

Liudmyła PETRUK\*

<https://orcid.org/0000-0002-3221-5028>

Igor GRYGUS\*\*

<https://orcid.org/0000-0003-2856-8514>

## The influence of physical exercises on physical development and physical preparedness of the first year female students

---

**Jak cytować [how to cite]:** Petruk L., Grygus I. (2019): *The influence of physical exercises on physical development and physical preparedness of the first year female students*. „Sport i Turystyka. Środkowoeuropejskie Czasopismo Naukowe, 2, 3, s. 97–105.

---

### Wpływ ćwiczeń fizycznych na rozwój fizyczny i fizyczne przygotowanie studentek pierwszego roku studiów

#### Streszczenie

Na uczelniach wyższych Ukrainy jest wiele studentek mających przewlekłe lub przejściowe problemy zdrowotne związane z wadami rozwoju fizycznego i zwiększoną niewydolnością funkcjonalną organizmu. Niewydolności te można wyeliminować przy pomocy zajęć wychowania fizycznego, które są ważną częścią procesu dydaktycznego uczelni wyższych na III i IV poziomie akredytacji. Przeanalizowaliśmy dynamikę ilościowego składu studentek pierwszego roku w specjalnej grupie medycznej w ciągu ostatnich sześciu lat i zidentyfikowaliśmy najczęściej występujące wśród studentów nozologie. W badaniu wzięło udział 20 studentek z chorobami układu sercowo-naczyniowego. Aby określić poziom rozwoju fizycznego, przeanalizowaliśmy wskaźniki an-

---

\* Senior Lecturer, Department of Theory and Methods of Physical Education, Institute of Health, National University of Water and Environmental Engineering; e-mail: l.a.petrak@nuwm.edu.ua

\*\* Doctor of Medical Sciences, Professor, Director of the Institute of Health, National University of Water and Environmental Engineering; e-mail: grigus03@gmail.com

tropometryczne i oceniliśmy możliwości funkcjonalne układu sercowo-naczyniowego. Poziom przygotowania fizycznego został określony przez ćwiczenia testowe, takie jak siła ręki, elastyczność i kucanie na jednej nodze.

Odkryliśmy, że liczba studentek pierwszego roku, które zostały zakwalifikowane do specjalnej grupy medycznej, wynosi 23,6% i rośnie każdego roku, chociaż ogólna liczba studentów maleje. Najczęstszymi chorobami wśród tej kategorii studentów są patologie układu sercowo-naczyniowego (46,4%), układu mięśniowo-szkieletowego (20,8%) i narządów wzroku (11,4%). Określiśmy rozwój fizyczny uczniów według wskaźników antropometrycznych. Oceniliśmy stan funkcjonalny układu sercowo-naczyniowego. Ustaliliśmy, że uzyskane dane mieszczą się w granicach wieku i norm fizjologicznych, które można znaleźć w literaturze. Obliczyliśmy wskaźnik Ruffiera, który wskazuje na niski wskaźnik układu sercowo-naczyniowego studentek pierwszego roku.

Zastosowanie proponowanego systemu ćwiczeń fizycznych na zajęciach wychowania fizycznego dla studentek pierwszego roku pozytywnie wpłynęło na pracę układu sercowo-naczyniowego i fizyczną wydolność respondentów.

**Słowa kluczowe:** rozwój fizyczny, fizyczne przygotowanie, studentki, specjalna grupa medyczna, warunki zdrowotne studentek.

## Abstract

In institutions of higher education in Ukraine, there is a large number of female students with certain permanent or temporary health problems, associated with the disadvantages of physical development and reduced functional capacity of the body. These disadvantages can be eliminated with the help of physical education courses, which are an important part of the process of training in higher education institutions of III-IV accreditation level.

We have reviewed the dynamics of the quantitative composition of first-year female students of a special medical group over the last six years and identified the most common nosology of students. The study involved 20 female students with diseases of the cardiovascular system. To determine the level of physical development we have analyzed the anthropometric indicators and evaluated the functional capabilities of the cardiovascular system. The level of physical preparedness was determined by test exercises such as hand strength, flexibility and squatting on one leg.

We have found that the number of first-year female students who were classified into a special medical group is 23.6% and increases every year, although the total number of students is decreasing. The most common diseases among this category of students are pathologies of the cardiovascular system (46,4%), musculoskeletal system (20,8%) and vision organs (11,4%). We have determined the physical development of students according to anthropometric indicators is determined. We have evaluated the functional state of the cardiovascular system. We have established that the obtained data are within the limits of the age and physiological norms that can be found in the literature. We have calculated the Ruffier Index, which indicates low rates of cardiovascular system of first-year female students.

The use of the proposed system of physical exercises for physical education for first-year female students has positively influenced the work of the cardiovascular system and the physical preparedness of the respondents.

**Keywords:** physical development, physical preparedness, female students, special medical group, students' health condition.

## Introduction

The actual problem of the present is the preservation and strengthening of the health of student youth. According to the research results of the Ukrainian Research Institute for the Health Care of Children and Adolescents, a maximum of 10–15% of children aged 7–18 can be considered healthy.

The problem of physical education and correction of the health of students in special medical groups (SMG) is highlighted by such Ukrainian scientists as A. Maglivov, V. Platonov, O. Dubogay, A. Tsios, M. Yevtushok, I. Vrzhessnevsky, V. Koryagin, O. Blavt.

In institutions of higher education in Ukraine, there is a large number of female students with certain permanent or temporary health problems, associated with the disadvantages of physical development and reduced functional capacity of the body.

The number of students engaged in special medical groups increases annually and has doubled in the last 10 years [6], [7], [8], [11], [12]. In this case, 12–18% of students are sent for classes in special medical groups for using the complexes of therapeutic physical culture [7], [9], [12]. There is also a tendency to increase the number of students of a special medical group from the first to the fourth course [10], [11], [12], which affects their motor activity, working capacity, success, physical development and physical preparedness [2], [4], [5], [8], [14]. Such disadvantages can be eliminated with the help of physical education courses, which are an important part of the process of training in higher education institutions of the III–IV level of accreditation.

**The aim** of the research is to determine the impact of the proposed physical exercises on physical development and physical preparedness of first-year female students who have deviations in the work of the cardiovascular system.

The tasks of the study are:

- 1) to establish the dynamics of the quantitative composition of the first-year female students of the special medical group of the National University of Water and Environmental Engineering (NUWEE) for the last six years.
- 2) to determine the most common nosology of NUWEE students during the 2017–2018 academic year.
- 3) to determine the effectiveness of the impact of the proposed physical exercises on the level of physical development and physical preparedness of the first-year female students.

## Materials and methods of research

The research was organized at the Department of Physical Education of NUWEE. The research was attended by 20 students of the first year of the Educational and Scientific Institute of Economics and Management who have a history of cardiovascular disease.

According to anthropometric indicators (body weight, height, and chest circumference), we have determined the physical development of the students, and based on the obtained data, two indices were calculated: the Quetelet Index and the Pignet index.

The level of physical preparedness of female students was determined by such test exercises as: force of the hand (dynamometry), flexibility (body tilt from sitting position), and squat on one (right) foot with a support by hand.

The indicators of heart rate at rest determined the assessment of cardiovascular functionality of students, during loading and after loading. According to the obtained data, the Ruffier index was calculated.

## Research results

During the 2017–2018 academic year, 369 students of I-IV courses were enrolled to special medical groups at NUWEE which is 12.5% from the total number of students of the University – 2953. In higher educational institutions of Ukraine, this indicator varies within 13% –35% [12, p. 190].

Over the past six years, we have analyzed the dynamics of the number of first-year NUWEE students, which were classified into a special medical group according to the condition of health (Table 1). In this academic year, these 87 students represent 23.6% of the total number of students in SMG. For comparison, in the 2015-1016 academic year the number of such freshmen was 10.6%. The obtained data allow saying that the percentage of students with health deviations increases every year, although the total number of students is decreasing. Such a gradual increase in the number of students confirms the opinion of scholars that each year the students do not become healthier [3], [9].

**Table 1.** Dynamics of quantity indicators of the number of first-year students who attend classes in the special medical group at NUWEE

Academic years		2012–2013	2013–2014	2014–2015	2015–2016	2016–2017	2017–2018
General amount of students who attend PE classes		4179	3991	3927	3460	3399	2953
General amount of students in SMG		817	786	776	621	530	369
Those of them who study in the 1 <sup>st</sup> year	male	43	60	51	23	40	45
	female	107	116	107	43	69	42
	total	150	176	158	66	109	87
	%	<b>18,4</b>	<b>22,4</b>	<b>20,4</b>	<b>10,6</b>	<b>20,6</b>	<b>23,6</b>

Source: own research.

To determine the most common diseases of students of special medical group at NUWEE, we have analyzed the medical certificates and identified three major diseases of students. The largest number of students (46.4%) have abnormalities in the cardiovascular system, 20.8% – have problems with the musculoskeletal system; 11.4% – have visual impairment; 5.5% of students have violation in the gastrointestinal tract; 3.8% – diseases of the genitourinary system, 2.8% – the endocrine system problems, 2.8% – deviation in the respiratory system. In addition, there are students who have skin, lymphatic system, and brain diseases.

To determine the indicators of physical development and physical preparedness of the first year students, we examined 20 first year students studying at the Educational and Scientific Institute of Economics and Management of NUWEE who have a history of cardiovascular disease. Students were divided into two groups: experimental (EG) (10 students) and control (CG) (10 students) groups. The examinations were organized in both groups at the beginning and at the end of the academic year.

Physical education classes for these two groups had some differences: general development exercises and exercises for the development of flexibility, selected by non-traditional methods in the EG made up 90% of the duration of the academic session, whereas the CG classes were conducted under the basic curriculum. In addition, in the EG, the preparatory part occupied 50% of the classes, in the control group – 30%, the bulk of them were respectively 35 and 55% of the academic session. In the main part of the class, physical exercises aimed at the development of strength, dexterity, flexibility, and dynamic force were used. Yoga exercises, music therapy and aromatherapy were widely used in educational activities in EG. Lectures, conversations, discussions on a healthy lifestyle, the effects of physical exercises on the cardiovascular system, physiological features of the cardiovascular system and the whole organism were also held.

Physical development of the students was determined by anthropometric indices (body weight, height, and chest circumference), on the basis of the obtained data we calculated two indices: the Quetelet Index and the Pignet index (Table 2). These indices are good informative indicators of the physical development of the studied female students. The obtained data are slightly lower than the age norms found in the literature [1], [8], [13]. There is no significant increase in the anthropometric indices of students in the EG and CG during the academic year, which allows to assert approximately the same and poor physical development of the examined students.

To determine the level of physical preparedness of the students in EG and CG we have analyzed the obtained data from the following test exercises: strength of the hand (dynamometry) (kg), flexibility (body tilt from sitting position) (cm), squatting on one (right) foot with a support by hand (number of times). There was no significant difference between the rates of students in the EG and the CG, but the obtained data are lower than the normative indicators (Table 2). The largest

changes in the indicators of physical preparedness on the seventh indicator – flexibility (cm) – was observed among the students of the EG. We also noticed improvement in two other indicators, the strength of hand and squatting on one leg.

**Table 2.** An increase of indicators of students' physical development and physical preparedness under the influence of exercises during the academic year ( $X \pm m$ )

№	Indicators	Norm	EG n = 10		CG n = 10	
			Beginning of the a.y.	End of the a.y.	Beginning of the a.y.	End of the a.y.
1	Weight, kg	56±1,4	52,6±1,2	52,7±1,4	53,8±2,1	53,5±1,1
2	Height, cm	168±1,8	167,5±2,48	169,4±1,38	166,9±1,08	167,3±1,58
3	Chest circumf., cm	86,6±1,4	84,2±0,97	85,3±1,2	74,2±3,89	76,3±2,41
4	The Quetelet Index, g/cm	361,4±3,27	314,9±6,46	331,8±7,36	322,17±11,23	327,24±3,11
5	The Pignet index, cm/g/cm	25,1±2,7	30,07±2,8	29,94±1,6	34,0±3,35	34,21±2,16
6	Strength of the hand, kg	30,9±0,89	23,1±0,97	26,9±1,6	21,6±0,97	23,4±0,86
7	Flexibility, cm	20,2±1,74	17,3±1,62	22,1±2,1	18,3±2,38	19,92±1,9
8	Squatting on one foot, times	9,0±0,54	5,7±0,86	8,6±0,92	4,5±0,86	6,4±0,71

Source: own research.

Having analyzed the obtained results of physical preparedness of female students in both the EG and the CG during the academic year, we can speak about the improvement of the EG students' results in comparison with the initial data at the beginning of the academic year.

**Table 3.** Dynamics of indicators of functional possibilities of female students during the academic year ( $X \pm m$ )

№	Indicators	Norm	EG n = 10		CG n = 10	
			Beginning of the a.y.	End of the a.y.	Beginning of the a.y.	End of the a.y.
1	HR in rest within 1 minute	81,0±2,94	92,4±3,46	90,0±3,34	93,6±4,32	92,1±2,3
2	HR after activity	116,8±2,97	139,2±3,46	127,6±2,52	155,6±4,76	149±3,12
3	HR after 5 minutes of rest	84,0±3,35	95,6±4,32	90,8±2,07	94,4±5,19	93,2±2,07
4	The Ruffier index	10,1±2,11	18,6±1,08	14,2±1,2	19,0±1,12	17,1±0,8

Source: own research.

The evaluation of functional capability of the cardiovascular system of the students was carried out by heart rate determiners (HR) at rest, during and after activity (Table 3). According to the obtained data, the Ruffier index was calculated.

After comparing the heart rate of students in the EG and CG at the beginning and at the end of the academic year, an improvement in the cardiovascular system in the EG was observed. It is evidenced by a decrease in the heart rate of students in the EG in a state of rest and better period of recovery of heart rate after dosed physical activity. However, the obtained results are worse than those available in the literature [12], [13] and regulatory documents.

The obtained indicators of the state of the cardiovascular system in the EG and CG according to the Ruffier index at the beginning of the academic year do not differ significantly, but they are worse in comparison with the data described by V. Romanenko. However, for students who were engaged in the system of proposed physical exercises, the Ruffier index indicators were improved at the end of the academic year, indicating positive changes in the cardiovascular system.

## **Conclusions**

After analyzing the collected data of the quantitative composition of the first year students of the special medical group for the last six years, it has been established that this year such students at the university make up 23.6%, and each year the percentage of such students in NUWEE increases.

Analysis of medical cards of students enrolled in a special medical group allowed to determine the most common diseases among student youth. Almost half (46.4%) of all diseases are pathologies of the cardiovascular system. The second position is occupied by diseases of the musculoskeletal system (20.8%), the third is visual defects (11.4%).

We have determined the physical development of female students according to anthropometric indicators.

After analyzing the results of physical preparedness and the response of heart rate to the dosage activity of female students in both experimental and control groups during the academic year, we observe the improvement of the results in the EG students' results in comparison to the initial data at the beginning of the academic year. The application of the proposed system of physical exercises for the EG female students positively influenced on the work of the cardiovascular system and the physical preparedness of the respondents.

In addition, we have determined that the obtained data take place below the age norms available in the literature.

## References

- [1] Boichuk T.V., Holod N.R. (2012): *Characteristics of parameters of physical development and functional preparedness of students of a special medical group*. Fizychnе vykhovannia, sport i kultura u suchasnomu suspilstvi: zb. nauk. prats Volynskoho natsionalnoho un-tu imeni Lesi Ukrainky. Lutsk. № 2 (18). S. 216–221.
- [2] Dębski S.S., Skalski D., Lizakowski P., Grygus I., Stanula A. (2017): *Zdrowotne właściwości zachowań ruchowych – wybrane zagadnienia*. Medycyna i zdrowie. Wybrane aspekty ratownictwa. Gdynia-Gdańsk-Starogard Gdański. Tom 2. S. 12–44. ISBN: 978-83-89481-17-7
- [3] Dubohai O.D., Tsos A.V., Yevtushok M.V. (2012): *Methods of physical education of students of a special medical group: navch. posib. dlia stud. vyshch. navch. zakl.* Lutsk: Skhidnoievrop. nats. un-t im. Lesi Ukrainky. 276.
- [4] Grygus I., Kuczer T. (2013): *Optymalizacja sprawności fizycznej studentów z różnymi rodzajami autonomicznego układu nerwowego*. Journal of Health Sciences. 3(10): 583–604.
- [5] Grygus I., Mykhaylova N. (2013): *Wpływ ruchowej aktywności na stan zdrowia studentów*. Journal of Health Sciences. 3(5): 649–656.
- [6] Grygus I.M., Petruk L.A. (2015): *Assessment of indices of physical development and functional status of female students of a special medical group*. Journal of Education, Health and Sport. 5(10): 158–169.
- [7] Holod N.R. (2016): *Physical rehabilitation of students of special medical group taking into account motor activity disabilities: avtoref. dys. kand. nauk z fiz. vykhovannia ta sportu: spets. 24.00.03 “Fizychna reabilitatsiia”*. Ivano-Frankivsk. 21.
- [8] Ivanochko V.V. (2013): *Structure and content of health fitness programs for students with cardiorespiratory system diseases: avtoref. dys. kand. nauk z fiz. vykhovannia ta sportu: spets. 24.00.02 “Fiz. kultura, fiz. vykhovannia riznykh hrup naselennia”*. L. 20.
- [9] Malakhova Zh.V. (2013): *Healthforming technologies in the process of physical education of students of special medical groups: avtoref. dys.. kand. nauk z fiz. vykhovannia ta sportu: spets. 24.00.02 “Fiz. kultura, fiz. vykhovannia riznykh hrup naselennia”*. K. 20.
- [10] Pelech I.V., Grygus I.M. (2016): *Level of physical fitness students*. Journal of Education, Health and Sport. 6(2): 87–98. <http://dx.doi.org/10.5281/zenodo.46057>.
- [11] Petruk L.A., Fedotov V.M. (2012): *Physical education of students of special medical groups: navchalno-metodychnyi posibnyk*. Rivne: NUVHP. 112.
- [12] Prysiazhniuk S.I. (2008): *Physical Education: navch. pos. K.: Tsentr uchbovoi literatury*. 504.



- [13] Romanenko V.A. (2005): *Diagnostics of motor abilities: uchebnoe posobie*. Donetsk: DIFKS. 290.
- [14] Vrzhesnevskiy I.I. (2011): *Assessment of physical abilities in the system of medical and pedagogical control in the process of physical education of a special department of the university: avtoref. dys. kand. nauk z fiz. vykhovannia ta sportu: spets. 24.00.02. "Fiz. kultura, fiz. vykhovannia riznykh hrup naseleennia"*. K., 20.

---

### **Deklaracja braku konfliktu interesów**

Autorzy deklarują brak potencjalnych konfliktów interesów w odniesieniu do badań, autorstwa i/lub publikacji artykułu *The influence of physical exercises on physical development and physical preparedness of the first year female students*.

### **Finansowanie**

Autorzy nie otrzymali żadnego wsparcia finansowego w zakresie badań, autorstwa i/lub publikacji artykułu *The influence of physical exercises on physical development and physical preparedness of the first year female students*.

### **Declaration of Conflicting Interests**

The authors declared no potential conflicts of interests with respect to the research, authorship, and/or publication of the article *The influence of physical exercises on physical development and physical preparedness of the first year female students*.

### **Funding**

The authors received no financial support for the research, authorship, and/or publication of the article *The influence of physical exercises on physical development and physical preparedness of the first year female students*.

---