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## IMPACT OF SYSTEMATIC PHYSICAL EXERTION ON MORPHO-FUNCTIONAL DEVELOPMENT OF SCHOOLCHILDREN

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### Abstracts

**Topicality.** The problem of children health retention and enhancement attracts more and more attention of experts from different spheres. Significant negative changes in the health state and morpho-functional development of schoolchildren that were observed during the recent years, on the one hand, are connected with the growth of studying exertion on the background of considerable breach of study and educational process organization conditions, on the other hand, with the decline in children organism functional reserves, on which the level of children organism adaptive resources depends. Among the chain of reasons causing increase in functional disorders and diseases of schoolchildren the insufficient movement activity takes the leading place. **The objective of the research** – to study the impact of systematic physical exertion on the morpho-functional development of senior schoolchildren. 132 pupils of the 10–11 forms took part in the investigation (age group from 16 to 18 years old) participated in the research, including boys – 65 pupils, girls – 67 pupils. The whole contingent of the teenagers was divided by their age, gender and amount of movement regime. The first group included the pupils with low movement activity, who attended 2 Physical Training lessons at a comprehensive school. The second group (high movement regime) comprised teenager sportsmen, who played sports (basketball) 10–12 hours a week, with the prevailing development of organism aerobic resources. The pupils referred to the 1<sup>st</sup> and 2<sup>nd</sup> health groups and those who do not have chronic diseases as well as those who had not been ill for two weeks before the investigation were examined. **Results.** It was determined that the level of physical development, functional state of teenager organism are influenced by the amount of movement regime. It was revealed that boys and girls who go in for sport are characterized by a higher level of physical development and functional reserves. The teenagers that attend only Physical Training classes at a comprehensive school turned out to have a low level of physical development. The results of the research make it possible to predict the stages of the ultimate formation of children organism somatic and physiological rates, to facilitate more objective assessment of the functional state of organism vital systems.

**Key words:** morphofunctional development, schoolchildren, physical exertion, sportsmen.

**Евеліна Жигульова, Іван Стасюк. Вплив систематичних фізичних навантажень на морфофункціональний розвиток школярів. Актуальність.** Проблема збереження й зміцнення здоров'я дітей привертає до себе все більше уваги фахівців різних галузей. Значні негативні зрушення в стані здоров'я та морфофункціонального розвитку школярів, які спостерігаються протягом останніх років, з одного боку, пов'язані зі зростанням навчального навантаження на фоні значних порушень умов навчання та організації навчально-виховного процесу, а з іншого – зниженням функціональних резервів організму дітей, від яких залежить рівень адаптаційних можливостей організму дитини. Серед низки причин підвищення функціональних розладів та захворюваності дітей шкільного віку недостатня рухова активність посідає чільне місце. **Мета дослідження** – вивчити вплив систематичних фізичних навантажень на морфофункціональний розвиток дітей старшого шкільного віку. У дослідженні взяли участь 132 учня 10–11 класів (вікова група від 16 до 18 років), у тому числі 65 хлопців, 67 дівчат. Весь контингент підлітків розподілили за віком, статтю та об'ємом рухового режиму. До першої групи увійшли учні з низькою руховою активністю, які відвідували два уроки фізичної культури в загальноосвітній школі. Другу групу (високий руховий режим) склали підлітки-спортсмени, які займалися 10–12 годин на тиждень ігровими видами спорту (баскетбол) із переважним розвитком аеробних можливостей організму. Обстежувались учні, віднесені до 1- та 2-ї груп здоров'я, які не мають хронічних хвороб та які в останні два тижня перед дослідженням не хворіли. **Результати роботи.** Установлено, що на рівень фізичного розвитку, функціонального стану організму підлітків впливає величина рухового режиму. Виявлено, що в юнаків і дівчат, котрі займаються спортом, спостерігали найвищий рівень фізичного розвитку та функціональних резервів. У підлітків, які відвідують лише уроки фізичної культури в загальноосвітній школі, виявлено низький рівень фізичного розвитку. Результати дослідження дають змогу прогнозувати етапи кінцевого становлення сомато-фізіологічних показників організму дітей, сприяють більш об'єктивній оцінці функціонального стану життєво важливих систем організму.

**Ключові слова:** морфофункціональний розвиток, школярі, фізичні навантаження, спортсмени.

Эвелина Жигулёва, Иван Стасюк. Влияние систематических физических нагрузок на морфо-функциональное развитие школьников. *Актуальность.* Проблема сохранения и укрепления здоровья детей привлекает к себе все больше внимания специалистов различных отраслей. Значительные негативные сдвиги в состоянии здоровья и морфофункциональном развитии школьников, наблюдаемых в последние годы, с одной стороны, связаны с ростом учебной нагрузки на фоне значительных нарушений условий обучения и организации учебно-воспитательного процесса, а с другой – снижением функциональных резервов организма детей, от которых зависит уровень адаптационных возможностей организма ребенка. Среди ряда причин повышения функциональных расстройств и заболеваемости детей школьного возраста недостаточная двигательная активность занимает ведущее место. *Цель исследования* – изучить влияние систематических физических нагрузок на морфофункциональное развитие детей старшего школьного возраста. В исследовании приняли участие 132 ученика 10–11 классов (возрастная группа – от 16 до 18 лет), в том числе 65 юношей, 67 девушек. Весь контингент подростков распределили по возрасту, полу и объему двигательного режима. В первую группу вошли ученики с низкой двигательной активностью, которые посещали два урока физической культуры в общеобразовательной школе. Вторую группу (высокий двигательный режим) составили подростки-спортсмены, которые занимались 10–12 часов в неделю игровыми видами спорта (баскетбол) с преимущественным развитием аэробных возможностей организма. Исследовались ученики, отнесенные к 1- и 2-й группам здоровья, которые не имеют хронических болезней и которые в последние две недели перед исследованием не болели. *Результаты работы.* Установлено, что на уровень физического развития, функционального состояния организма подростков влияет величина двигательного режима. Выявлено, что у юношей и девушек, которые занимаются спортом, наблюдается высокий уровень физического развития и функциональных резервов. У подростков, посещающих только уроки физической культуры в общеобразовательной школе, выявлен низкий уровень физического развития. Результаты исследования позволяют прогнозировать этапы конечного становления сомато-физиологических показателей организма детей, способствуют более объективной оценке функционального состояния жизненно важных систем организма.

**Ключевые слова:** морфофункциональное развитие, школьники, физические нагрузки, спортсмены.

**Introduction.** Human health is a leading priority of modern society, its retention is one of the basic functions of such society institutions as medicine, sport, recreation and leisure. The strategy of health retention is reflected in regulatory legal and methodological documents that regulate the development of education, physical education, sport and health care in Ukraine. However, the practical realization of such strategy is complicated by the whole system of social economic, organizational governing and cultural factors [1; 3; 4].

The statistics and sociological study data of the state of population health, life and health culture in Ukraine excite serious anxiety of experts. The increase in death rate due to the rise in disease incidence and disability, low birth rates, depopulation, extension of deviant forms of behavior with health risks become destructive manifestations and consequences of those social transformations which the Ukrainian society has endured during the recent decades [4].

The biggest anxiety is caused by the abrupt worsening of children health characteristics, which have been noted during the recent years. Thus the problem of children and adolescents` health retention and enhancement attracts more and more attention of doctors, educators, sociologists. Herewith chronic pathology growth paces among adolescents at the age of 15-18 are 1.5-2 times higher as those of the children before 14 years old. Such negative peculiarities of the modern educational process as increase of static exertion, restriction of pupils` locomotion on the background of educational activity intensification lead to the development of untimely tiredness and stressful states for schoolchildren, tension of their organism adaptive mechanisms and, as a result, to the worsening of children health state [5;6].

There are such negative tendencies noted in children morpho-functional development as the inhibition of growth and puberty of 1/3 boys and girls, decrease of lung capacity (by 15%), hand muscle strength (by 18%) [4]. It is indicated that significant negative changes in the health state and morphofunctional development of schoolchildren that were observed during the recent years, on the one hand, are connected with the growth of studying exertion on the background of considerable breach of study and educational process organization conditions, on the other hand, with the decline of functional reserves in children organism, on which the level of children organism adaptive resources depends [2; 3; 5; 7].

It is generally recognized that one of the most important factors of disease risk is hypokinesia which causes health level decline and a whole range of pre-pathologic states [1; 3; 5]. Among the reasons for the increase of functional disorders and disease incidence of schoolchildren insufficient movement activity

occupies the leading place. The extension of hypokinesia among the pupils of comprehensive schools reaches 60-80% [3].

In childhood and adolescence and in the period of physical and psychic formation hypokinesia plays a considerably negative role, because at such stage of development the biological significance of locomotion is enormous. With the efficient movement regime the child individual development shifts to a higher level within its genetic program [5; 6]. Therefore, the natural stimulation of growth and development processes takes place, studying of which has not only theoretical importance for the age physiology but exclusively practical – health retention of rising generation as the reserve of the most important component of manufacturing forces – working population.

In the presence of a large number of publications on the regularities of organism growth at different ontogenesis age stages the problem of formation, retention and assessment of individual health still remains also urgent today.

**The research aim** is to study the impact of systematic physical exertions on morpho-functional development of senior schoolchildren.

**The materials and methods of the research.** 132 pupils of the 10-11 forms (age group of 16-18 years) participated in the research, including 65 male and 67 female pupils. All the contingent of adolescents was divided by age, gender and amount of movement regime. The first group included the pupils with low movement activity, who attended 2 Physical Training lessons at a comprehensive school. The second group (high movement regime) comprised adolescent athletes, who did sports (basketball) 10-12 hours a week, with the prevailing development of organism aerobic resources. The pupils referred to the 1<sup>st</sup> and 2<sup>nd</sup> health groups and those who doesn't have chronic diseases as well as those who had not been ill for two weeks before the investigation were examined.

**The methods of the research.** Theoretical methods: synthesis and generalization of literature sources. While investigating the peculiarities of senior schoolchildren morpho-functional development were evaluated on the basis of measuring somatic and physiological rates. The reaction of children organism physiological systems in the conditions of life activity was determined by means of functional tests; statistical methods of analysis.

**The results of the research. Discussion.** Taking into consideration the fact that one of the most sensitive and objective evidences of children population health state is physical development, and the processes of child growth and development are closely related to an individual way of life, we carried out the morphological and functional evaluation of the 16-18-year-olds' organism adaptation to different movement regimes.

It was determined that the morpho-functional indices within one age and gender group were quite variable. The basis of somatometric methods of human physical development is comprised by the body morphological parameters: height, body weight, chest girth. Our study of anthropometric indices of boy and girl bodies found out age and intergroup differences, which are represented bellow (See Table 1). The received data determined that at the age of 16-18 years the boys' body height of both groups increases by more than 7 cm and the girls' – by 5-7 cm.

Table 1

**Anthropometric indices of boys and girls with different levels of locomotion**

Age, years	Boys (n=31)		Male athletes (n=34)	
	M±m	δ	M±m	δ
Body height, cm				
16	165.23 ±0.49	3.62	168.36 ±0.51*	3.86
17	169.48 ±0.54	3.84	172.28 ±0.62*	4.11
18	172.52 ±0.68	4.12	175.41 ±0.74*	4.38
Body weight, kg				
16	61.41 ±0.36	2.11	64.32 ±0.41*	2.34
17	64.36 ±0.45	2.38	67.18 ±0.52*	2.46
18	67.51 ±0.64	2.61	70.45 ±0.68*	2.72
Chest girth, cm				
16	82.16 ±0.44	2.58	84.24 ±0.38	2.81
17	84.31 ±0.61	2.66	87.31 ±0.46*	2.94
18	87.45 ±0.65	2.71	90.52 ±0.58*	3.22

End of the Table 1

Age, years	Girls (n =35)		Female athletes (n =32)	
	M±m	δ	M±m	δ
Body height, cm				
16	164.31 ±0.47	3.61	165.61 ±0.49	3.75
17	167.26 ±0.52	3.88	168.32 ±0.54	3.96
18	169.15 ±0.63	4.11	172.18 ±0.66**	4.25
Body weight, kg				
16	58.42 ±0.35	2.06	60.22 ±0.42**	2.42
17	61.31 ±0.43	2.41	64.38 ±0.51**	2.57
18	64.16 ±0.61	2.56	68.17 ±0.62**	2.62
Chest girth, cm				
16	79.26 ±0.65	2.51	81.26 ±0.72	2.67
17	82.45 ±0.76	2.68	84.38 ±0.79	2.78
18	84.37 ±0.81	2.76	87.25 ±0.88**	2.85

*Notes:* \* – the relevance of the differences in comparison with the results of the boys group ( $p < 0,05$ ); \*\* – the relevance of the differences in comparison with the results of the girls group ( $p < 0,05$ ).

It should be noted that the male athletes' body height is characterized by higher indices in all age groups. So, if the body height of the boys who do not go in for sport is  $172.52 \pm 0.68$  cm, then of those from the group of the male athletes it is  $175.41 \pm 0.74$  cm ( $p < 0.05$ ). In general, body height is an integral index that changes during life and depends on the rate of growth and development of certain bones.

The body weight is quite a labile index of physical development which quickly responds to exo- and endogenous factors, directly depends on the height but its increase occurs unevenly with age. We determined that adolescents' body weight indices in the period of 16-18 years continuously increase, and body weight gain of the boys from both groups is more than 6 kg, and for the girls – 6-8 kg. The highest indices of body weight are determined in the adolescents' athletes of all age groups, and the discrepancy is more than 3-4 kg. For instance, the body weight of the boys that do not go in for sport is  $67.51 \pm 0.64$  kg at the age of 18, and in the group of the male athletes –  $70.45 \pm 0.68$  kg ( $p < 0.05$ ).

The investigation of chest girth also discovered age changeability and group differences of the examined. The highest rates of chest girth gain in a year were found out in the group of adolescents going in for sport.

So, while at the age of 16 the chest girth indices of the male athletes are  $84.24 \pm 0.38$  cm, by the age of 18 the given index rises up to  $90.52 \pm 0.58$  cm. The peculiarity discovered by us consists in reliably larger ( $p < 0.05$ ) chest girth of adolescent athletes in comparison with the group of children with low movement regime.

Thus, the study of anthropometric indices of adolescents' body total parameters discovered age and group differences. The determined growth activity of physical development indices allows us to characterize objectively age changeability in the body structure at the final stage of the somatic type formation. The adolescent athletes total body sizes are characterized by the maximum value, while those with the low movement regime are distinguished by the minimum figures of the studied indices. It may be stated that doing sports has stimulating impact on the growth of the body total sizes.

While anthropometric investigations characterize organism structural changes, physiometric indices, to a considerable extent, reflect functional state of certain organs and organs systems.

The investigation of heart rate (HR) discovered the following peculiarity: in the period of 16-18 years the decline of the given index by 5-6 bpm is observed in all groups of the examined boys, and 5-8 bpm in the groups of the girls. (See Table 2, Table 3).

It was determined that the heart rate of the adolescent athletes was relevantly lower than the one of the children with the low movement regime. The reduction of the heart rate under the influence of systematic trainings is connected with the enhancement of parasympathetic impacts on the heart automatism function which reflects the efficiency of cardiovascular system functioning.

Table 2

## Physiometric indices of boys' organism with low level of locomotion

Age, years	Boys (n=31)		Female athletes (n=34)	
	M±m	δ	M±m	δ
HR, bpm				
16	81.25±0.48	2.61	68.21±0.42**	2.45
17	78.41±0.42	2.56	65.36±0.39**	2.41
18	76.38±0.38	2.49	62.42±0.35**	2.36
BPc, mm Hg				
16	119.24±0.96	4.21	118.61±0.92	4.16
17	122.15±0.92	4.33	120.18±0.88	4.22
18	124.28±0.86	4.39	121.45±0.84*	4.28
BPd, mm Hg				
16	75.31±0.65	2.46	84.34 ±0.63	2.41
17	77.26±0.62	2.44	75.16±0.61*	2.36
18	79.30±0.59	2.39	76.14±0.57*	2.32
LC, l				
16	2.75±0.09	0.36	3.62±0.15*	0.51
17	2.98±0.11	0.41	4.15±0.17**	0.58
18	3.24±0.13	0.49	4.46±0.19*	0.63
Hand dynamometry, kg				
16	28.31±0.31	1.46	34.18±0.36**	1.61
17	31.15±0.34	1.52	39.26±0.39**	1.69
18	34.2±0.37	1.62	42.35±0.41**	1.75
Spinal dynamometry, kg				
16	86.35±0.81	2.62	98.65±0.92**	2.91
17	90.24±0.85	2.75	115.24±0.96**	3.08
18	94.16±0.91	2.88	125.31±0.99**	3.16

Notes: \* – the relevance of the differences in comparison with the results of the boys group ( $p < 0.05$ ); \*\* – the relevance of the differences in comparison with the results of the boys group ( $p < 0.01$ ).

Table 3

## Physiometric indices of girl organism with different level of locomotion

Age, years	Girls (n=35)		Female athletes (n=32)	
	M±m	δ	M±m	δ
HR, bpm				
16	85.36±0.49	2.65	67.61±0.44 <sup>#</sup>	2.41
17	79.45±0.41	2.51	64.45±0.41 <sup>#</sup>	2.37
18	77.18±0.39	2.46	62.28±0.35 <sup>#</sup>	2.31
BPs, mm Hg				
16	116.15±0.95	4.25	115.34±0.89	4.04
17	118.42±0.91	4.21	117.18±0.82	3.92
18	119.62±0.88	4.15	118.45±0.76	3.84
BPd, mm Hg				
16	73.65±0.64	2.49	72.48 ±0.62	2.31
17	75.34±0.61	2.41	73.32±0.59**	2.26
18	76.18±0.58	2.35	74.15±0.56**	2.22
LC, l				
16	2.46±0.09	0.32	3.46±0.14**	0.49
17	2.78±0.11	0.36	3.81±0.16**	0.54
18	3.06±0.13	0.41	4.15±0.18**	0.58

End of the Table 3

Hand dynamometry, kg				
16	24.15±0.29	1.35	29.65±0.33**	1.44
17	28.26±0.32	1.42	34.28±0.36**	1.56
18	31.35±0.35	1.54	37.15±0.39**	1.64
Spinal dynamometry, kg				
16	72.18±0.69	2.61	82.65±0.75 <sup>#</sup>	2.81
17	78.26±0.73	2.75	94.15±0.81 <sup>#</sup>	2.87
18	84.36±0.78	2.82	106.48±0.88 <sup>#</sup>	2.94

*Notes:* \*\* – the relevance of the differences in comparison with the results of the girls group ( $p < 0.05$ ); <sup>#</sup> – the relevance of the differences in comparison with the results of the girls group ( $p < 0.01$ ).

The indices of the systolic blood pressure (BPs) and diastolic blood pressure (BPd) are also characterized by age changeability and group differences. In the period of 16-18 years old the index of systolic blood pressure in all the boys groups increases by 3-5 mm Hg, in the girls groups – by 3-4 mm Hg; the indices of diastolic blood pressure – by 2-4 mm Hg and 2-3 mm Hg respectively.

In all age periods involved in the experiment the indices of adolescent athletes' blood pressure are characterized by lower figures which is explained by the considerable reconstruction of hemodynamics under the influence of high physical exertion.

In the period of 16-18 years old the index of lung capacity (LC), hand and backbone strength of all the examined girls and boys continuously is growing. The increase of the mentioned indices in the group of adolescent athletes is characterized by the highest rate.

For the integral evaluation of the blood circulation state we calculated certain hemodynamic indices (See Table 4, Table 5). The pulse pressure of the boys and girls groups tends to increase and by the age of 18 it reaches the highest rates.

Table 4

#### Hemodynamics indices of boys' organism with different level of locomotion

Age, years	Boys (n=31)		Male athletes (n=34)	
	M±m	δ	M±m	δ
Pulse pressure, mm Hg.				
16	43.93±0.45	2.38	44.27±0.41	2.16
17	44.89±0.43	2.25	45.02±0.39	2.04
18	44.98±0.41	2.17	45.31±0.37	1.91
Systolic output, mL				
16	61.25±0.56	2.56	63.18±0.58	2.61
17	65.46±0.59	2.65	66.35±0.62	2.75
18	68.15±0.62	2.75	71.12±0.65*	2.82
Cardiac output, L/min				
16	4.81±0.12	0.48	6.84±0.16*	0.62
17	5.06±0.14	0.54	7.26±0.18*	0.69
18	5.26±0.15	0.59	7.68±0.19*	0.75
Cardiac index, L/min/m <sup>2</sup>				
16	3.12±0.13	0.37	3.61±0.17*	0.48
17	3.35±0.15	0.42	3.82±0.19*	0.52
18	3.56±0.17	0.47	4.12±0.21*	0.58

*Notes:* \* – the relevance of the differences in comparison with the results of the boys group ( $p < 0.05$ );

In the group of adolescent athletes the pulse pressure indices are characterized by the highest rates during all the investigated age period, although the relevant differences were not discovered.

**Haemodynamics indices of girls organism with different level of locomotion**

Age, years	Girls (n=35)		Female athletes (n=32)	
	M±m	δ	M±m	δ
Pulse pressure, mm Hg				
16	42.50±0.48	2.21	42.86±0.45	2.19
17	43.08±0.49	2.19	43.86±0.43	2.23
18	43.44±0.51	2.15	44.30±0.44	2.14
Systolic output, mL				
16	61.45±0.57	2.54	62.48±0.59	2.57
17	63.26±0.59	2.65	65.31±0.61**	2.65
18	65.15±0.62	2.71	69.18±0.65**	2.78
Cardiac output, L/min				
16	4.68±0.12	0.46	5.64 ±0.17**	0.58
17	4.85±0.14	0.52	5.98±0.19**	0.62
18	5.06±0.16	0.57	6.24±0.21**	0.65
Cardiac index, L/min/m <sup>2</sup>				
16	3.06±0.09	0.35	3.41±0.12	0.43
17	3.21±0.11	0.39	3.65±0.14	0.49
18	3.36±0.12	0.42	3.88±0.16**	0.56

Notes: \*\* – the relevance of the differences in comparison with the results of the girls group ( $p < 0,05$ ).

The calculations of the systolic output allowed us to discover age and group differences among the examined adolescents. We determined that systolic output in the period of 16-18 years old increased by 4-7 mL both for boys and girls. The given index is much higher for the adolescent athletes than for those children that did not go in for sport ( $p < 0,05$ ).

In order to level the possible impact of individual anthropometric characteristics of the hemodynamic indices of the examined children we calculated cardiac index. It was determined that cardiac index in all experimental groups reached the highest rates by 18 years old. In the group of adolescent athletes the cardiac index of all age groups is characterized by the highest rates.

Thereby, the received data allowed us to discover age changeability and group differences in the formation of hemodynamic indices. By the age of 18 practically all boys and girls are characterized by stabilizing the cardiovascular system functional maturity. However, the change rate of these indices for better was revealed in those children who go in for sport. Regular physical exertion considerably increases functional power and efficiency of cardiovascular system activity of adolescent athletes' organism.

**Conclusions.** The carried out investigation shows that regular physical exercises facilitate increase of the function level of children's organs and organism system. In the process of muscle activity as a result of systematic physical trainings children increase functional resources of cardiovascular, respiratory and other systems, develop the complex of structural functional changes directed upon optimizing the activity of both certain systems and the entire organism. Such changes comprise the foundation of enhancement and disease prevention in the process of healthy physical exercising; here with the resistance of organism to unfavorable environmental conditions increases.

**References**

1. Bukhanovska, T. M., Maltseva, L. O. & Andreichyn, L. V. (2012). Stan zdorovia suchasnykh shkoliariv, shliakhy yoho zberezhennia ta polipshennia [Health status of modern schoolchildren, ways of its preservation and improvement]. *Ukraina. Zdorovia natsii*, no. 1(21), 44–50.
2. Vlasova, S. (2017). Innovatsii v systemi fizychnoho vykhovannia shkoliariv [Innovations in the physical education system of pupils]. *Fizychno vykhovannia, sport i kultura zdorovia u suchasnomu suspilstvi*, no. 2(38), 51–56.
3. Harashchuk, O. V. & Kutsenko, V. I. (2016). Mahistralnyi shliakh zdoroviazberihaiuchoi paradyhmy rozvytku osvity [The main way of health retentive paradigm in education development]. *Naukovyi visnyk IFNTUNH. Serii: Ekonomika ta upravlinnia v naftovii i hazovii promyslovosti*, no. 1(13), 87–93.

4. Dudina, O. O. & Tereshchenko, A. V. (2014). Sytuatsiinyi analiz stanu zdorovia dytiachoho naselennia [Situational analysis of children population health state]. *Visnyk sotsialnoi hihiieny ta orhanizatsii okhorony zdorovia Ukrainy*, no. 2(60), 49–57.
5. Futornyi, S. M. (2016). Formuvannia zdorovoho sposobu zhyttia molodoho pokolinnia u protsesi fizychnoho vykhovannia [Formation of young generation healthy way of life in the process of physical education]. *Teoriia i metodyka fiz. vykhovannia i sportu*, no. 2, 54–57.
6. Khurtenko O. V. (2011). Shliakhy pidvyshchennia rukhovoï aktyvnosti ta rozvytku rukhovyykh umin i navychok ditei starshoho shkilnoho viku [Ways of movement activity increase and movement abilities and skills development of senior schoolchildren]. *Visnyk Natsionalnoi akademii Derzhavnoi prykordonnoi sluzhby Ukrainy*, vyp. 1, 89–96.
7. Kuts, O., Kedrovsky, B. & Leonova, V. (2017). Conceptual background of the school system reform of physical education in Ukraine. *Physical Education, Sports and Health Culture in Modern Society*, no. 4 (40), 15–23.

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