5]. With it, it is necessary to observe all principles and structures of pedagogic process. It witnesses that we considered this aspect also, when creating our methodic.

**Conclusions:**

Analysis of scientific methodic literature showed that main problem is seeking of innovative approaches to physical exercises' practicing, considering children's interests and age characteristics. It facilitated improvement

of mobile games application methodic at physical culture lessons for 7-9 yrs. children. Special aspects of the improved methodic are the following: ten complexes of general exercises in game form for preparatory part; for all parts of training mobile games were selected so that they should maximally facilitate physical qualities' development; every training had positive emotional coloring that facilitated pupils wish to constantly attend the lessons.

The prospects of further researches are connected with study of schoolchildren's with different health adaptation to physical loads under influence of mobile games; further study of personality-oriented approach to physical education of primary school pupils with accent on memory, thinking, attention,. Physical qualities and motor skills increment and health strengthening.

**Conflict of interests**

The author declares that there is no conflict of interests.

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**Information about the author:**

**Shuba L.V.;** <http://orcid.org/0000-0002-8037-4218>; [mila-shuba@yandex.ru](mailto:mila-shuba@yandex.ru); Zaporozhye National Technical University; street Zykovskogo, 64, Zaporozhye, 69063, Ukraine.

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# Influence of carbohydrate gel “Energel. Endurance” on athlete’s workability

Vdovenko N.V.<sup>1</sup>, Maidanuyk E.V.<sup>1</sup>, Ivanova A.M.<sup>1</sup>, Hrobatenko A.V.<sup>2</sup>

<sup>1</sup>State Scientific Research Institute of Physical Culture and Sport

<sup>2</sup>Kyiv National University of Trade and Economics

## Abstract

**Purpose:** to study influence of carbohydrate course application on qualified athlete’s special workability.

**Material:** workability of cyclic kinds of sports athlete (n=14) was determined before and after gel course application under increasing loads.

**Results:** confident increase of work power was found at threshold of anaerobic metabolism (by 12%). Besides, rising of mechanic effectiveness and economy of muscular work at threshold of anaerobic metabolism and at maximal oxygen consumption was registered. Such results witness about presence of conditions for improvement of muscular energy supply at the account o aerobic component that permits to prolong working time without fatigue.

**Conclusions:** purposefulness of carbohydrate gel application in conditions of physical loads, requiring endurance, has been proved. Its application in athlete’s training is recommended for increase of training and competition effectiveness.

**Keywords:** athlete, products of special purpose, endurance, workability.

## Introduction

The problem of effectiveness rising in elite sports’ training and competition functioning nowadays has acquired especial importance in connection with rapid growth of sport results, further increase of rivalry at international sport arena, constantly increasing physical loads. The main methods of its solution are optimization of training and competition loads, psychological training, rational working, rest and eating regimes. Besides, it implies creation of conditions, under which physical loads volumes would guaranty the best sport results for sportsman [7, 8, 19, 20].

Alongside with these methods still more important role is played by auxiliary factors of physical workability improvement. They are special food products, which contain biologically active substances and are not related to doping.

For sustaining high sport workability organism shall be supplied with food substances in proper and optimal for their assimilation quantity and proportions. Athlete’s demand in energy and food substances depends on intensity of metabolic processes, which take place in organism under physical load [4, 10, 14].

As on to day, it is undoubted that athlete’s eating shall include special food products. It is known that sustaining and recreation of main metabolic functions’ workability under highly intensive and prolonged training and competition loads is not always possible only with traditional food. One of reasons of this can be daily diet of big volume. It weakens food assimilation in organism. Including of highly calorific special food products in main eating regime permits the following: to operatively correct athlete’s eating; to provide organism with energy and food substances in proportion to energy consumption. Such approach facilitates sustaining of high

workability and readiness for physical loads in conditions of repeated trainings [4, 8, 17, 18]. In other works effective mechanisms of athlete organisms’ bio-chemical adaptation to competition loads were shown [12, 22].

In connection with the above mentioned studies in the field of new special food products and their influence on physical workability become relevant and promising. Scientists worked out and implemented in practice food product which contains amber and apple acids,  $\beta$ -alanine, sodium, potassium, magnesium and ascorbic acid. Logical continuation of such studies [2, 5, 6] was determination of carbohydrate gel influence on physical workability. Determination of elite sportswomen’s anaerobic efficiency is of great importance [16]. Among approaches to increase of athlete’s workability we can mark out application of special ergogenic means, which permits for athlete to freely breathe and do not influence negatively on efficiency [11]. Such approach proves their application’s purposefulness for efficiency rising [21, 23]. It can also increase athlete’s physical endurance [26]. Determination of connection between eating and its adequacy is of not less importance [24, 27, 28]. It should be noted that insufficient quantity of macro and micro elements in food can reduce physical workability and increase risk of diseases [15].

*Hypothesis:* it was assumed that new, permitted (not containing doping) ergogenic factors can facilitate elite athlete’s training and competition functioning. Such factor’ application shall consider specific features of kind of sports and training period. Such approaches can ensure optimization of athlete’s functional state and facilitate complete realization of their potentials in Olympic and Para-Olympic Games.

*The purpose of the research:* to study influence of carbohydrate “Energel. Endurance” course application on qualified athlete’s special workability.

## Material and methods

**Participants:** in the research athlete- academic rowers participated - men: 18-25 yrs age; body height  $191.3 \pm 5.59$  cm; body mass  $82.9 \pm 9.8$  kg. Their qualifications were: first sport category (n=6); candidate masters of sports (n=6); masters of sports (n=2). As on the start of researches, according to the data of prophylactic medical examinations all athlete were practically healthy. The athlete were instructed about purpose, procedures and potential risks of the research. All athlete gave written consent for participation in the research. They were divided into two homogenous groups, 7 persons in each.

**Procedure:** the research was carried out on general stage of preparatory period of annual cycle. The research took two micro cycles (10 days). During this period athlete used "Energel. Endurance", two bags every day according to the following scheme: 1 bag 20-30 minutes before training loads with sufficient quantity of water.

Testing was fulfilled with the help of ergo meter Monark Ergomic 894. The testing procedure envisaged continuously increasing loading with constant pedals' rotation frequency of  $-60 \text{ rpm}^{-1}$ . Initial power was 58.8 W. Then, load increased by 0.3 kg every 3 minutes. It corresponded to increase of power by 17.6 W. The work was fulfilled up to reaching maximal oxygen consumption. Total testing time, considering warming up was from 43 to 53 minutes (see fig. 1).

In the testing we used gas analyzer "Oxycon Mobil", produced by "Jeager" (Germany) and pulse meters (Polar S810i, produced by "Polar" (Finland). In the process of testing the following indicators were registered with discreteness of 10 seconds: oxygen consumption (OC,  $\text{ml} \cdot \text{min}^{-1}$ ;  $\text{ml} \cdot \text{min}^{-1} \cdot \text{kg}^{-1}$ ), maximal oxygen consumption (MOC,  $\text{ml} \cdot \text{min}^{-1}$ ;  $\text{ml} \cdot \text{min}^{-1} \cdot \text{kg}^{-1}$ ), heart beats rate (HBR,  $\text{bpm}^{-1}$ ), minute volume of breathing ( $\text{l} \cdot \text{min}^{-1}$  and  $\text{l} \cdot \text{min}^{-1} \cdot \text{kg}^{-1}$ ), release of carbon dioxide ( $\text{CO}_2$ ,  $\text{ml} \cdot \text{min}^{-1}$ ). Mechanical effectiveness was determined as relation of work power to

oxygen consumption and expressed in percents (W/OC, %). Economy of work was defined as relation of oxygen consumption to work power and expressed in percents (OC/W, %).

Lactate concentration in athlete's blood was registered with bio-chemical analyzer LP-400, produced by "Dr. Lange" (Germany) with the help of standard agents, produced by the same company.

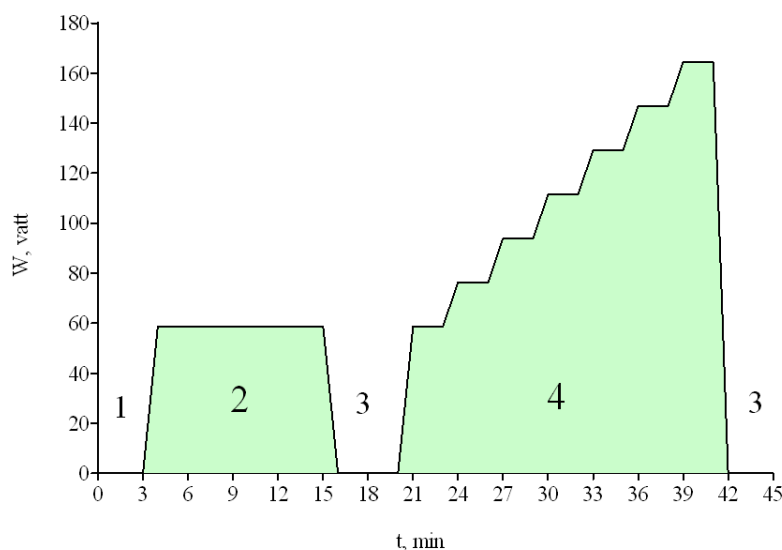
Anaerobic threshold (AnT) was found by emersion of VentilationThreshold, VT – the moment of ventilation equivalent increase by oxygen  $\text{VE}/\text{VO}_2$ ) and lactate threshold LT – sharp rising of lactate concentration in blood [20].

These tests were carried out at the beginning and at the end of the research.

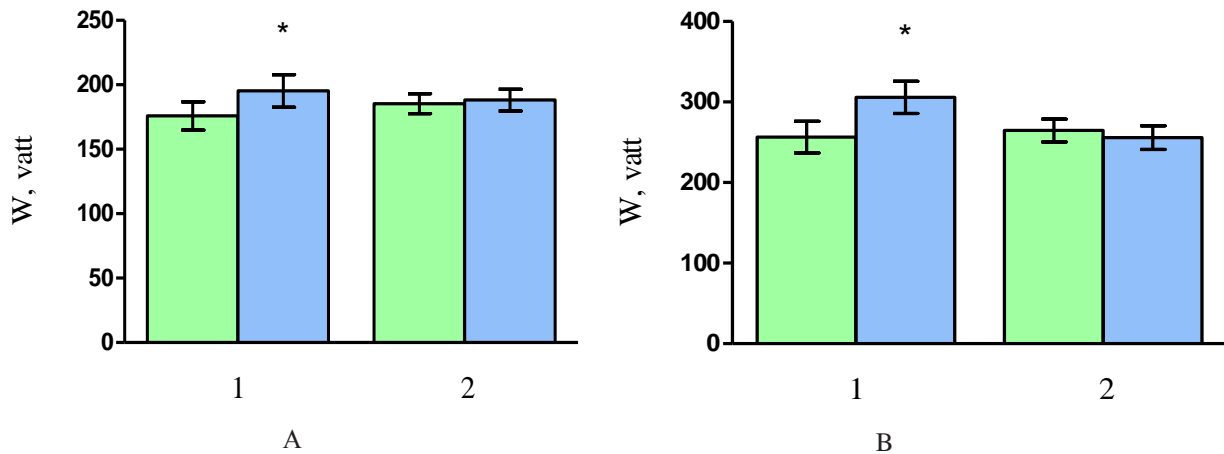
**Statistical analysis:** was fulfilled with the help of programs "GraphPad Prism version 5.00 for Windows" (GraphPad software Inc.,USA). Confidence of differences was determined by non parametrical statistic (Wilcoxon's iconic test). Value  $p \leq 0.05$  was taken as confident.

## Results

By results of the research we found positive influence of course application of "Energel. Endurance" on athlete's aerobic potentials. It is proved by confident ( $p \leq 0.05$ ) increase of loads at level of anaerobic metabolism's threshold (AnMT) in athlete of the tested group. After course application of "Energel. Endurance" the athlete of main group demonstrated increase of power in average by 20.7 W that, in average, was by 12.1% higher than results of the first testing. At the same time, in control group power at AnMT level practically remained at initial level (increased, in average only by 2.8 W (1.5%)) (see fig. 2). It can be explained by ergogenic action of amber and apple acids, which are component of the gel. Biological significance of this effect lies in the fact that there happens quick re-synthesis of adenosine triphosphate by cells and

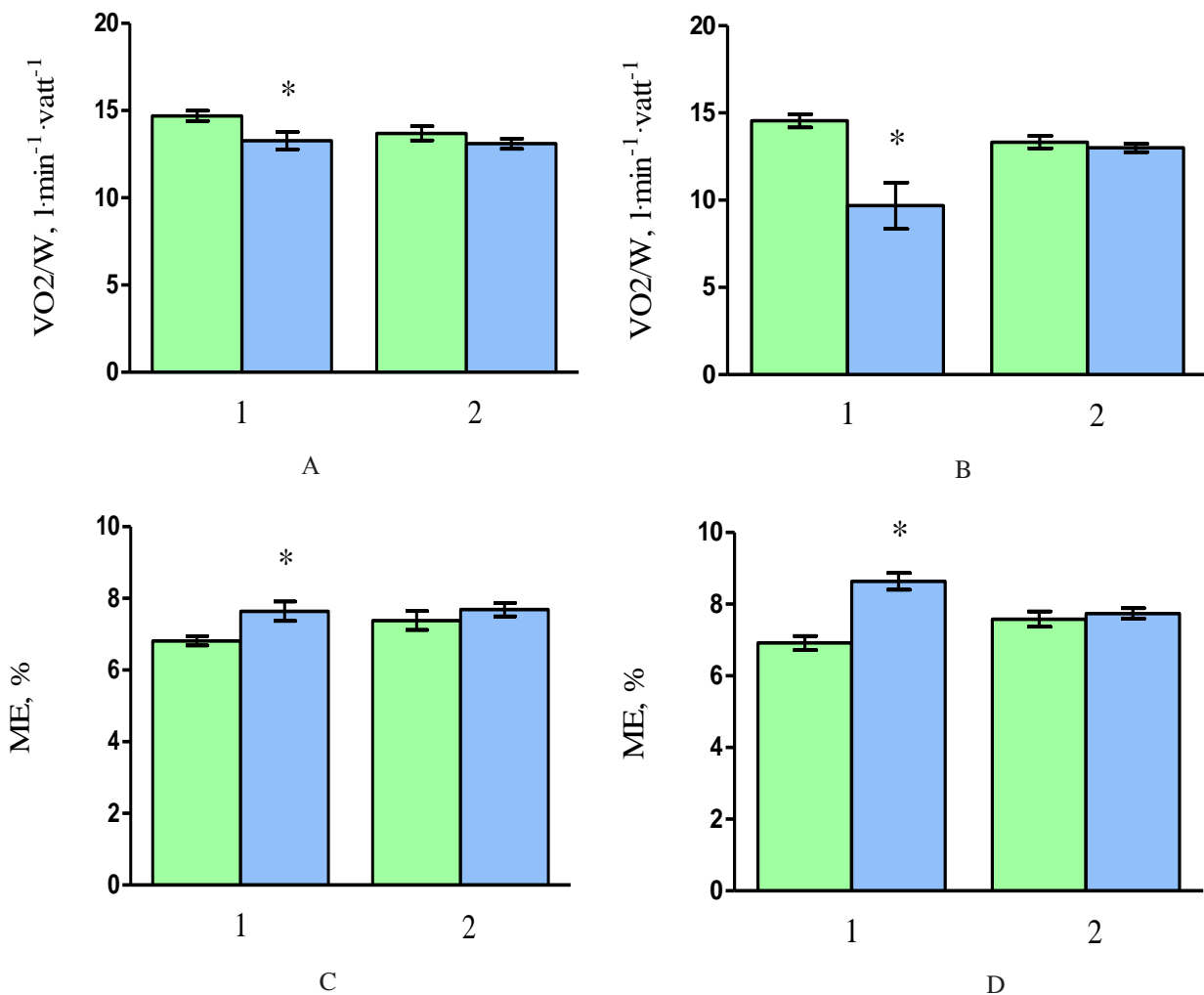


**Fig.1.** Diagram of athlete's testing procedure: 1 – warming up; 2 – standard work; 3 – recreation; 4 – stage-by stage increasing work; W – power; t – time, minutes.



**Fig. 2.** Mean power of test loads at AnMT level (A) and MOC (B) in experimental and control groups (n = 14): 1 – experimental group, 2 – control group. \* – p ≤ 0.05; W – power; t – time, minutes.

■ – beginning of the research,  
■ – end of the research.



**Fig. 3.** Influence of "Energel. Endurance" on economy and effectiveness of test loading fulfillment on ergo meter at AnMT (A, C) and MOC (B, D) levels: 1 – experimental group; Eс – economy, економічність, Ef – effectiveness; \* – p ≤ 0.05; W – power; t – time, minutes.

■ – beginning of the research,  
■ – end of the research.

increase of their anti-oxidant effect [1, 9].

Confident increase of work effectiveness on ergo meter was registered as product of power to oxygen consumption ( $\text{VO}_2$ ,  $\text{l}\cdot\text{min}^{-1}$ ); at AnMT and MOC levels. Results of experimental group athlete witness about increase of their aerobic potentials. Effectiveness of experimental group athlete's muscles work increased in average: at AnMT level by 11.7% (6.8 and 7.6% accordingly before and after course application of the substance); at MOC level – by 25.0% (6.9 and 8.7% accordingly). At the same time, in control group work effectiveness nearly did not change: at AnMT level it increased not confidently by 4.2% (7.4 and 7.7% accordingly before and after experiment); at MOC level – by 2.2% (7.4 and 7.7% accordingly before and after experiment, not confidently) (see fig. 3 C, 3 D).

Increase of aerobic energy supply component in experimental group athlete resulted in improvement of muscular functioning economy, which is found as product of oxygen consumption to achieved power of load ( $\text{VO}_2/\text{W}$ ,  $\text{l}\cdot\text{min}^{-1}\cdot\text{W}^{-1}$ ). After “Energel. Endurance” course application experimental group athlete achieved higher power of load at AnMT level (energy consumption). Results were found by oxygen consumption values ( $\text{VO}_2$ ,  $\text{l}\cdot\text{min}^{-1}$ ): 14.7 and 11.1  $\text{l}\cdot\text{min}^{-1}\cdot\text{W}^{-1}$  accordingly. Thus, economy of muscular work in experimental group increased by: 24.8% under loads at AnMT level; by 33.4% under maximal load. Such results witness about significant increment of aerobic energy supply component (see fig. 3A, 3B). In control group we did not register confident changes in economy of work. In control group we found the following: economy at AnMT level increased by 4.6% and by 2.6% under maximal load (see fig 3 F, 3 B).

## Discussion

On the base of the received new scientific data we expanded the arsenal of permitted ergogenic means, which are used in training of elite athlete: we worked out and recommended for practical application new functional product of carbohydrate character in conditions of intensive training and competition loads.

Increase of physical workability after course application of “Energel. Endurance” can be explained by the presence of metabolites of Krebs's cycle,  $\beta$ -alanine, mixture of carbohydrates and electrolytes in the content. With it, every element separately manifests its own properties.  $\beta$ -alanine increases carnosine in muscles, regulates inter-cellular calcium content and strength of muscular contraction; increases level of pantothenic acid [13, 25]. Carbohydrate mixture permits to preserve glycogen reserves and minerals keep electrolyte balance [2, 3]. It creates conditions for improvement energy supply of muscular functioning at the cost of aerobic component that permits to prolong working time without fatigue's increasing [5] (see fig. 4).

## Conclusions:

1. Positive influence of “Energel. Endurance” course application on athlete's physical workability and endurance (aerobic potentials) has been determined. It is proved by power of work confident increase by 12.1% at AnMT level.
2. “Energel. Endurance” course application by athlete facilitated increase of aerobic potentials. We found confident rising of effectiveness of load fulfillment at AnMT and MOC levels (in average by 11.7% and 25.0% accordingly). We also registered confident

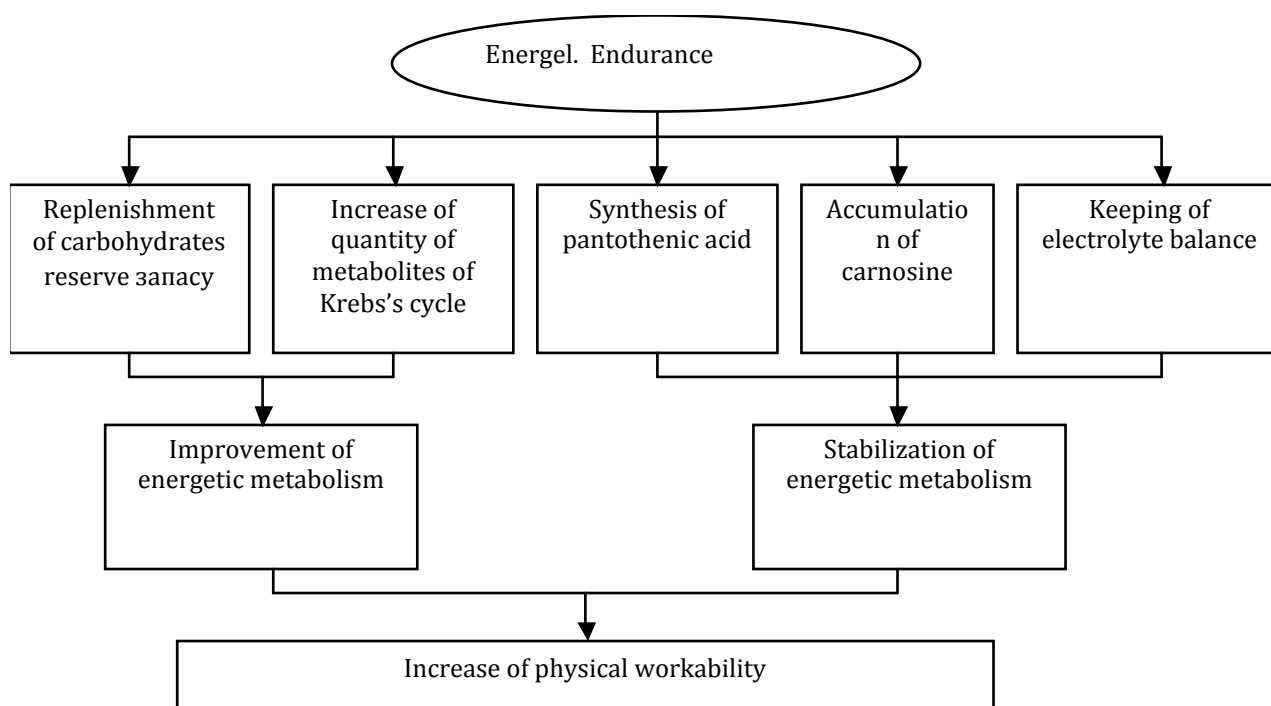


Fig. 4. Ways of realization of carbohydrate gel “Energel. Endurance” ergogenic influence under physical loads.

increase of muscular work economy: by 24.8% and by 33.4%, accordingly.

3. The results of our research show that it is purposeful to use carbohydrate gel “Energel. Endurance”, under physical loads, requiring endurance.

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### Conflict of interests

The authors declare that there is no conflict of interests.

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#### Information about the authors:

**Vdovenko N.V.;** <http://orcid.org/0000-0002-3097-5920>; [natazly-v@rambler.ru](mailto:natazly-v@rambler.ru); State Scientific Research Institute of Physical Culture and Sport; Fizkultury str. 1, Kiev, 03680, Ukraine.

**Maidanuyk E.V.;** <http://orcid.org/0000-0003-0451-1847>; [darinam7@gmail.com](mailto:darinam7@gmail.com); State Scientific Research Institute of Physical Culture and Sport; Fizkultury str. 1, Kiev, 03680, Ukraine.

**Ivanova A.M.;** <http://orcid.org/0000-0002-9950-3980>; [ivanova.anna.m@gmail.com](mailto:ivanova.anna.m@gmail.com); State Scientific Research Institute of Physical Culture and Sport; Fizkultury str. 1, Kiev, 03680, Ukraine.

**Hrobatenko A.V.;** <http://orcid.org/0000-0002-3110-4094>; [hrobatenko\\_o@ukr.net](mailto:hrobatenko_o@ukr.net); Kyiv National University of Trade and Economics; Kyoto str., 19, Kiev, 02156, Ukraine.

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## CONTACT INFORMATION

box 11135, Kharkov-68, 61068, Ukraine

phone. 38-099-430-69-22

<http://www.sportpedagogy.org.ua>

e-mail: sportart@gmail.com

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