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Dependence of Students' Health on the Organization of their Motor Activity in Higher Educational Institutions

Wpływ organizacji aktywności ruchowej studentów na uczelniach na stan ich zdrowia

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SUMMARY

Aim: To investigate the impact of the peculiarities of the organization of students' motor activity on their health in the learning process.

Materials and Methods: The research involved 164 students (93 men and 71 women) from two higher educational institutions. The research was conducted in 2017-2021 and included carrying-out the comparative analysis of the peculiarities of the organization of physical education in two institutions and the research of their impact on students' health. The state of students' health was studied in terms of the indicators of their body length and weight, lung capacity, hand dynamometry, heart rate, blood pressure and level of physical health.

Results: It was found that the main difference in the organization of motor activity of students in the studied institutions is the total number of hours provided for the study "Physical Education" academic subject during the years of attendance: compulsory training sessions are held for 4 years in one institution and for 2 years in the other. It was found that the students whose physical education training sessions were conducted throughout the entire study period had significantly better health indicators; there was an increase in the number of students with average, above-average and high levels of physical health.

Conclusions: The obtained results show that the peculiarities of the organization of motor activity of students in the higher educational institution have a significant impact on their health, which will help improve their future life-sustaining activities.

Key words: health, motor activity, physical education, students

Słowa kluczowe: zdrowie, aktywność ruchowa, wychowanie fizyczne, uczniowie

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INTRODUCTION

There are many global problems in modern education including vital ones among them the solution of which predetermines the existence of not only the educational system but also society as a whole. This is a matter of students' health, which, unfortunately, has been a major concern in recent years [1-3]. Constant mental and emotional stress, information stress, low motor activity, lack of material security, irrational lifestyle, pernicious habits, etc. play not the least role among the factors that negatively affect the health of young people [4, 5].

The results of numerous studies [6-8] show that the level of health of student youth in recent years is becoming critical.

The researchers note that most students have health problems and low levels of physical fitness at the time of their admission [9, 10]. Their health indicators are being deteriorated over the years of study in higher educational institutions (HEIs). The experts believe the low efficiency of the current system of functioning of physical education in HEIs to be one of the reasons for this situation. The scientists note that the system of physical education of students requires radical changes, first and foremost in organizational and methodological support [11, 12].

The problem of maintaining the health of students at the present stage of development of the higher education system

has become a priority. Strengthening and maintaining the health of students in HEIs should be carried out on the basis of productive improvement of the educational process of physical education, taking into account modern requirements for specialists' training as carriers and promoters of physical culture in future professional activities and family life [13, 14]. Modern educational activities are intensive in nature of specialists' training that meets the socio-economic requirements of society and the state, which are constantly changing; at the same time it is necessary to ensure the development of the individual taking into account his/her needs, abilities, values, including motor skills as a prerequisite strengthening and maintaining health, realizing the intellectual and physical potential of current and future professionally trained youth [15, 16].

In recent years, a large number of studies have been conducted to improve the system of physical education in HEIs in order to improve the health of students [17-19]: the scientists proposed different approaches to improving physical, theoretical, methodological training of students, monitoring activities; they develop modern technologies to improve exercises and substantiate methods of using innovative technologies based on modern types of motor activity, interactive teaching methods, sports-oriented physical education, computer technology, etc. However, in the context of reforming higher education, the study of the dynamics of students' health in the process of their studies in HEIs is especially relevant as the most informative indicator of the effectiveness of the physical education system.

AIM

The aim is to investigate the impact of the peculiarities of the organization of students' motor activity on their health in the learning process.

MATERIALS AND METHODS

The research involved 164 students (93 men and 71 women) from two institutions of higher education in Ukraine: Ukrainian State University of Chemical Technology (USUCT (n=84), 49 men, 35 women) and Zhytomyr Ivan Franko State University (ZHSU) (n=80), 44 men, 36 women). The research was conducted in 2017-2021. It included carrying-out the comparative analysis of the peculiarities of the organization of physical education in two HEIs and the research of the impact of these peculiarities on students' health.

The state of students' health was studied in terms of the indicators of their body length and weight, lung capacity (LC), hand dynamometry, heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), body mass index (BMI) and level of physical health. The level of students' physical health was assessed according to the method of H.L. Apanasenko [20]. The study of these indicators was carried out in the dynamics i.e. during the period of study of students in the HEI from the 1st to the 4th instructional year. These indicators were obtained during the annual survey of students in relevant medical institutions by health professionals. The authors of the article processed the obtained indicators, assessed the reliability of the difference between them, interpreted

the obtained data and formulated scientific conclusions and recommendations.

Research methods: theoretical analysis (provided study of 25 sources on the topic of the article from the scientometric databases Web of Science Core Collection, PubMed, Scopus, Index Copernicus, Google Scholar and others), documentary method (provided study of the working documentation of physical education departments of two HEIs for the comparative analysis of the peculiarities of physical education), medical and biological methods (provided assessment of anthropometric and physiometric indicators of students), statistical methods (used to determine the reliability of the difference between the studied indicators of students of different HEIs, correct processing of results and formulating sound conclusions). During the research the authenticity of difference between the indicators of students was determined by means of Student's t-test.

This research complies with the ethical standards of the Act of Ukraine "On Higher Education" No.1556-VII dated 01.07.2014 and the Letter from the Ministry of Education and Science of Ukraine "On the Academic Plagiarism Prevention" No.1/11-8681 dated 15.08.2018. Also, this research followed the regulations of the World Medical Association Declaration of Helsinki – ethical principles for medical research involving human subjects. Informed consent was received from all individuals who took part in this research.

RESULTS

The analysis of the working educational documentation of the departments of physical education of the two HEIs shows that the peculiarities of the organization of physical education of students in these HEIs have certain differences concerning the duration of "Physical Education" academic subject depending on the instructional year, the number of academic hours provided for the subject mastery, approaches to the basic and elective components of the curriculum, sports as well as fitness and health recreation systems presented in the curriculum, organization of fitness and health recreation as well as sports events during extracurricular activities. Thus, the study of "Physical Education" academic subject in USUCT is carried out during the entire years of attendance at the first "bachelor's" level of higher education for 4 hours a week. Four modules on the following sports are planned in each semester: track-and-field athletics, gymnastics, game-oriented sports, swimming. Students are not given the opportunity to choose a sport during their training sessions. During the extracurricular activities, the students have the opportunity to attend training sessions in sports sections or sports and health groups available on the basis of the sports facilities of the university. At ZHSU, compulsory training sessions are held only during the 1st and the 2nd instructional years for 4 hours a week. Each semester contains two modules. The 1st module is basic and includes elements of track-and-field athletics, gymnastics, game-oriented sports and swimming. The 2nd module is elective one and provides students the opportunity to freely choose the sport from those offered by the HEI: badminton, basketball, volleyball, table tennis, track-and-field athletics, swimming, fencing, shaping, athletic

gymnastics, taekwondo, orienteering. During the extracurricular activities, a section on various sports and health-improving physical culture was organized on the basis of the ZHSU sports facilities. Training sessions in the sections are free for students (the number of training sessions is not limited).

One of the priority tasks currently facing specialists in the field of physical education is to improve the system of both practical and theoretical as well as methodological training of students. Theoretical material forms a worldview system of scientific and practical knowledge and attitudes of students to physical culture. Methodical skills provide an opportunity to creatively use the acquired knowledge for professional and personal development, self-improvement, organization of a healthy lifestyle and, in particular, motor activity, which indirectly affects the physical state of students. Therefore, we paid close attention to the peculiarities of the organization of theoretical and methodological training of students within the system of physical education.

Theoretical training in USUCT is implemented in the form of short reports from the teacher (10-15 minutes) during practical training sessions and individual consultations. Lectures on physical education are not provided by the curriculum. Each semester provides consideration of four topics from the section of theoretical and methodical preparation with developed tasks for independent preparation, advancement questions and the list of the recommended literature. The academic performance rating of students' is carried out on the quality of oral answers and performance of self-preparation tasks. Scientific conferences, debates, round tables in extracurricular activities are held for students on the problems of physical education during their extracurricular activities. The students obtain additional points during the final certification for participation in such events. ZHSU provides 2 hours of training sessions in each semester and

4 hours of independent training to study the theoretical and methodological sections of the curriculum in the basic and elective components. The department has developed the topics of theoretical preparation and the content of lecture material for the entire period of attendance, provided the list of topics for independent work of students and the list of recommended reading. The main form of final control in both HEIs is the pass/fail exam, which is taken at the end of each semester. Thus, the main difference in the organization of physical education of students in the studied HEIs is the total number of hours provided for the study of "Physical Education" academic subject during the entire years of attendance.

The results of the analysis of the dynamics of the indicators that characterize the health of students of the two HEIs are presented in Table 1 (male students) and Table 2 (female students). The analysis of the indicators that characterize the state of health of students shows that there were no statistically significant differences between the representatives of different HEIs on any of the parameters measured during the research during the 1st instructional year ($p > 0.05$). The average values of all indicators corresponded to age normative standards.

The comparative analysis of the indicators that characterize the state of health of students in the two HEIs showed that in USUCT, in contrast to ZHSU, all the studied parameters tend to improve over the period of studies. However, in the dynamics of learning from the 1st to the 4th instructional years, none of the studied students in the HEIs, both men and women, revealed statistically significant changes in body length, body weight, body mass index, systolic blood pressure and diastolic blood pressure ($p > 0.05$). The male students of USUCT showed a significant ($p < 0.05$) improvement in such indicators as LC – by 325 ml, heart rate at rest – by 4.8 beats/min⁻¹, dynamometry of a stronger hand – by 6.1 kg.

Table 1. Dynamics of the indicators that characterize the state of health of students (men) of the two HEIs, in the process of their studies during the 1st-4th instructional years, Mean \pm SD

Indicators	USUCT (n=49)				ZHSU (n=44)			
	1 st year	2 nd year	3 ^d year	4 th year	1 st year	2 nd year	3 ^d year	4 th year
Body length, cm	178.8 \pm 7.36	179.2 \pm 7.14	179.3 \pm 7.27	179.3 \pm 7.15	177.5 \pm 6.92	177.8 \pm 6.58	177.8 \pm 6.73	177.4 \pm 6.82
Body weight, kg	68.8 \pm 8.14	71.4 \pm 8.96	70.9 \pm 8.53	71.6 \pm 8.54	68.9 \pm 8.36	70.2 \pm 7.47	70.4 \pm 7.16	71.2 \pm 6.94
BMI, kg/m ²	21.77 \pm 2.44	22.31 \pm 2.57	22.15 \pm 2.54	22.37 \pm 2.56	22.01 \pm 1.98	22.42 \pm 2.21	22.49 \pm 2.13	22.74 \pm 1.92
LC, ml	3545.0 \pm 601.0	3660.0 \pm 690.0	3790.0 \pm 720.0	3870.0* \pm 602.0	3565.0 \pm 620.0	3780.0 \pm 730.0	3650.0 \pm 780.0	3590.0 \pm 730.0
HR, beat/min ⁻¹	73.3 \pm 6.62	71.1 \pm 7.38	69.2 \pm 7.06	68.5* \pm 7.25	73.8 \pm 8.14	73.6 \pm 7.85	74.3 \pm 5.57	74.9 \pm 7.83
SBP, millimeter of mercury	121.3 \pm 4.37	121.9 \pm 4.10	122.1 \pm 5.32	122.1 \pm 4.94	120.8 \pm 3.97	122.0 \pm 4.28	122.3 \pm 4.84	122.5 \pm 4.63
DBP, millimeter of mercury	79.3 \pm 3.11	80.0 \pm 3.45	80.2 \pm 4.13	80.1 \pm 3.85	79.4 \pm 3.97	79.6 \pm 4.72	80.3 \pm 4.66	81.1 \pm 4.91
Hand dynamometry, kg	44.1 \pm 9.22	46.0 \pm 8.95	48.3 \pm 9.64	50.2* \pm 8.77	43.8 \pm 9.19	45.9 \pm 8.85	45.6 \pm 8.33	46.1 \pm 7.86

Note: Mean - arithmetical average; SD - standard deviation; * - the reliability of the difference between the indicators of the 1st-4th instructional years at $p < 0.05$

Table 2. Dynamics of the indicators that characterize the state of health of students (women) of the two HEIs, in the process of their studies during the 1st-4th instructional years, Mean±SD

Indicators	USUCT (n=35)				ZHSU (n=36)			
	1 st year	2 nd year	3 rd year	4 th year	1 st year	2 nd year	3 rd year	4 th year
Body length, cm	166.4 ± 3.63	166.4 ± 3.84	166.4 ± 3.84	166.4 ± 3.84	165.9 ± 3.16	166.0 ± 3.54	166.0 ± 3.54	166.0 ± 3.54
Body weight, kg	57.3 ± 8.01	57.9 ± 7.64	58.5 ± 6.95	58.8 ± 7.57	57.3 ± 8.25	58.9 ± 8.28	59.2 ± 7.98	59.7 ± 7.8
BMI, kg/m ²	20.83 ± 5.43	21.05 ± 5.24	21.27 ± 6.16	21.38 ± 6.57	20.91 ± 4.18	21.41 ± 5.39	21.87 ± 6.20	22.03 ± 5.88
LC, ml	2500.0 ±620.0	2610.0 ±602.0	2610.0 ±687.0	2845.0* ±590.0	2590.0 ±650.0	2725.0 ±695.0	2650.0 ±650.0	2600.0 ±705.0
HR, beat/min ⁻¹	73.9 ± 7.91	72.3 ± 6.82	70.9 ± 7.26	69.8* ± 6.52	73.5 ± 6.15	72.9 ± 8.72	74.2 ± 7.96	74.9 ± 10.23
SBP, millimeter of mercury	118.3 ± 4.33	119.1 ± 3.98	119.1 ± 4.15	120.2 ± 3.99	119.7 ± 4.87	119.2 ± 4.66	120.0 ± 3.21	120.1 ± 3.76
DBP, millimeter of mercury	79.1 ± 4.26	78.7 ± 4.41	77.6 ± 3.41	77.2 ± 4.41	78.8 ± 4.69	78.6 ± 4.19	77.9 ± 4.87	78.9 ± 3.79
Hand dynamometry, kg	19.8 ± 6.34	22.3 ± 7.19	24.6 ± 7.16	25.8* ± 6.87	20.7 ± 7.27	21.4 ± 6.98	21.8 ± 7.35	21.6 ± 7.35

Note: Mean - arithmetical average; SD - standard deviation; * - the reliability of the difference between the indicators of the 1st-4th instructional years at p<0.05

ZHSU male students also showed a positive dynamics of most indicators in the process of their studies only during the 1st and the 2nd instructional years, while students attended physical education training sessions. However, during the 3rd and the 4th instructional years most indicators deteriorated relative to the 2nd one.

The dynamics of the indicators of female students of both HEIs has a similar trend of change as that of male students: changes in all studied parameters are positive from the 1st to the 4th instructional years in USUCT, and changes are characterized by positive dynamics only during the 1st and the 2nd instructional years in ZHSU, and the indicators tend to deteriorate during senior instructional years.

Thus, the analysis of the indicators that characterize the health of female students of USUCT, showed that the indicators of LC significantly (p<0.05) improved during the study period by 345 ml, heart rate at rest – by 4.1 beats/min⁻¹, hand dynamometry – by 6 kg. None of the studied parameters changed significantly in terms of statistics in ZHSU female students during the period of study in HEI (p<0.05). Moreover, there is a tendency to their gradual deterioration in the dynamics of some indicators.

The analysis of the results of the study of physical health of male students according to the method of H.L. Apanasenko shows that most students of both HEIs had low and below-average levels of physical health during the 1st instructional year. Thus, 40.8 % of USUCT students and 40.9% of ZHSU students had low levels of physical health among male students. Below-average level of physical health was observed in 36.7% of USUCT students and 36.4% of ZHSU students. 22.5% of USUCT students and 22.7% of ZHSU students had an average level of physical health (Table 3).

There has been a steady trend of improving the physical health of male students during their studies at USUCT. Thus, during the 4th instructional year the number of students with

a low level of health decreased to 34.7%, with a below-average level – to 34.7%, and with an average level increased to 30.6%, while 4.1% of students were identified with an above-average level of physical health. There is an improvement in the health of male students of ZHSU only during the 2nd instructional year and its deterioration during the senior instructional years. Moreover, the health indicators were worse during the 4th instructional year than during the 1st one: the number of students with low and below-average levels increased to 43.2%, and the number of students with an average level decreased to 13.6%.

There is a similar trend in the female health indicators of female students of the two HEIs: USUCT students improved during the entire years of attendance, and ZHSU students did it only during the junior instructional years with deterioration during the senior instructional years. The ratio of the number of students in both institutions in terms of the levels of their health was almost the same at the beginning of the study. Among USUCT first-year students, 34.3% had a low level of physical health, 51.4% – a below-average level, and 14.3% – an average level; among ZHSU female students, 33.3% had a low level of health, 50.0% – a below-average level of health, and 16.7% – an average level of health. During the 4th instructional year, the number of USUCT female students with a low level decreased to 22.9%, with a below-average level – to 42.9%, and with an average level – increased to 25.7%. Moreover, USUCT had 14.2% of female students with above-average level of health and 2.9% with high level of health at the end of their studies. In ZHSU, on the other hand, the 4th instructional year revealed an increase in the number of female students with a low level of health (up to 41.7%) and a decrease in the number of female students with an average level (up to 11.1%). However, no ZHSU female students had above-average and high levels of physical health at the end of their study.

Table 3. The ratio of the levels of physical health of students of different HEIs, %

Levels of physical health	USUCT				ZH U			
	1 st year	2 nd year	3 ^d year	4 th year	1 st year	2 nd year	3 ^d year	4 th year
	Male students							
Low	40.8	36.7	32.6	30.6	40.9	34.1	38.6	43.2
Below-average	36.7	40.8	36.7	34.7	36.4	50.0	43.2	43.2
Average	22.5	22.5	26.5	30.6	22.7	15.9	18.2	13.6
Above-average	-	-	4.1	4.1	-	-	-	-
High	-	-	-	-	-	-	-	-
	Female students							
Low	34.3	28.6	25.7	22.9	33.3	30.5	38.9	41.7
Below-average	51.4	54.3	51.4	42.9	50.0	41.7	44.4	47.2
Average	14.3	17.1	20.0	25.7	16.7	27.8	16.7	11.1
Above-average	-	-	2.9	14.2	-	-	-	-
High	-	-	-	2.9	-	-	-	-

DISCUSSION

Health directly affects the ability to work and productivity, the country's economy, the moral climate in society, the upbringing of the younger generation, reflects the way and quality of life [21, 22]. A healthy lifestyle is an important preventative factor in promoting good health. Attention to one's own health, the ability to ensure individual prevention of its disorders, conscious focus on the health of various forms of life sustaining activities are all indicators of the general culture of a human being [23, 24].

The problem of lifestyle and health of students is relevant in today's socio-economic environment. The health of this generation largely determines the health of future generations. The health of students, along with their social maturity, is a necessary condition for studying in the HEI and hence high professional suitability.

The research of the scientists [2, 4, 7, 9, 25] states that one of the reasons for the deterioration of the health of student youth of Ukraine is the imperfect organization of physical education in HEIs, which is in conflict with the goals of pedagogy. If we summarize the essence of the shortcomings in the system of physical education of students in HEIs, as well as proposals and requirements made by teachers for its reform, it becomes clear that the necessary solutions can only be found in the ways to rationalize physical education as a component of integrated educational process. As a result of the comparative analysis of the organizational peculiarities of the physical education system in the two HEIs, we found that compulsory physical education training sessions were held for 4 years 4 hours a week in USUCT, and training sessions in ZHSU were held for 2 years 4 hours a week. At the same time, USUCT paid much more attention, as contrasted with ZHSU, to the issues of theoretical and methodological training as a basis for forming students' worldview on the organization of a healthy lifestyle that indirectly affects the level of students' health. As a result, USUCT students, both male and female, had significantly better indicators of health at the end of their studies in the HEI (during the 4th instructional year) than ZHSU students.

The results confirm the conclusions of many scientists, who indicate that the HEI with more effective functioning system of physical education is also characterised by quite high level of students' health. Thus we expanded and supplemented data on the content and organization of physical education in various HEIs; on the impact of organizational peculiarities of physical education upon the indicators of physical health of students.

CONCLUSIONS

1. The analysis of the working educational documentation of the departments of physical education of the two HEIs shows that the peculiarities of the organization of physical education of students in these HEIs have certain differences, which primarily relate to the duration of "Physical Education" academic subject. Compulsory training sessions in USUCT are held during the entire years of attendance at the first "bachelor's" level of higher education (4 years) and during the 1st and the 2nd instructional years in ZHSU.
2. Comparison of the indicators that characterize the state of students' health in different HEIs in the dynamics of their education shows that they did not have statistically significant differences during the 1st instructional year ($p > 0.05$). USUCT students (both men and women) showed a decrease during the period from the 1st to the 4th instructional years in heart rate at rest, improvement of the indicators of LC and hand dynamometry ($p < 0.05$), increase in the number of students with average, above-average and high levels of physical health. ZHSU students did not experience significant changes in physical health during the research period ($p > 0.05$).
3. The obtained results show that the peculiarities of the organization of motor activity of students in HEIs have a significant impact on their state of health during and after their years of attendance.

Prospects for further research are aimed at assessing the level of physical health of students during distance learning in quarantine.

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