

INTERCONNECTIONS OF STRENGTH PREPAREDNESS AND MORPHOFUNCTIONAL STATE OF YOUTH

Liudmyla Cherkashina¹, Roman Cherkashin¹

¹Lesya Ukrainka Eastern European National University, Lutsk, lcherkashina1983@i.ua

<https://doi.org/10.29038/2220-7481-2019-01-77-83>

Abstracts

The Topicality of our Research is determined by the need to increase the strength of youth preparedness as a means of diversifying the health-improving effect on the body of youth. *The purpose of the research* is to define the interconnections between the strength preparedness and the morphofunctional state of youth. *Methods of the research* – theoretical (the analysis of psychological and pedagogical and special literature, comparison, systematization of information), empirical (anthropometric measurements, pedagogical testing, medical-biological methods), statistical methods. A correlation analysis was performed in order to study possible functional interconnections between the indicators of strength's development and components of physical condition. *Results of the Work.* The data of flexion and extension of the hands in the emphasis are positively correlated with the circumference of the chest ($r = 0,34$), shoulder (0,47), forearm (0,37), wrist (0,34) and are negative with body length (-0,32), thickness of skin and fat folds at triceps (- 0,36), under ilium bone (-0,37), the gastrocnemius muscle (-0,43). The results of arm-pumping exercises in push-up position have separate connections with other strength's indications of youth. In particular, the obtained results are related to the data on the bent suspension (0,57), pull-up (0,62), lift up from the lying position per min (0,32), the deadlift (0,34). The deadlift is positively connected with dynamometry (0,31), the standing long jump (0,30), inclining forward from the sitting position; the bent suspension with pulling (0,64). The dynamometry of the wrist is connected with the weight of the body (0,35) and the circumference of a lower leg (0,36); the standing long jump with body length (0,31). *Conclusions.* The results of the study indicate that there are positive and negative connections between the strength's preparedness, physical development and youth's functional capabilities. The revealed patterns should be taken into account in the process of planning of training classes on physical education in academic institutions.

Key words: strength preparedness, morphofunctional state, interconnections, youth.

Актуальність дослідження зумовлена потребою підвищення силової підготовленості молоді як засобу різнобічного оздоровчого впливу на організм молоді. *Мета дослідження* – визначити взаємозв'язки силової підготовленості та морфофункціонального стану молоді. *Методи дослідження* – теоретичні (аналіз психолого-педагогічної та спеціальної літератури, порівняння, систематизація інформації), емпіричні (антропометричні вимірювання, педагогічне тестування, медико-біологічні методи), статистичні. Із метою вивчення можливих функціональних взаємозв'язків між показниками розвитку сили й складниками фізичного стану проведено кореляційний аналіз. *Результати роботи.* Дані згинання й розгинання рук в упорі лежачи позитивно взаємопов'язані з окружністю грудної клітки ($r = 0,34$), плеча (0,47), передпліччя (0,37), зап'ястя (0,34) і від'ємно – із довжиною тіла (-0,32), товщиною шкірно-жирових складок трицепса (-0,36), над клубовою кісткою (-0,37), гомілкового м'яза (-0,43) Результати згинання й розгинання рук в упорі лежачи мають окремі зв'язки з іншими силовими показниками молоді. Зокрема, отримані результати пов'язані з даними вису на зігнутих руках (0,57), підтягування у висі (0,62), підйому в сід із положення лежачи за 1 хв (0,32), становою силою (0,34). Станова сила позитивно пов'язана з динамометрією (0,31), стрибком у довжину з місця (0,30), нахилом уперед із положення сидячи; вис на зігнутих руках – із підтягуванням (0,64). Динамометрія кисті пов'язана з масою тіла (0,35) та окружністю гомілки (0,36); стрибок у довжину з місця – із довжиною тіла (0,31). *Висновки.* Результати дослідження свідчать про наявність позитивних і негативних зв'язків між силовою підготовленістю, фізичним розвитком і функціональними можливостями молоді. Виявлені закономірності потрібно враховувати в процесі планування навчально-тренувальних занять із фізичного виховання в навчальних закладах.

Ключові слова: силова підготовленість, морфофункціональний стан, взаємозв'язки, молодь.

Людмила Черкашина, Роман Черкашин. Взаимосвязи силовой подготовленности и морфофункционального состояния молодежи. *Актуальность* исследования обусловлена необходимостью повышения силовой подготовленности молодежи как средства разностороннего оздоровительного воздействия на ее организм. *Цель исследования* – определить взаимосвязи силовой подготовленности и морфофункционального

состояния молодежи. **Методы исследования** – теоретические (анализ психолого-педагогической и специальной литературы, сравнение, систематизация информации), эмпирические (антропометрические измерения, педагогическое тестирование, медико-биологические методы), статистические. С целью изучения возможных функциональных взаимосвязей между показателями развития силы и составляющими физического состояния проведен корреляционный анализ. **Результаты работы.** Данные сгибания и разгибания рук в упоре лежа положительно взаимосвязаны с окружностью грудной клетки ($r = 0,34$), плеча (0,47), предплечья (0,37), запястья (0,34) и отрицательно – с длиной тела (-0,32), толщиной кожно-жировых складок трицепса (-0,36), надподвздошной костью (-0,37), берцовой мышцей (-0,43). Результаты сгибания и разгибания рук в упоре лежа имеют отдельные связи с другими силовыми показателями молодежи. В частности, полученные результаты связаны с данными веса на согнутых руках (0,57), подтягивания в висе (0,62), подъема в сид из положения лежа за 1 мин (0,32), становой силой (0,34). Становая сила положительно связана с динамометрией (0,31), прыжком в длину с места (0,30), наклоном вперед из положения сидя; вис на согнутых руках – с подтягиванием (0,64). Динамометрия кисти связана с массой тела (0,35) и окружностью голени (0,36), прыжок в длину с места – с длиной тела (0,31). **Выводы.** Результаты исследования свидетельствуют о наличии положительных и отрицательных связей между силовой подготовленностью, физическим развитием и функциональными возможностями молодежи. Выявленные закономерности нужно учитывать при планировании учебно-тренировочных занятий по физическому воспитанию в учебных заведениях.

Ключевые слова: силовая подготовленность, морфофункциональное состояние, взаимосвязи, молодежь.

Introduction. Research studies have proved that systematic physical exercises strengthen health, improve neuro-psychological resistance to emotional stress, support physical and mental working efficiency of children and young people [4; 6; 9; 10; 11]. The primary role in health-improving training belongs to vigorous exercises that build up the physique which functionally provides not only body movements but also energy production. Muscular system provides the corset function of all body organs and systems. Insufficient amount of muscle tissue leads to the development of metabolic diseases: diabetes, obesity, atherosclerosis, hypertrophy. Strength training have a positive effect on health, working efficiency, endurance, agility, speed [1; 3; 8]. Therefore, the optimal level of strength development is an effective factor in preventing diseases and providing locomotor and energy producing functions of the body.

The second equally important reason for the use of vigorous exercises is the desire of young people to have a perfect body build. It is this aesthetic motive that is a much more effective incentive for individual and systematic physical exercises than sound health [2; 7]. At the same time, for the implementation of health-improving training it is necessary to study the interconnections between strength development and morphofunctional state of the youth, which requires further research.

The purpose of the research is to find out the interconnections between strength preparedness and morphofunctional state of the youth.

Material and methods of the research. Theoretical (the analysis of psychological, pedagogical and special literature, comparison, systematization of information), empirical (anthropometric measurements, pedagogical testing, medical-biological methods) and statistical methods of research have been applied. The dynamometry of right and left hands, lifting force, bent suspension, pull-ups, push-ups, sit up from the lying position in 30 seconds, sit up from the lying position in 1 minute, standing long jump have been defined to assess strength development. Physical preparedness is determined by the level of development of physical qualities: endurance (3000 meters race), speed (100 meters race), agility (shuttle run 4x9 m), and dorsal spine mobility (bent forward from the sitting position). Physical development has been identified by the indicators of body length, body weight, the circumferences of chest, neck, shoulder, forearm, waist, hips, thigh, lower leg and wrist, the thickness of skin and fat folds of biceps, triceps, under the shoulder blade, over the ilium bone, of the gastrocnemius muscle. The systolic and diastolic blood pressure, heart rate, inspiratory hold (Shtange test), expiratory hold (Genchi test), and lung capacity have been measured to determine the state of the cardiovascular and respiratory systems of the body. Correlation analysis has been performed to study possible functional interconnections between the indicators of strength development and components of physical fitness.

Experiment involved 237 17-year-old boys, the students of Lutsk comprehensive secondary schools № 11 and № 18, and first year students of Lesia Ukrainka Eastern European National University.

Research results. The obtained data indicate that body weight is closely correlated with body length ($r = 0.56$), the circumferences of chest (0.75), forearm (0.61), hips (0.66), thigh (0.66), lower leg (0.61), wrist (0.64) and the thickness of skin and fat folds of biceps (0.60) and over the ilium bone (0.52) (Table 1).

Table 1

Correlation of the Indicators of Physical Development of the Youth
(zeros and commas are not specified)

	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	56	63	57	29	39	51	34	47	54	20	-01	14	17	18
2		77	49	34	61	66	66	61	64	60	34	47	52	42
3			59	38	59	72	61	49	58	31	30	40	39	39
4				32	49	42	38	37	45	23	11	24	21	30
5					16	32	40	19	25	10	15	15	18	-05
6						52	54	38	62	46	24	40	40	34
7							60	37	53	35	22	35	34	36
8								59	53	47	36	49	49	29
9									40	50	31	42	51	29
10										45	15	36	38	35
11											47	53	53	32
12												30	33	41
13													71	41
14														58

Notes:

- | | | |
|--|---|--|
| <p>1. Body length;</p> <p>2. Body weight;</p> <p>3. Chest circumference at rest;</p> <p>4. Neck circumference;</p> <p>5. Shoulder circumference;</p> | <p>6. Forearm circumference;</p> <p>7. Hips circumference;</p> <p>8. Thigh circumference;</p> <p>9. Lower leg circumference;</p> <p>10. Wrist circumference;</p> <p>11. Biceps skin and fat fold thickness;</p> <p>12. Triceps skin and fat fold thickness;</p> | <p>13. The thickness of skin and fat fold under the shoulder blade;</p> <p>14. The thickness of skin and fat fold over the ilium bone;</p> <p>15. The thickness of skin and fat fold of the gastrocnemius muscle .</p> |
|--|---|--|

The average correlation between body weight and the circumferences of neck (0.49), shoulder (0.34), the thickness of skin and fat folds of triceps (0.34), under the shoulder blade (0.47), of lower leg (0.42); the systolic (0.36) and diastolic (0.34) arterial blood pressure has been found out. It should be noted that body weight negatively correlates with the long-distance running (-0.31), that is, an increase in the body weight leads to a decrease in the results in these events. Overall, body weight has the highest number of reliable ($p < 0,05$) interconnections – 22.

Body length also has a large number of interconnections. The highest correlation coefficient has been found out between body length and chest circumference (0,63); the circumferences of neck (0,57), hips (0,51) and wrist (0,54). The average correlation is observed with the circumferences of forearm (0,39), waist (0,38), thigh (0,34), lower leg (0,42).

Chest circumference is a rather informative indicator, which is associated with many others. The results of correlation analysis show that, in addition to the already mentioned connections, chest circumference correlates with the circumferences of neck (0.59), shoulder (0.38), forearm (0.59), waist (0.54), hips (0.72), thigh (0.61), lower leg (0.49), wrist (0.58); with the thickness of skin and fat folds of biceps (0.31), triceps (0.30), under the shoulder blade (0.40), over the ilium bone (0.39), of the gastrocnemius muscle (0.39); with systolic arterial blood pressure (0.31), the duration of bent suspension (-0.31), a number of pull-ups (-0.32). Similar tendency of correlation connections is observed in other circumferences of body parts and the thickness of skin and fat folds.

Correlation analysis shows positive and negative connections between physical preparedness, physical development and functional capabilities of the youth (Table 2). Shuttle run 9 x 4 meters has interconnections with the thickness of skin and fat folds of triceps (0.31) and the gastrocnemius muscle (0.38); 100 meters race has interconnections with systolic arterial blood pressure (0.38). Negative correlation is found out between 3000 meters race (endurance) and body weight (-0.31), the thickness of skin and fat folds of triceps (-0.33), and over the ilium bone (-0.31).

Correlation of the Indicators of Physical Development and Physical Preparedness of the Youth
(zeros and commas are not specified)

	16	17	18	19	20	21	22	23	24	25	26	27	28	29
1	15	15	19	26	02	21	05	02	21	-01	-37	31	-31	-32
2	10	19	36	34	09	-05	35	-01	-36	18	-15	22	25	-18
3	13	26	31	25	11	-14	26	-09	-33	18	33	13	02	34
4	20	25	08	08	16	-07	18	-08	-34	14	-19	05	-01	-15
5	08	11	08	06	12	-11	20	11	-22	20	48	15	02	47
6	15	28	29	16	03	01	19	-11	-49	13	37	23	05	37
7	04	13	32	15	09	01	14	01	-42	04	-20	25	22	-18
8	10	20	40	13	09	-03	24	01	-39	02	-34	27	17	-25
9	-03	16	23	30	-02	07	36	-05	-36	09	-25	17	15	-21
10	12	27	26	19	-01	04	21	05	-26	25	39	16	09	39
11	-05	15	22	23	-10	04	25	-22	-34	02	-19	25	28	-12
12	-17	04	20	10	07	-19	07	08	-16	-16	-13	04	31	-36
13	09	16	27	06	04	01	29	-08	-25	04	-21	30	17	-15
14	07	15	43	18	11	06	20	-07	-34	-04	-34	34	21	-37
15	04	05	27	10	18	-11	12	05	-28	-16	-31	17	38	-43
16		64	06	-13	14	-10	19	04	-02	14	09	07	04	09
17			63	25	04	-15	23	03	-10	10	-15	09	-03	16
18				45	02	10	-03	12	-30	01	-11	12	07	05
19					-16	04	02	-01	-25	08	-18	02	-07	12
20						39	11	02	04	-11	07	-12	21	08
21							02	-09	-01	12	41	18	08	32
22								31	-01	17	42	06	21	31
23									28	30	-03	-17	-07	34
24										17	65	-35	-01	57
25											09	06	-18	21
26												-14	14	62
27													11	08
28														25

Notes: 1–15 – See Table 1;

16. Inspiratory hold;

17. Expiratory hold;

18. Systolic arterial blood pressure;

19. Diastolic arterial blood pressure;

20. Heart rate at rest;

21. Dynamometry of the right handt;

22. Dynamometry of the left hand;

23. Lifting force;

24. Bent suspension;

25. Standing long jump;

26. Pull-ups;

27. Balance stand

("Flamingo" test);

28. Shuttle run 9 x 4 meters;

29. Push-ups;

The results of push-ups are positively **interconnected** with chest circumference ($r = 0.34$), shoulder circumference (0.47), forearm circumference (0.37), wrist circumference (0.34) and negatively – with body length ($r = -0.32$), the thickness of skin and fat folds of triceps (-0.36), under the ilium bone (-0.37), and of the gastrocnemius muscle (-0.43) (fig. 1).

The data on push-ups have some connections with other physical qualities of boys. In particular, the obtained results are related to the data on bent suspension (0.57), pull-ups (0.62), sit up from the lying position in a minute (0.32), lifting force (0.34).

Similar tendency is observed in the results of pull-ups (Fig. 2). They are also negatively **correlated** with body length and the thickness of skin and fat folds and positively - with physical tests (dynamometry of the hand, bent suspension, push-ups).

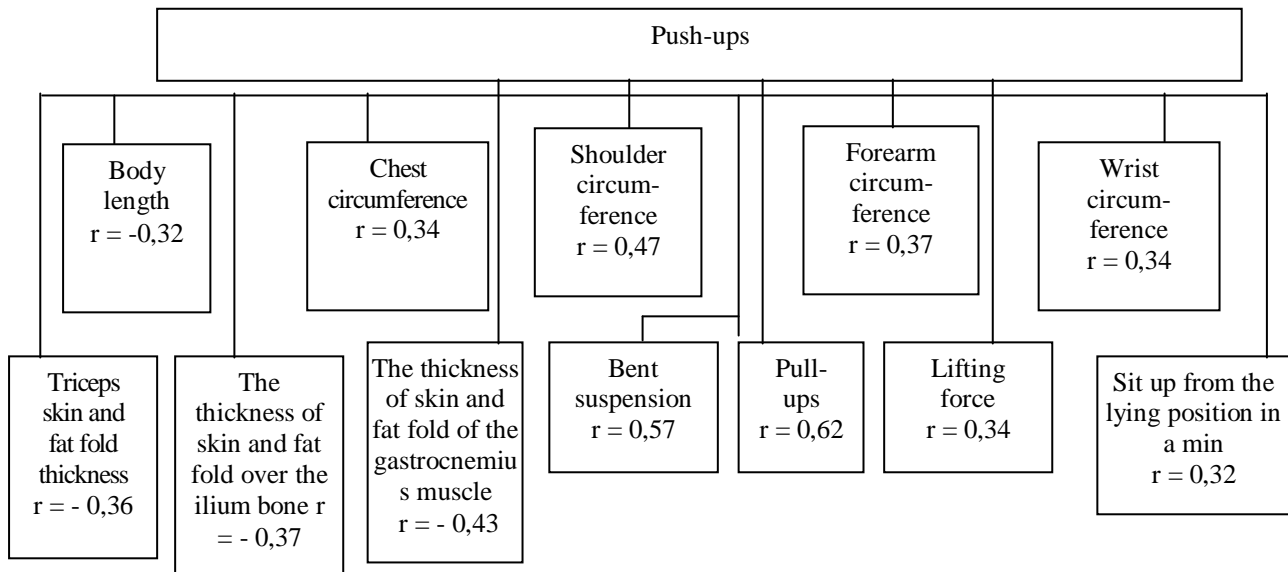


Fig. 1. Correlation between the results of push-ups and the indicators of physical fitness

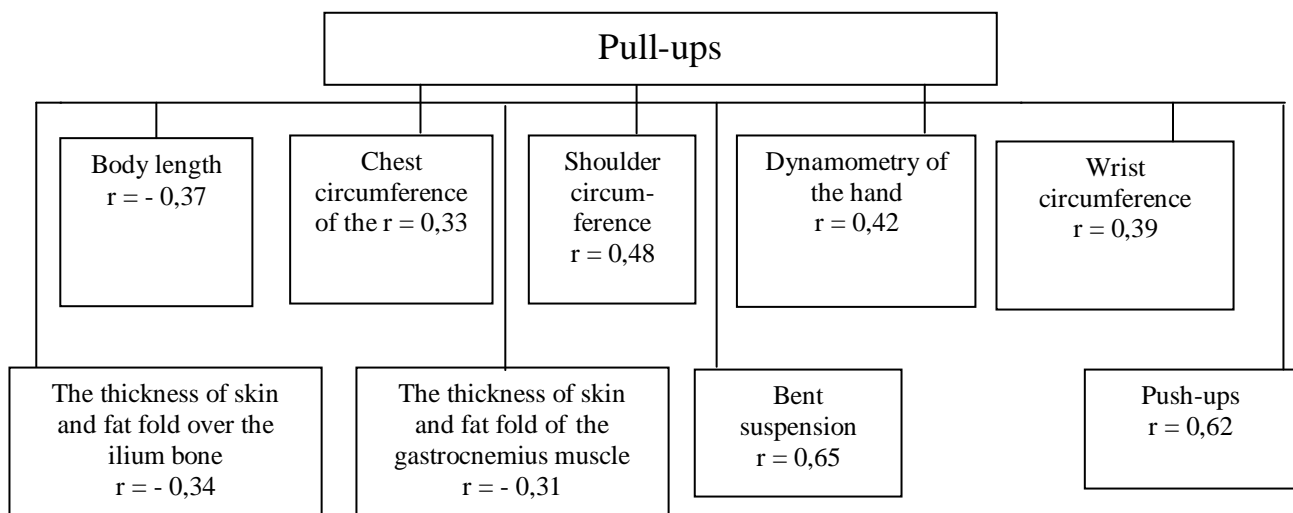


Fig. 2. Correlation between the results of high pull-ups and the indicators of physical fitness

Discussion. Correlation analysis made it possible to find out functional interconnections between the indicators of physical fitness of the youth. Our research is based on the biological law of integration of body structures and body functions[5]. According to this law, integration of body parts is transformed into a coordinated organization, in which all these parts to a certain degree depend on each other. The indication of correlation is an instrument to determine the integration of organules, tissues, organs and organ systems.

37 indicators which showed boys' physical development, physical preparedness, physical efficiency and functional capabilities have been analyzed in total.

The results of correlation analysis have proved that the majority of veracious interconnections are observed between the indicators of physical development. Anthropometric indicators of a human being are closely interrelated. Body weight and length, the circumferences of chest, shoulder, forearm, hips, thigh, lower leg, wrist, the thickness of skin and fat folds of biceps and over the ilium bone are most closely interconnected.

Our research focused on the interconnections between strength development and morphofunctional indicators of boys. Correlation analysis shows positive and negative connections between strength preparedness, physical development and functional capabilities of the youth .

It should be noted that the tendency of negative correlation between body weight and strength preparedness of the youth is observed. It is established that the lifting force is positively connected with dynamometry (0.31), standing long jump (0.30), bent forward from the sitting position; bent suspension – with pull-ups (0.64). Dynamometry of the hand is connected with body weight (0.35) and lower leg circumference (0.36); standing long jump – with body length (0.31).

Negative correlation is found out between the duration of bent suspension and body height (-0.38), body weight (-0.36), chest circumference (-0.33), the circumferences of neck (-0.34), forearm (-0.49), waist (-0.31), hips (-0.42), thigh (0.39), lower leg (-0.36), the thickness of the skin and fat folds of biceps (-0.34), under the ilium bone (-0.34), systolic blood pressure (-0.30). Pull-ups – with body height (-0.31), chest circumference on exhalation (-0.31), on inhalation (-0.33) and at rest (-0.32), forearm circumference (-0.34). Sit up from the lying position – with weight (-0.42), waist circumference (-0.38), the thickness of skin and fat fold of biceps (-0.33), under the shoulder blade (-0.35), over the ilium bone (-0.40). 100-meters race and dynamometry (-0.31); balance stand (“Flamingo” test) and bent suspension (-0.35); running with increasing speed (endurance) and 100-meters race (-0.63) are negatively interconnected.

The results of correlation analysis show the interconnection and interdependence of physical preparedness, physical development and body structure of the youth. This should be taken into consideration while planning training classes in physical education in higher educational establishments.

Conclusion. Correlation analysis has been performed to study possible functional interconnections between the indicators of strength development and the components of physical fitness. The obtained data on push-ups are positively interconnected with the circumferences of chest ($r = 0.34$), shoulder (0.47), forearm (0.37), wrist (0.34) and negatively – with body length (-0.32), the thickness of skin and fat folds of triceps (-0.36), over the ilium bone (-0.37), of the gastrocnemius muscle (-0.43) The results of push-ups have some connections with other strength indicators of boys. In particular, the obtained results are related to the data on bent suspension (0.57), pull-ups (0.62), sit up from the lying position in a minute (0.32), lifting force (0.34). Lifting force is positively connected with dynamometry (0.31), standing long jump (0.30), bent forward from the sitting position; bent suspension – with pull-ups (0.64). Dynamometry of the hand is connected with body weight (0.35) and lower leg circumference (0.36); standing long jump – with body length (0.31).

The results of the study show positive and negative connections between strength preparedness, physical development and functional capabilities of the youth. These regularities should be taken into account while planning training classes in physical education in higher educational establishments.

References

1. Zakhozhyi, V. V. (2010). Metodyka formuvannya hotovnosti starshoklasnykiv do samostiinykh zaniat fizychnymy vpravamy [Methodology of formation of high school students' readiness for solo physical exercises]. *Fizychnye vykhovannia, sport i kultura zdorovia u suchasnomu suspilstvi*: zb. nauk. pr. Skhidnoievrop. Nats. Un-tu im. Lesi Ukrainky. Lutsk, no. 2, 33–37.
2. Krutsevych, T. Yu. (2002). Sotsyalno-pedahohycheskye aspekty systemy fizycheskoho vospytanyia [Social and pedagogical aspects of the physical education system]. *Fizychnye vykhovannia, sport i kultura zdorovia u suchasnomu suspilstvi*: zb. nauk. prats Skhidnoievrop. Nats. Un-tu im. Lesi Ukrainky. Lutsk, T. 1, 125–131.
3. Muravov, I. V. (1989). Ozdorovitelnyie aspekty fizicheskoy kultury i sporta [Health improvement aspects of physical culture and sport]. Kiev: Zdorovya, 124.
4. Pantik, V. V., Navrotskyi, E. M. (2004). Vplyv systematychnykh zaniat fizychnymy vpravamy na systemy orhanizmu ta riven somatychnoho zdorovia liudyny [Influence of systematic physical exercises on body systems and level of somatic human health.]. *Naukovyi visnyk Volynskoho derzhavnoho universytetu imeni Lesi Ukrainky*, no. 4, 195–199.
5. Uilmor, Dzh. H., Kostil, D. L. (1997). Fiziologiya sporta i dvigatelnoy aktivnosti [Physiology of sport and motor activity]. K.: Olimpiyskaya lit, 504.
6. Tsos, A., Berhier, Yu., Sabirov, O. (2015). Riven fizychnoi aktyvnosti studentiv vyshchyykh navchalnykh zakladiv [Level of physical activity of students of higher educational institutions]. *Fizychnye vykhovannia, sport i kultura zdorovia u suchasnomu suspilstvi*: zb. nauk. pr. Skhidnoievrop. Nats. Un-tu im. Lesi Ukrainky. Lutsk, no. 3 (31), 202–210.
7. Tsos, A. V., Hats, H. O. (2012). Pedahohichna diahnostryka v protsesi navchannia fizychnoi kultury uchniv zahalnoosvitnikh navchalnykh zakladiv [Pedagogical diagnostics in the process of teaching physical education

- for students of general educational institutions]. *Fizychnye vykhovannia, sport i kultura zdorovia u suchasnomu suspilstvi*: zb. nauk. pr. Volyn. Nats. Un-tu im. Lesi Ukrainky, no. 4 (20), 201–209.
8. Cherkashyn, R. (2010). Riven rozvytku syly u studentiv vyshchykh navchalnykh zakladiv [The level of force development among students of higher educational institutions]. *Fizychnye vykhovannia, sport i kultura zdorovia u suchasnomu suspilstvi*: zb. nauk. pr. VNU im. Lesi Ukrainky. Lutsk, no. 2 (10), 73–75.
 9. Bielikova, N., Indyka, S. (2016). Organization of Volunteer Health-saving Activity of Future Specialists in Physical Education and Sport. *Fizychnye vykhovannia, sport i kultura zdorovia u suchasnomu suspilstvi*: zb. nauk. prats Skhidnoievrop. Nats. Un-t im. Lesi Ukrainky. Lutsk, no. 1 (33), 29–33.
 10. Ulianytska, N., Vadziuk, S., Byelikova, N., Usova, O. (2017). Violation of the Teenagers–Computer Users' Binocular Vision and Peculiarities of its Restoration. *Fizychnye vykhovannia, sport i kultura zdorovia u suchasnomu suspilstvi*: zb. nauk. prats Skhidnoievrop. Nats. Un-t im. Lesi Ukrainky. Lutsk, no. 2 (38), 182–187. <https://doi.org/10.29038/2220-7481-2017-02-182-187>.
 11. Vashchuk, L., Dedeliuk, N., Tomashchuk, O., Roda, O., Mudryk, Zh. (2017). The use of individual fitness programs according to the body types of high school girls as means of increasing physical activity. *Fizychnye vykhovannia, sport i kultura zdorovia u suchasnomu suspilstvi*: zb. nauk. prats Skhidnoievrop. Nats. Un-t im. Lesi Ukrainky. Lutsk, no. 2 (38), 36–40. <https://doi.org/10.29038/2220-7481-2017-02-36-40>.

Received: 04.03.2019.