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# SPIS TREŚCI/CONTENTS

## ORIGINAL ARTICLES/PRACE ORYGINALNE

- Włodzisław Kuliński, Jakub Skuza  
**Physical Therapy in Rheumatoid Arthritis**  
 Fizjoterapia w reumatoidalnym zapaleniu stawów 81
- Joanna Łuczak, Joanna Klonowska, Joanna Michalik  
**Modification of Patients' Sensitivity to Galvanic Current After the Administered Systemic Cryotherapy**  
 Zmienność wrażliwości pacjentów na prąd galwaniczny po zastosowaniu krioterapii ogólnoustrojowej 88
- Agnieszka Przedborska, Mateusz Szymczak, Małgorzata Kilon, Łukasz Kikowski, Jan Raczkowski  
**Ocena wpływu krioterapii ogólnoustrojowej na stan funkcjonalny stawów kolanowych u pacjentów z reumatoidalnym zapaleniem stawów**  
 Evaluation of the Impact of the Whole-body Cryotherapy Treatment on the Functional Condition of the Knee Joints in Patients with Rheumatoid Arthritis 93
- Grygoriy P. Griban, Olena V. Filatova, Anatolii I. Bosenko, Ganna V. Tamozhanska, Andrii M. Lytvynenko, Mariia S. Topchii, Nadiia A. Orlyk, Kostiantyn V. Prontenko  
**Water in Students' Life and its Impact on their Health**  
 Woda w życiu studentów i jej wpływ na ich zdrowie 99
- Olena M. Shkola, Olena V. Fomenko, Olena V. Otravenko, Viktoriia I. Donchenko, Valeriy O. Zhamardi, Natalia A. Lyakhova, Olena D. Shynkarova  
**Study of the State of Physical Fitness of Students of Medical Institutions of Higher Education by Means of Crossfit in the Process of Physical Education**  
 Badanie stanu wydolności fizycznej studentów uczelni medycznych uprawiających crossfit na zajęciach wychowania fizycznego 105

## REVIEW ARTICLE/PRACA POGLĄDOWA

- Serhii M. Novik, Yevheniia Yu. Shostak, Oleksandr V. Petryshyn, Anna V. Fastivetz, Pavlo V. Khomenko  
**Health-saving factors of youth responsibility formation at physical training and recreational establishments**  
 Czynniki prozdrowotne sprzyjające kształtowaniu się odpowiedzialności młodzieży w ośrodkach sportu i rekreacji 110

## CASES REPORTS/PRACE KAZUISTYCZNE

- Edyta Zagozda, Krystyna Frydrysiak, Łukasz Kikowski  
**Application of Hyperbaric Therapy Following Traumatic Amputation. Case Report**  
 Zastosowanie terapii hiperbarycznej w następstwie amputacji urazowej. Opis przypadku 115
- Alicja Kasprzak, Jaworska Sylwia, Łątka Adam, Michał Holik, Michał Czarnecki  
**Evaluation of Training with the Use of Modern Technologies in a Patient After Recovery from COVID-19. Case report**  
 Ocena treningu z wykorzystaniem nowoczesnych technologii u pacjenta po wyzdrowieniu z COVID-19. Opis przypadku 120
- Jarosław Pasek, Grzegorz Cieślak, Tomasz Pasek  
**Physical Combined Therapy in the Treatment of Herpetic Withlow. Case Report**  
 Fizykalna terapia skojarzona w leczeniu zanokcicy. Opis przypadku 125

## VARIA

- Krzysztof Bielecki  
**Słowo i jego znaczenie w relacjach lekarz-chory** 129

- Z życia Towarzystwa** 133



# Water in Students' Life and its Impact on their Health

## Woda w życiu studentów i jej wpływ na ich zdrowie

DOI: 10.36740/ABAL202102104

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### SUMMARY

**Aim:** Is to study the role of water in the life of students and to investigate the impact of its quality on the health of students who did sports.

**Materials and Methods:** The study was conducted at Polissya National University (Zhytomyr, Ukraine) in 2018-2020. Thus, 509 students between the ages of 17 and 23 who did not do sports and 317 student-athletes were surveyed. The level of students' health was examined according to the methodology of G.L. Apanasenko.

**Results:** It was found that the majority of students who did not do sport (97.5% of males and 96.7% of females) did not stick to the water consumption schedule, while 50.8% of males and 52.2% of females who did sport followed strict norms of the water consumption schedule to maintain water balance. According to most health indicators, students-athletes had better average values of the studied indicators than those students did not do sport.

**Conclusions:** Water plays an important role in the lives of students and especially those students who do sport. High-quality water, sticking to water consumption schedule, especially during prolonged physical exercise and at high temperatures have a positive effect on the body and improve the health of students.

**Key words:** water, water consumption schedule, students, health.

### STRESZCZENIE

**Cel:** Celem pracy było zbadanie roli wody w życiu studentów oraz analiza wpływu jej jakości na zdrowie studentów uprawiających sport.

**Materiał i metody:** Badania przeprowadzono na Poleskim Uniwersytecie Narodowym (Żytomierz, Ukraina) w latach 2018-2020. W tym okresie przebadano 509 studentów w wieku od 17 do 23 lat, którzy nie uprawiali sportu, oraz 317 studentów-sportowców. Poziom zdrowia studentów zbadano zgodnie z metodologią G.L. Apanasenko.

**Wyniki:** Większość studentów nieuprawiających sportu (97,5% mężczyzn i 96,7% kobiet) nie przestrzegała zaleceń spożycia wody, podczas gdy 50,8% mężczyzn i 52,2% kobiet uprawiających sport przestrzegało rygorystycznego harmonogramu spożycia wody w celu utrzymania równowagi wodno-elektrolitowej. Według większości wskaźników zdrowotnych studenci-sportowcy mieli lepsze średnie wartości badanych wskaźników niż studenci nieuprawiający sportu.

**Wnioski:** Woda odgrywa ważną rolę w życiu studentów, a zwłaszcza tych, którzy uprawiają sport. Woda wysokiej jakości, przestrzeganie harmonogramu jej spożycia, szczególnie podczas długotrwałego wysiłku fizycznego i przy wysokich temperaturach, wpływa pozytywnie na organizm i poprawia stan zdrowia studentów.

**Słowa kluczowe:** woda, harmonogram spożycia wody, studenci, zdrowie

## INTRODUCTION

Water is one of the most important nutrients in the human body, without which life processes cannot take place, and life itself is impossible [1, 2]. It is the second most important after oxygen. This is a natural liquid mineral that determines not only the state of human health but also life expectancy. Biochemical reactions occur in water medium due to the unique physicochemical properties of water. Water is one of the most valuable resources, and clean water is one of the scarcest natural resources. Poor quality water and sanitation are the cause of almost 80 % of all diseases in countries with low social development [3, 4].

The water content in the body depends on the age, gender, and functional status of the person. In the body of young students, water accounts for about 2/3 of body weight: about 60 % for males, and 50% of total body weight for females. Water is unevenly distributed among individual tissues; its content varies from 0.3% in tooth enamel to 99% in biological fluids. Half of all body water is accounted for muscles, about 1/8 - for the skeleton, 1/20 – for the blood [5, 6].

Water is of particular importance during exercise: erythrocytes carry oxygen to active muscles through blood plasma, which consists mainly of water; nutrients - glucose, fatty acids, and amino acids are also transported to the muscles by the plasma; leaving the cells, CO<sub>2</sub> and other metabolic by-products enter the plasma, where they are excreted from the body; hormones that regulate metabolic processes and muscle activity are transported to their targets by blood plasma during exercise; body fluids contain buffer compounds that provide normal pH during the formation of lactate; water promotes the return of heat generated during exercise; blood plasma volume is the main indicator of blood pressure and the functions of the cardiovascular system respectively [2, 7]. Thus, water and its quality play an important role in the lives of people and especially students who play sports in the learning process. However, research aimed at studying water quality, sticking to water consumption schedule by students and, especially, by students who do sport, has been conducted insufficiently.

### AIM

The aim of this article is to study the role of water in the life of students and to investigate the impact of its quality on the health of students who did sports.

### MATERIALS AND METHODS

The study was conducted at Polissya National University (Zhytomyr, Ukraine) in 2018-2020. Thus, 509 students, including 237 males and 272 females of various specialties between the ages of 17 and 23, were surveyed. In addition, 317 student-athletes engaged in various sports took part in the research, including 179 males and 138 females of different sports qualifications. Experimental (EG, n=32 males, n=28 females) and control groups (CG, n=34 males, n=31 females) were formed to study the impact of water quality and keeping to water consumption schedule on the health of student-athletes. The EG included student-athletes whose water intake schedule was rational

during studying and training and was assessed by them as high and sufficient, the CG involved the students whose water consumption schedule was rated as medium and low. The level of students' health was examined at the end of the study at a higher education institution according to the methodology of G.L. Apanasenko based on the anthropometry indicators and the state of the cardiovascular system [8]. Medical examinations were performed by a doctor of the medical center of Polissya National University.

The methods of investigation: theoretical analysis and generalization of the scientific and methodological literature, pedagogic observation, questionnaire survey, medical and biological methods, and methods of mathematical statistics. 21 sources on the topic of the article from the scientometric databases PubMed, Scopus, Web of Science Core Collection and others were analyzed. The authenticity of the difference between the indicators of students of EG and CG was determined by Student's t-test.

This study complies with the ethical standards of the Act of Ukraine "On Higher Education" No. 1556-VII dated 01.07.2014 and the regulations of the World Medical Association Declaration of Helsinki.

## RESULTS

Replenishing fluid in the body should begin in the morning. To start all the processes in the body, it is necessary to start the morning with drinking water, which allows you to wake up faster, as well as cleanse the body of harmful substances accumulated during the night. At the same time, our surveys of the higher education institution (HEI) students and those students actively involved in sports showed significant differences in water consumption and keeping to water consumption schedule (Table 1). Most students, who did not do sport (97.5% of males and 96.7% of females), did not stick to a clear schedule of water consumption, their regime was chaotic. At the same time, student-athletes (50.8% of males and 52.2% of females) kept clear norms of water consumption to maintain water balance in the body.

It is known that the consumption of free water is better to distribute evenly throughout the day. Generally, the keeping to water consumption schedule is rational: 200-250 ml of liquid in the form of tea or coffee in the morning; 200-250 ml with the first course and 200-250 ml in the form of beverage at lunch; 200-250 ml of tea at dinner and 200-250 ml of yoghurt before going to bed. Drinking water after waking up is important. It was confirmed by surveys of athletes (54.2% of males and 55.8% of females), while only 11.8% of males and 14.3% of females, who did not do sport, followed this advice. The obtained data confirm that sports activity encourages students to acquire the skills of maintaining water balance in the body, which directly affects the efficiency of training activities and achieving sports results in competitions. Such indicators of student-athletes as drinking water before meals, baths, saunas, and sleep are generally better than of those students who do not do sport.

The water consumption schedule is of great importance for student-athletes during competitive activities. Our surveys

**Table 1.** The assessment of one's own water consumption schedule by the students who were engaged (n=317) and those who were not engaged (n=509) in sports during studying (%)

The indicators of keeping to water consumption schedule	Gender	Keeping to water consumption schedule			
		Students not engaged in sports (n=509)		Student-athletes (n=317)	
		Yes	No	Yes	No
Adhere to a clear schedule	male	2.5	97.5	50.8	49.2
	female	3.3	96.7	52.2	47.8
After waking up	male	11.8	88.2	54.2	45.8
	female	14.3	85.7	55.8	44.2
Before meals	male	8.9	91.1	38.6	61.4
	female	9.9	90.1	32.6	67.4
Drink water with meals	male	0.8	99.2	10.6	89.4
	female	0.4	99.6	9.4	90.6
Before a bath or sauna	male	3.4	96.6	18.4	81.6
	female	1.1	98.9	17.4	82.6
Before sleep	male	11.4	88.6	41.3	58.7
	female	10.7	89.3	37.0	63.0

**Table 2.** The assessment of the importance of sticking to water consumption schedule in the process of competitive activity by students-athletes of different sports (%)

Athletes	Gender	-	Subjective assessment		
			High	Middle	Low
Short-distance runners	male		21.4	35.7	42.9
	female		8.3	33.4	58.3
Middle and long-distance runners	male		84.2	15.8	-
	female		78.6	21.4	-
Road cyclists	male		94.4	5.6	-
	female		100.0	-	-
Heavyweight	male		5.9	23.5	70.6
	female		25.0	37.5	37.5
Powerlifters	male		4.4	39.1	56.5
	female		8.3	25.0	66.7
Kettlebell lifters	male		36.5	48.3	15.2
	female		32.4	55.9	11.7
Wrestlers	male		38.9	55.6	5.5
	female		39.5	48.9	11.6

have shown that the subjective assessment of the water intake schedule of student-athletes during their participation in competitions largely depends on the sport. Such athletes as road cyclists (94.4% of males and 100% of females), middle and long-distance runners (84.2% of males and 78.6% of females) assessed adherence to the water consumption schedule during participation in competitions as high (Table 2). The athletes whose activities were associated with the manifestations of endurance, including kettlebell lifters and wrestlers, also attached importance to this aspect of training.

Our research showed that students who did not do sport and student-athletes satisfied their thirst in different ways (Table 3). The athletes were more responsible for replenishing fluid in the body. More than 56.4% of athletes preferred drinking

water, fruit and vegetable juices, tea, and various beverages, while the number of students who were not engaged in sports with such preferences accounted for only 28.3%. Quite a few students were found to consume broths and soups (5.1% of males and 8.5% of females), and only 40.2% of males and 45.7% of females among the athletes consumed them. Besides, 64.8% of male athletes and 62.3% of female athletes preferred the consumption of products that form water in the body and replenish the water-salt balance. Students did not attach much importance to this source of fluid replenishment in the body except for 7.6% of males and 11.4% of females.

Our research has shown that the higher the level of sports qualifications is, the better level of special knowledge and skills regarding fluid consumption during sports activities

**Table 3.** The features of fluid replenishment in the body by students who were engaged (n=317) and those who were not engaged (n=509) in sports during studying (%)

Replenishment of fluid in the body by students during the day	Gender	Students not engaged in sports (n=509)	Student-athletes (n=317)
Drinking water, juices, tea, various drinks	male	28.3	56.4
	female	36.0	55.8
Soups and broths	male	5.1	40.2
	female	8.5	45.7
Products that form water in the body	male	7.6	64.8
	female	11.4	62.3

athletes have. In particular, the research showed that among the masters of sports of international level, no athlete had a medium or low level of knowledge of the water consumption schedule (75.0% of males and 60.0% of females had a high level, and other athletes – sufficient). At the same time, 47.2% of males and 47.8% of females among beginner athletes and 31.7% and 30.9% of athletes with athletic titles were found to have a low level of such knowledge (Table 4).

To study the impact of the water quality consumed by students who did sport during their studies on the state of their health during educational and training activities at HEI, a comparative analysis of the physical health of students, whose water consumption schedule was evaluated as high and sufficient (experimental groups) and medium and low (control groups) at the end of their study at HEI was conducted, using the methodology of G.L. Apanasenko (Table 5).

The analysis showed that according to most of the studied parameters that characterize the state of health, average values of both male and female student-athletes, who followed a rational water consumption schedule and consumed good-quality drinks during the educational process, training, and competitive activities, were better than those of student-athletes whose water intake schedule was rated as medium and low. A significant difference was found in the indicators of body mass index ( $p < 0.05$ ) – the difference in the indicators between the EG and CG males was  $0.6 \text{ kg/m}^2$ , females –  $1.2 \text{ kg/m}^2$ ; Robinson's index of the EG males was significantly ( $p < 0.05$ ) better than in the CG by 2.6 c.u., the EG females' was better by 3.1 c.u.; the level of somatic health in the EG was recorded to be significantly better than in the CG by 1.87 points among male students and by 1.76 points among female students. Thus, the obtained results make it possible

**Table 4.** The level of knowledge of student-athletes of different qualifications (n=317) of the consumption of drinks during training and competitive activities (%)

The level of knowledge	Gender	Qualification of athletes			
		Beginner athletes	Athletes with athletic titles	Masters of sports	Masters of sports of international level
High	male	5.6	16.4	45.2	75.0
	female	8.7	11.7	56.3	60.0
Sufficient	male	13.9	23.1	41.9	25.0
	female	13.1	22.3	25.0	40.0
Middle	male	33.3	28.8	12.9	-
	female	30.4	35.1	18.7	-
Low	male	47.2	31.7	-	-
	female	47.8	30.9	-	-

**Table 5.** The health level of students who did sport during their studies (Mean $\pm$ SD, n=125)

Indicators	Males (n=66)			Females (n=59)		
	EG (n=32)	CG (n=34)	p	EG (n=28)	CG (n=31)	p
Body mass index, $\text{kg/m}^2$	22.3 $\pm$ 0.21	22.9 $\pm$ 0.20	<0.05	19.9 $\pm$ 0.23	21.1 $\pm$ 0.22	<0.01
Life index, ml/kg	60.7 $\pm$ 0.89	58.4 $\pm$ 0.85	>0.05	51.3 $\pm$ 0.92	49.6 $\pm$ 0.94	>0.05
Power index, %	65.5 $\pm$ 0.87	63.2 $\pm$ 0.94	>0.05	50.9 $\pm$ 1.01	48.7 $\pm$ 1.06	>0.05
Robinson's index, c.u.	82.4 $\pm$ 0.85	85.0 $\pm$ 0.91	<0.05	81.3 $\pm$ 0.88	84.4 $\pm$ 0.89	<0.05
Heart rate recovery after 20 squats in 30 s, s	88.6 $\pm$ 1.97	94.3 $\pm$ 2.04	<0.005	95.1 $\pm$ 1.88	99.7 $\pm$ 1.95	>0.05
Level of physical health, points	10.84 $\pm$ 0.47	8.97 $\pm$ 0.49	<0.05	10.32 $\pm$ 0.38	8.56 $\pm$ 0.42	<0.01

Legend: Mean - arithmetical average; SD - standard deviation; p - the significance of the difference between the indicators of EG and CG due to the Student's t-test

to conclude that the quality of water and the rational schedule of its consumption will also contribute to the improvement of sports performance as one of the main factors in the health of student-athletes.

## DISCUSSION

The role of water, its quality, and rational water consumption schedule are noted in the works of many scientists [1, 9-11]. Regular drinking ensures students' well-being and normal working capacity, prevents the development of many diseases, protects against the loss of essential minerals during intense exercise and hydration.

The changes in the water amount in the athlete's body can adversely affect their endurance [12-14]. Decreased fluid stores in the body during exercise significantly reduces its subsequent loss of sweat during prolonged muscular activity. The studies [15-18] have shown a lack of tolerance to prolonged physical and thermal stress in the case of dehydration. For example, long-distance runners, slow down the running rate by almost 2% in the case of water loss by 1% of body weight due to dehydration. Dehydration leads to a decrease in physical performance, the degree of deterioration depends on the amount of fluid loss and the nature of the exercise performed. Moreover, performance decreases regardless of the means that caused dehydration (prolonged physical activity, immersion in warm water, staying in the sauna, or the use of diuretics). Even a slight degree of dehydration, which leads to a decrease in body weight by 1.8%, leads to significantly decreased performance during physical activity with maximum oxygen consumption at a rate of 90% [4, 19, 20].

Scientists [5, 7, 21] developed guidelines for optimal replenishment of fluid loss during physical activity. In competitions lasting less than one hour, they recommend taking 300-500 ml of 6-10-percent carbohydrate drink before physical activity and 500-1000 ml of cold (5-10 °C) water in the process of competition. If the competition lasts from one to three hours, the amount of water recommended consuming before the competitive activity is 300-500 ml, and it is advisable to drink from 800 to 1600 ml of chilled drink containing from 6 to 8% carbohydrates with additional consumption of electrolytes during the competition. Restoring the body's loss of water and electrolytes during the recovery period can be overly important for the effective performance of a further physical activity. With a high degree of dehydration (more than 5% of body weight), the recovery of fluid reserves in the body occurs within 48-72 hours [3, 6]. The effective recovery after physical activity can be achieved only if the loss of water with sweat will correspond to the consumption of drinks with such a concentration of sodium as it was in the sweat. The prospects for future research are aimed at studying the ways to improve the students' water consumption schedule while studying at HEI.

## CONCLUSIONS

1. It was found that the majority of students who did not do sport (97.5% of males and 96.7% of females) did not stick to the water consumption schedule, while 50.8% of males

and 52.2% of females who did sport followed strict norms of water consumption to maintain water balance in the body. The students involved in endurance sports kept to water consumption schedule more strictly. At the same time, none of the high-class student-athletes was found to have an average or low level of knowledge about water consumption (75.0% of males and 60.0% of females had a high level, and the rest – sufficient).

2. According to most health indicators, students-athletes whose water intake schedule was assessed as high and sufficient had better average values of the studied indicators than those students whose water consumption schedule was assessed as medium and low.
3. It was found that water plays an important role in the life of students, and especially during physical activity. High-quality water, keeping watering consumption schedule, especially during prolonged exercise and in high ambient temperatures having a positive effect on the body: they reduce dehydration, bring down fever, reduce the load on the cardiovascular system, accelerate the recovery process, and increase physical performance. All this helps to improve the health of students.

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The Authors declare no conflict of interest

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*Konferencje, sympozja, targi*

## REHA INNOVATIONS – KRAKÓW, 10-11 WRZEŚNIA 2021 R.

W dniach 10-11 września 2021 w Krakowie cała branża rehabilitacyjna będzie skupiona na dwóch wydarzeniach:

Targach REHA Innovations – Fizjoterapia, Nowoczesna Diagnostyka, Odnowa Biologiczna oraz

**REHA Sympozjum – XX Sympozjum Naukowe Polskiego Towarzystwa Rehabilitacji.**

**Targi i sympozjum organizowane są przez firmę Targi w Krakowie.**

Będą to pierwsze wydarzenia organizowane stacjonarnie w dobie pandemii SARS-CoV-2!

Podczas **REHA Innovations – Fizjoterapia, Nowoczesna Diagnostyka, Odnowa Biologiczna** nastąpi integracja środowisk związanych z szeroko pojętymi dziedzinami fizjoterapii, diagnostyki oraz odnowy biologicznej.

Targi będą platformą spotkań i rozmów. W jednym miejscu zbiorą się przedstawiciele biznesu, jednostki akademickie i start-up'y, by zaprezentować szerokie spektrum innowacji w obszarach cyfryzacji i robotyki.

Więcej informacji możecie Państwo znaleźć na stronie internetowej wydarzenia <https://www.rehainnovations.pl/>

Program **Reha Sympozjum - XX Sympozjum Naukowe Polskiego Towarzystwa Rehabilitacji** skupia swoją szczególną uwagę na kompleksowej rehabilitacji w dobie pandemii SARS-CoV-2! . Specjaliści z dziedzin z fizjoterapii i rehabilitacji zbiorą się, aby wymienić się cennymi doświadczeniami oraz sposobami pomocy swoim pacjentom.

Więcej informacji możecie Państwo znaleźć na stronie internetowej wydarzenia: <http://www.rehasympozjum.pl/>

Oba te wydarzenia łączą ze sobą szczególną troskę o zdrowie społeczeństwa oraz skupiają się na niezbędnej dla rozwoju innowacji wymianie doświadczeń i poglądów. Są to niewątpliwie unikalne wydarzenia, mające znaczącą wagę dla świata nauki oraz biznesu.

