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# Strengthening the Physical and Mental Health of Students During Swimming Classes

## Wzmocnienie zdrowia fizycznego i psychicznego studentów podczas zajęć z pływania

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### SUMMARY

**Aim:** The aim is to investigate the impact of swimming training sessions on the dynamics of somatic and mental health indicators of students of special medical groups.

**Materials and Methods:** The research involved 50 1st and 2nd year female students who had diseases of various etiology and were assigned to a special medical group. The students' somatic health was examined according to the indicators of weight, lungs vital capacity, wrist dynamometry, heart rate, arterial blood pressure, Stange test and Genchi test. The mental health was assessed by method of "Well-being, activity and mood".

**Results:** The experiments conducted within the EG revealed an improvement in all studied indicators of both somatic and mental health. At the end of the research, the vital index, the Robinson index, the Stange and Genchi tests, the level of somatic health, well-being, and mood in the EG were significantly better than in the CG.

**Conclusions:** Regular swimming training sessions help to improve the health of female students of special medical groups in general, strengthen their musculoskeletal, cardiovascular and respiratory systems as well as increase metabolism. In addition, swimming has a positive effect on the nervous system, relieves stress and improves the well-being of female students, increases their activity and mood.

**Key words:** somatic and mental health, students, swimming

**Słowa kluczowe:** zdrowie somatyczne i psychiczne, studenci, pływanie

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### INTRODUCTION

The research results of many scientists [1, 2] shows that the health of student youth is deteriorating. The efforts of many scientists are aimed at solving this problem by improving the system of physical education in higher educational institutions (HEI), the introduction of modern technologies to strengthen students' health, improve their physical fitness, motivation to exercise and play sports [3-5]. Physical education in HEI, as a part of the general educational system, provides the basis and development of somatic and moral health of students, a comprehensive approach to the formation of mental and physical qualities of the individual, improving their physical and psychological preparedness for active life, priority of health-improving activities, optimization of the learning

process with extensive use of various measures and forms of physical improvement and continuity of this process [6-8].

Swimming is one of the main health-preserving measures of physical education for students. According to scientists [9-11], swimming is one of the effective health measures for drug-free rehabilitation and an important preventive measure to avert accidents on the water. In addition, swimming significantly increases the physical, mental and intellectual development of the individual and raises his/her social status, adapting to life [12, 13]. Swimming is especially important in improving the health of students of special medical groups while studying at HEI. Acquiring the vital ability to swim for students of special medical groups is a priority, because the health function of swimming is that the physical properties of

the aquatic environment are very different from the properties of the air environment, familiar to humans [14, 15]. The health role of swimming in comparison with other types of physical activity lies in the various effects of water on the human body, which is associated with the physical, thermal, chemical and mechanical properties of the aquatic environment [16]. It is important that in case of many diseases, adequately dosed physical activity in the water slows down the course of pathological processes, which contributes to faster recovery of body functions. Physiological processes are activated, the body structure is improved, the activity of all organs and systems is enhanced, efficiency is increased and health is strengthened under the influence of physical activity in the water [17]. A large number of scientific papers have been devoted to the impact of swimming on the body of people of different ages, and in most cases swimming is used to remedy and heal people only within the system of medical and preventive facilities as well as organized recreation areas [12, 15, 18]. However, the research of the effect of swimming on improving the health of students of special medical groups in HEI has remained without sufficient attention of scientists.

### AIM

The aim is to investigate the impact of swimming training sessions on the dynamics of somatic and mental health indicators of students of special medical groups.

### MATERIALS AND METHODS

The research was conducted in 2018-2021 at the educational and sports base of the National Pedagogical Dragomanov University (Kyiv, Ukraine). The research involved 50 1<sup>st</sup> and 2<sup>nd</sup> year female students aged from 17 to 21 and studying at various faculties (foreign philology, physical and mathematical education and computer science, natural and geographical education and ecology, correctional pedagogy and psychology), who had diseases of various etiology and were assigned to a special medical group. The study of medical records and complaints about the health of students based on the results of their examination by specialists of the clinic revealed the most common deviations in the health of students of

special medical groups: posture disorders (mostly stooping, asymmetrical posture) – 38%; frequent acute respiratory diseases (complications in the form of bronchitis, pneumonia, etc.) – 29%; overweight – 12%; cardiovascular diseases – 16%; other diseases (various in their nosology) – 5%.

Two groups were formed: experimental (EG, n=25) and control (CG, n=25) groups. The EG students were engaged in swimming according to the author's method of load differentiation, the CG followed a modern type of fitness technology known as "cheerleading". The formation of the EG and the CG took place through questionnaires in order to study students' interests and desires at the beginning of their higher education (1<sup>st</sup> semester). All EG students were able to swim. The level of somatic and mental health in female students of the EG and the CG at the beginning of the experiment was significantly the same ( $p>0.05$ ). The total number of hours of physical education training sessions per week and their duration (75 minutes) in the EG and the CG was identical. Training sessions in groups were held twice a week (one was conducted according to the schedule before noon and the second training sessions was held in the afternoon at a convenient time for students). The duration of the experiment is 2 years.

The basis of the author's method for conducting swimming training sessions with the EG female students made the principle of differentiation, which provided a certain focus of measures and methods of teaching swimming to students, due to the nature and severity of their disease. The methodical recommendation of the author's method of conducting swimming training sessions in the EG consisted in the involvement of a number of cyclic exercises. Evenly distributing the load when exercising in the water helps to involve all major muscle groups. In the water, the movements were performed smoothly, with large amplitude, without pressure of body weight on the musculoskeletal system, which reduces static muscle tension and eliminates the risk of traumatism, as well as improves respiratory and cardiovascular systems, including psycho-emotional state.

The female students' somatic health level (SHL) was examined according to the indicators of weight, lungs vital

**Table 1.** The evaluation of female students' somatic health level (in points) [19]

Indicators	Female students' somatic health levels				
	Low	Below average	Average	Above average	High
Body mass index, kg/m <sup>2</sup>	16,9 i <	17,0-18,0	18,1-23,8	23,9-26,0	26,1 i >
Points	-2	-1	0		
Vital index, ml/kg	40 i <	41-45	46-50	51-55	56 i >
Points	-1	0	1	2	3
Strength index, %	40 i <	41-50	51-55	56-60	61 i >
Points	-1	0	1	2	3
Robinson index, c.u.	111 i >	95-110	85-94	70-84	69 i <
Points	-2	-1	0	3	5
HRR time, s	180 i >	120-180	90-120	60-90	59 i <
Points	-2	1	3	5	7
SHL, points	3 i <	4-6	7-11	12-15	16-18

capacity, wrist dynamometry, heart rate, arterial blood pressure, Stange test (ST, respiratory arrest during inspiration), Genchi test (GT, respiratory arrest during exhalation). The health level was evaluated in points and it included the estimation of the body mass index (BMI, the ratio of body weight to body length), vital index (VI, the ratio of lung capacity to body weight), strength index (SI, the ratio of the wrist dynamometry to body weight), Robinson index (RI, a product of heart rate and systolic blood pressure) and heart rate recovery (HRR) time after a standard exercise (20 squats in 30 sec) [Table 1] [19].

The mental health of the female students was assessed by method of “WAM” (well-being, activity and mood). The method of “WAM” consists of 30 pairs of words that describe general conditions, the degree of emotional and physical activity and mood of a person. With the help of this method, it is possible to assess the student’s mental state; identification of a psycho-emotional reaction to a mental load; determination of biological rhythms inherent in physiological and mental functions.

The methods of investigation: theoretical analysis of scientific and methodological literature (21 sources on the topic of the article from the databases PubMed, Scopus, Web of Science Core Collection and others were analyzed), pedagogical observation, medical examinations, psychological testing, experiment, methods of mathematical statistics. During

the researches the authenticity of difference between the indicators of students of EG and CG by means of Student’s t-test was determined. The significance for all statistical tests was set at  $p < 0.05$ . All statistical analyses were performed with the SPSS software, version 22, adapted to medical and biological researches. This study 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 BMI in EG and CG female students shows that the indicators of the groups did not differ significantly both at the beginning and at the end of the research ( $p > 0.05$ ). It was also found that there was a slight improvement of BMI during the research period in both groups, due to stabilization and weight loss ( $p > 0.05$ ). This indicates the effectiveness of both swimming and cheerleading, on the female body in the process of studying at HEI [Table 2]. The indicators of BMI at the beginning and end of the research, meet the age standards of female students.

Analyzing the VI, we found out that during the experiment there was a significant improvement of VI in both groups: in EG – for 8 ml/kg ( $p < 0.001$ ), and in CG – for 3.9 ml/kg ( $p < 0.05$ ). At the end of the experiment in EG the significantly

**Table 2.** The analysis of the indicators of somatic health of EG (n=25) and CG (n=25) female students during research period (Mean±SD)

Studied indicators	Research stages	EG	CG	$p_2$
Body mass index, kg/m <sup>2</sup>	Beginning	20.7±0.22	20.6±0.23	$p > 0.05$
	End	20.2±0.20	20.4±0.21	$p > 0.05$
	$p_1$	$p > 0.05$	$p > 0.05$	
Vital index, ml/kg	Beginning	49.1±1.25	48.8±1.27	$p > 0.05$
	End	57.1±1.28	52.7±1.29	$p < 0.05$
	$p_1$	$p < 0.001$	$p < 0.05$	
Stange test, s	Beginning	27.4±1.05	29.1±1.02	$p > 0.05$
	End	44.7±1.24	39.3±1.18	$p < 0.01$
	$p_1$	$p < 0.001$	$p < 0.001$	
Genchi test, s	Beginning	15.1±0.37	14.9±0.36	$p > 0.05$
	End	23.2±0.39	19.3±0.38	$p < 0.001$
	$p_1$	$p < 0.001$	$p < 0.001$	
Strength index, %	Beginning	41.3±1.09	41.5±1.12	$p > 0.05$
	End	46.4±1.11	45.7±1.15	$p > 0.05$
	$p_1$	$p < 0.01$	$p < 0.05$	
Robinson index, c.u.	Beginning	87.1±1.28	86.8±1.25	$p > 0.05$
	End	80.7±1.23	84.2±1.22	$p < 0.05$
	$p_1$	$p < 0.01$	$p > 0.05$	
HRR time, s	Beginning	141.5±3.06	142.4±3.11	$p > 0.05$
	End	119.2±2.97	123.7±3.02	$p > 0.05$
	$p_1$	$p < 0.001$	$p < 0.001$	
Somatic health level, points	Beginning	2.36±0.53	2.45±0.56	$p > 0.05$
	End	8.19±0.55	6.07±0.58	$p < 0.05$
	$p_1$	$p < 0.001$	$p < 0.001$	

Mean – arithmetical average, SD – standard deviation,  $p_1$  – the significance of the difference between the studied indicators within groups at the beginning and the end of research,  $p_2$  – the significance of the difference between EG and CG



**Table 3.** The analysis of the indicators of mental health of EG (n=25) and CG (n=25) female students during research period (Mean±SD)

Studied indicators	Research stages	EG	CG	p <sub>2</sub>
Well-being, points	Beginning	4.3±0.19	4.4±0.20	p>0.05
	End	6.4±0.17	5.9±0.18	p<0.05
	p <sub>1</sub>	p<0.001	p<0.001	
Activity, points	Beginning	4.7±0.21	4.8±0.23	p>0.05
	End	5.6±0.22	5.7±0.23	p>0.05
	p <sub>1</sub>	p<0.01	p<0.05	
Mood, points	Beginning	4.8±0.18	5.1±0.19	p>0.05
	End	7.2±0.19	6.4±0.20	p<0.05
	p <sub>1</sub>	p<0.001	p<0.001	

Mean – arithmetical average, SD – standard deviation, p<sub>1</sub> – the significance of the difference between the studied indicators within groups at the beginning and the end of research, p<sub>2</sub> – the significance of the difference between EG and CG

better level of VI than in CG was found for 4.4 ml/kg (p<0.05). The indicators of the respiratory system of female students in both groups at the beginning of the experiment corresponded to the average level, and at the end in the EG – high, in the CG – higher than average. Evaluation of breath-holding indicators showed that the EG and the CG values did not differ significantly at the beginning of the experiment in both the Stange test and the Genchi test (p>0.05), and the EG values were significantly better at the end of the experiment than in the CG for 5.4 s and 3.9 s respectively (p<0.05). This emphasizes the positive impact of swimming training sessions on the functional state of the respiratory system of female students.

The strength indicators of female students, which were evaluated with the help of SI, significantly improved during the experiment in both groups: in EG – for 5.1 % (p<0.01), in CG – for 4.2 % (p<0.05). At the same time, SI in the EG and the CG students did not differ significantly both at the beginning and at the end of the research (p>0.05). The strength capabilities of the EG and the CG students corresponded to a lower than average level for the entire period of the experiment.

The comparison of the indicators of RI in EG and CG showed that they did not differ at the beginning of the experiment (p>0.05), and the EG revealed a significantly better level of functioning of the cardiovascular system at the end of the experiment than in the CG for 3.5 c.u. (p<0.05). The indicators of RI were improved in both groups during the experiment, with a significant improvement in the EG (for 6.4 c.u.; p<0.01), and insignificant in the CG (for 2.6 c.u.; p>0.05). This confirms the positive effect of swimming training sessions on the functionality of the cardiovascular system of female students. HRR time significantly improved during the experiment in both groups (p<0.001), but the indicators of EG and CG did not differ significantly at the beginning and the end of the research (p>0.05).

The level of somatic health of the EG and the CG female students at the beginning of the experiment corresponded to a low level and did not differ significantly (p>0.05). Health significantly improved in both groups during the experiment

(p<0.001) and corresponded to the average level at the end of the research in the EG, and below average – in the CG. Herewith, the difference between the EG and the CG at the end of the research was significant and made 2.12 points (p<0.05).

The analysis of the indicators of female students' mental health showed that all three characteristics did not differ significantly between the EG and the CG at the beginning of the experiment (p>0.05). All mental health indicators significantly improved (p<0.05-0.001) in both groups during the research, but the EG indicators of well-being and mood turned out to be significantly better in comparison with the CG ones at the end of the experiment for 0.5 points and 0.8 points respectively (p<0.05) [Table 3]. This confirmed the more pronounced positive effect of swimming training sessions on the indicators of mental health of students of special medical groups.

## DISCUSSION

The issue of health preservation and strengthening the physical potential of student youth is one of the main problems of today's developed European countries [4, 7, 20]. The essence of the problem is that more than 20% of the population of Ukraine is young students. From one year to the next there is a tendency towards increase in the number of students who make a part of special medical groups as a consequence of their health status (according to various scientists – from 30 to 40%), whose physical activity in groups of students of the main groups is contraindicated [14]. Therefore, swimming may be one of the main measures of rehabilitation and health improvement of students of special medical groups. According to research [18], it is swimming that is a unique means of correction and training of the cardiovascular and respiratory systems of the human body. Swimming measures also include a variety of content- and focus-related physical exercises performed in the water for the prevention and correction of health disorders, as well as treatment of diseases of various etiologies [14, 21].

The fact of increased heat transfer in the water is used to reduce body weight. Performing swimming movements in

the water results in increased metabolism in the body. The uplifting power of water creates favourable conditions for performing various exercises by overweight people. At the same time, performing such exercises in the gym caused them some difficulties [15].

Scientists [21] recommend the use of swimming in orthopedics and traumatology for the rehabilitation of patients with pathology of the musculoskeletal system (correction of posture disorders), diseases of the respiratory, cardiovascular, endocrine systems and more. Features of circulatory dynamics facilitate blood circulation during intense muscular work in the process of swimming or performing movements and exercises in the water, which helps to strengthen the heart muscle, blood vessels become more elastic, blood pressure decreases [20]. Swimming stimulates the activity of hematopoietic organs, increases the number of leukocytes in the blood and reduces congestion in the internal organs. The functions of subcutaneous vessels improve under the influence of low water temperatures. Therefore, tempering by means of the aquatic environment plays a significant role in health improvement of the human body [16, 17].

Intense muscular work requires increased breathing in the process of swimming. The mechanism of positive effect of exercises in the water on the respiratory system lies in the active training of the respiratory muscles, increased chest mobility and enhanced pulmonary ventilation of gas exchange. Performing "breathing exercises" increases the volume of breath, enhances the vital capacity of the lungs and escalates blood oxygen consumption. Performing movements in the water requires deep breathing involving the most remote parts of the lungs, which prevents stagnation in them [11, 18].

According to the research [15], hydrostatic water pressure as a "universal acupuncturist" affects acupuncture points that are connected to internal organs and nerve nodes and stimulates their functioning. This effect increases metabolism and facilitates blood circulation strengthening the nervous system. Unloading of the musculoskeletal system is facilitated even by being in the aquatic environment, when a person experiences a state of hydrostatic weightlessness. This frees the musculoskeletal system from the pressure of body weight, creates conditions for the correction of posture disorders, the restoration of certain motor functions and the consequences of traumas received in everyday life [10, 13]. The results of our research confirm the findings of many scientists in this field and significantly expand them on the use of swimming to strengthen somatic and mental health of students of special medical groups in the process of studying at HEI.

## CONCLUSIONS

1. The experiments conducted within the EG revealed an improvement in all studied indicators of both somatic and mental health. At the end of the research, the vital index (for 4.4 ml/kg), the Robinson index (for 3.5 c.u.), the Stange test (for 5.4 s), Genchi test (for 3.9 s), the level of somatic health (for 2.12 points), well-being (for 0.5 points), and mood (for 0.8 points) in the EG were significantly ( $p < 0.05$ -0.001) better than in the CG.

2. It was found that regular swimming training sessions help to improve the health of female students of special medical groups in general, strengthen their musculoskeletal, cardiovascular and respiratory systems as well as increase metabolism. In addition, swimming has a positive effect on the nervous system, relieves stress and improves the well-being of female students, increases their activity and mood. An important feature of planning swimming training sessions in special medical groups is to take into account the nature of the disease of students, the coordination of loads with the level of their physical fitness.
3. Prospects for further research are to study the impact of swimming training sessions on the mental performance indicators of female students.

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## Polskie Stowarzyszenie Pacjentów Uzdrowiskowych

Z inicjatywy Pani Profesor Ireny Ponikowskiej w 2019 roku powstało Polskie Stowarzyszenie Pacjentów Uzdrowiskowych (PSPU). Celem Stowarzyszenia jest m.in. integracja pacjentów korzystających z lecznictwa uzdrowiskowego, zwiększenie dostępności do lecznictwa uzdrowiskowego dla osób potrzebujących, poprawa jakości usług świadczonych w sektorze lecznictwa uzdrowiskowego, współpraca z lekarzami i zakładami lecznictwa uzdrowiskowego, edukacja pacjentów.

Każdy członek Stowarzyszenia będzie mógł korzystać ze zniżek w opłatach za pobyt i leczenie m.in. w przypadku pobytów komercyjnych w wybranych zakładach lecznictwa uzdrowiskowego oraz brać udział w organizowanych przez Stowarzyszenie konferencjach, warsztatach, konsultacjach.

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