ISSN 2082-1867

Acta Balneologica

JOURNAL OF THE POLISH BALNEOLOGY AND PHYSICAL MEDICINE ASSOCIATION

VOL. LXV NUMBER 2 (174)/2023 BIMONTHLY MARCH-APRIL

Aluna Publishing

Acta Balneologica

PUBLISHER:
ALUNA Publishing
ul. Przesmyckiego 29
05-510 Konstancin Jeziorna
www.actabalneologica.pl

PROJECT COORDINATOR:
MEDDOM PRESS
tel. 604-208-453
barbadom@wp.pl

GRAPHIC DESIGN:
Piotr Dobrzyński
www.poligrafia.nets.pl

SUBSCRIPTION:
prenumerata@wydawnictwo-aluna.pl

CONTENTS

Acta Balneol. 2023;VOL.LXV,2(174):115-119

ORIGINAL ARTICLE

DOI: 10.36740/ABAL202302109

INDEPENDENT PHYSICAL EXERCISES AS THE MAIN MEANS OF MAINTAINING STUDENTS' HEALTH DURING THEIR DISTANCE LEARNING

Nadiia M. Havrylova[1], Svitlana M. Uskova[1], Viktor V. Nazymok[1], Serhii A. Abramov[1], Anatolii V. Lukachyna[1], Nataliia V. Ivaniuta[1], Nataliia Liakhova[2]

[1]NATIONAL TECHNICAL UNIVERSITY OF UKRAINE "IGOR SIKORSKY KYIV POLYTECHNIC INSTITUTE", KYIV, UKRAINE
[2]POLTAVA STATE MEDICAL UNIVERSITY, POLTAVA, UKRAINE

ABSTRACT

Aim: The aim is to study the influence of independent physical exercises of different focuses on the health indicators of students during their distance learning.

Materials and Methods: The research was conducted during 2020-2021. The research involved 188 students (103 men and 85 women) of the first instructional years of technical specialties. Of these, 131 students regularly performed physical exercises during their distance learning, and 57 did not perform physical exercises at all.

Results: It was found that students who regularly engaged in physical exercises during distance learning did not significantly deteriorate their health indicators and correspond to age norms. At the same time, strength training sessions have a positive effect on body mass index and strength index, while endurance training sessions have a positive effect on body mass index, vital index, and index of Robinson. Students who did not exercise showed a significant deterioration in all health indicators.

Conclusions: It was found that distance learning resulted in a significant decrease in students' physical activity. It was found that students who did not exercise on their own had an increase in body weight, which can cause many diseases. It was proved that regular independent physical exercises are one of the main means of maintaining and promoting the health of students during their distance learning.

KEY WORDS: students, health, independent physical exercises, distance learning

INTRODUCTION

The rapid spread of COVID-19 coronavirus disease in 2019-2020 forced most higher educational institutions (HEIs) in many countries to switch to distance learning, which involves obtaining education without the physical presence of students in the HEIs. Students of Ukrainian HEIs are no exception.

The negative factors of students' transition to distance learning are lack of social component of education, i. e. lack of real contact with instructors and colleagues; significant limitation of opportunities to work with real laboratory facilities and samples of equipment (for technical specialties); significant limitation of motor activities, as there is no need to change the workplace, classroom, building, etc. Scientists [1, 2] identify the following negative factors of distance learning: violation of daily routine and nutrition, which results in a significant increase in body weight, obesity, and other negative health consequences; irrational organization of the workplace and prolonged sitting, which leads to overloading of the spine and the entire musculoskeletal system of students; hypodynamia and hypokinesia, which leads to a decrease in energy consumption, worsens metabolism, the activity of the main body systems; exceeding the norm of daily use of computers, tablets, etc. by ten times which negatively affects students' eyesight; monogeny, information, intellectual and emotional overload of students, the need to process a large amount of perceived information per unit of time, attention span which results in stress and negatively affects the mental health of students.

According to experts [3, 4], independent and regular exercise of various focuses is one of the most effective means of promoting health during forced distance learning caused by COVID-19. Firstly, physical exercises, increasing the amount of students' motor activities, ensure the effective functioning of the cardiovascular system, blood circulation, respiratory system, and other life support systems of the body; strengthening the muscles of the whole body and, in particular, the back, which helps to improve blood supply to the brain and, accordingly, increase the success of learning. Secondly, physical exercises help improve the psycho-emotional state of students, reduce stress and irritability, improve mood as well as well-being, and reduce fatigue due to the abundance of online information and the need to process, analyze, and memorize it. Thirdly, according to scientists [5], exercise promotes the production of certain hormones that reduce the possibility of the SARS-CoV-2 coronavirus attack and complications of COVID-19, as well

as reduces inflammation and cell death during infection. It was found that patients who were constantly inactive (less than 10 minutes per week for exercise) had a higher risk of hospitalization than those who exercised 150 minutes or more per week [6].

Depending on the impact of the development of certain physical qualities of a person, exercises can have a different focus. For example, according to scientists [7], aerobic exercises for endurance development are the most effective for promoting human health during independent training. From the physiological point of view, endurance is characterized as the ability to perform work for a long time at the required level of intensity, as the ability to fight fatigue. Endurance allows you to perform work that places high demands on the cardiovascular, respiratory, and central nervous systems for a long time. The studies [8] show that when a certain level of endurance development is achieved, changes occur at the functional level in the body, primarily in the main life support systems (cardiovascular, and respiratory). The development of endurance allows to effectively form reserves of adaptation of the organism and ensures their high efficiency, to form perfect mechanisms of regulation of vascular tone in conditions of nervous and emotional stress and thus ensure the prevention of cardiovascular diseases. According to scientists [9], recreational jogging and walking are universal means of increasing motor activities. The authors emphasize the positive changes in health as a result of physical exercises aimed at developing endurance, namely: increasing the body's resistance to adverse environmental factors, normalizing body weight, and strengthening the musculoskeletal system.

Regarding the positive impact of strength exercises on students' bodies, scientists [10] prove that as a result of systematic training, the volume of the heart muscle gradually increases, and the network of blood vessels that feed it increases; changes also occur in the blood composition (the number of red blood cells, hemoglobin increases); the chest circumference and lung capacity increase; the activity of the central nervous system and mental performance improves; and concentration increases. Strength exercises help to eliminate body structure defects, ensure the good functional condition of the musculoskeletal system and cardiorespiratory systems, and promote a good mood.

AIM

The aim is to study the influence of independent physical exercises of different focuses on the health indicators of students during their distance learning.

MATERIALS AND METHODS

The research was conducted during 2020-2021 at the Department of Health and Sports Technologies of the National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute" (Kyiv, Ukraine). The research involved 188 students (103 men and 85 women) of the first instructional years of technical specialties. Of these, 131 students (73 males and 58 females) regularly performed physical exercises during their distance learning (main group), and 57 did not perform physical exercises at all (control group (C)).

Research methods include analysis and generalization of literary sources on the research topic, questionnaires, medical and biological methods and statistical methods. The questionnaire allowed us to find out whether students were engaged in physical exercises at all and to divide students into groups depending on the focus of the training sessions. It was found that 51 men and 17 women were engaged in strength exercises during their distance learning (group "Strength" (S)), and 22 men and 41 women were engaged in aerobic endurance exercises (group "Endurance" (E)). Students' health level was assessed by body weight, height, vital capacity of the lungs (VCL), hand dynamometry, pulse, and blood pressure. In addition, we determined body mass indices (BMI, the ratio of body weight to height), life index (LI, the ratio of VCL to body weight), strength index (SI, the ratio of hand strength to body weight) and index of Robinson (IR, the ratio of the product of pulse and systolic blood pressure to 100). These indicators were assessed twice: at the beginning of the distance learning program (March 2020) and after its completion (September 2021).

The significance of the difference in the results of the students was determined during the studying based on the Student's test. The significance for all statistical tests was set at $p<0.05$. All statistical analyses were performed with the SPSS software, version 21, adapted to medical and biological researches. This research followed the regulations of the World Medical Association Declaration of Helsinki. Informed consent was received from all students who took part in this research.

RESULTS

The results of the comparative analysis of students' health indicators who independently engaged in strength training, and aerobic endurance exercises and those who did not engage in physical exercises at all during their distance learning are presented in Table 1 (men) and Table 2 (women).

The analysis of the studied indicators of male students before the start of distance learning showed that the indicators of all groups did not differ significantly ($p<0.05$). After completing the distance learning program, the S group significantly improved the SI ($p<0.05$), and the rest of the indicators did not change significantly ($p>0.05$). The IR improved significantly in the E group ($p<0.05$), and the rest also improved, but not significantly. All indicators deteriorated in the C group, with significant deterioration in the BMI, SI, and IR ($p<0.05$-0.01), and insignificant deterioration in the LI ($p>0.05$).

A similar trend was observed among female students: those students who exercised independently during distance learning had improved or unchanged health indicators, while those who did not exercise had significantly deteriorated. This confirms the conclusions of many scientists about the decline in health among students who lead a sedentary lifestyle and the importance of physical activities in their daily routines.

Table 1. Comparison of health indicators of male students before and after completing distance learning (n=103)

Groups	n	Stages of distance learning		Significance of the differences	
		Beginning	End	t	p
		BMI. kg/m^2			
S	51	23.7±0.19	24.1±0.21	1.41	>0.05
E	22	23.5±0.28	23.8±0.29	0.74	>0.05
C	30	23.8±0.26	24.4±0.28	3.40	<0.01
		LI. ml/kg			
S	51	55.9±0.93	56.1±0.95	0.15	>0.05
E	22	56.4±1.23	56.9±1.19	0.29	>0.05
C	30	55.8±1.20	53.7±1.24	1.22	>0.05
		SI. %			
S	51	58.3±0.89	61.3±0.85	2.44	<0.05
E	22	57.4±1.07	55.8±1.14	1.02	>0.05
C	30	56.2±1.11	52.7±1.17	2.17	<0.05
		IR. c.u.			
S	51	89.6±1.07	88.7±1.02	0.61	>0.05
E	22	89.1±1.32	85.3±1.24	2.10	<0.05
C	30	89.5±1.27	93.6±1.30	2.26	<0.05

Table 2. Comparison of health indicators of female students before and after completing distance learning (n=85)

Groups	n	Stages of distance learning		Significance of the differences	
		Beginning	End	t	p
		BMI. kg/m^2			
S	17	22.1±0.32	22.4±0.31	0.67	>0.05
E	41	21.8±0.23	21.6±0.20	0.66	>0.05
C	27	22.3±0.26	23.2±0.28	2.23	<0.05
		LI. ml/kg			
S	17	46.2±1.42	46.7±1.37	0.25	>0.05
E	41	46.5±1.25	48.1±1.27	0.90	>0.05
C	27	46.3±1.33	44.5±1.32	0.96	>0.05
		SI. %			
S	17	39.8±1.42	42.5±1.34	1.38	>0.05
E	41	38.1±1.12	38.4±1.08	0.19	>0.05
C	27	39.3±1.25	36.9±1.29	1.34	>0.05
		IR. c.u.			
S	17	88.5±1.44	88.1±1.38	0.20	>0.05
E	41	87.8±1.20	84.7±1.18	1.84	<0.05
C	27	88.2±1.23	92.5±1.25	2.45	<0.05

DISCUSSION

Scientists [11] have proven that the quality of the educational process directly depends on the health of students. The sedentary lifestyle of students during their distance learning negatively affects the fitness of the heart, which is the main muscle that pumps blood. Moreover, this, in turn, can result in diseases of the circulatory system: vasoconstriction, vegetative-vascular dystonia, hypertension, and myocardial weakness. As a result of inactivity, blood circulation slows down, which leads to a decrease in the supply of oxygen to all organs and systems. Decomposition (oxidation) products do not have time to be removed from the body. The body does not have time to renew itself during intense mental stress and, as a result, the quality of assimilation of new material and the speed of its processing deteriorate [12]. In addition, the sedentary lifestyle of students negatively affects the state of their musculoskeletal system and, in particular, the spine. This leads to pathologies such as osteochondrosis, scoliosis, and stoop. Untrained back muscles spasm, which causes pain in the back and other parts of the body, depending on the part of the spine where the spasms occur. Moreover, prolonged sitting at a computer weakens the tone of blood vessels, causes edema, venous stasis, and leg heaviness, and provokes venous dilation in the lower extremities [4].

Independent physical exercises, the weekly volume of which should be from 3 to 6 hours or more, take the first place among the many recommendations of scientists to reduce the negative impact of a sedentary lifestyle on students during their distance learning [2, 5]. At the same time, scientists [6] note that a greater number (volume) of physical exercises means a lower risk of developing

severe COVID-19. Experts recommend moderate-intensity exercises, with almost half of the sessions being aerobic. More than this, even daily 30-minute walks are enough to help the body fight various diseases. The researchers also found that people who rarely exercised were hospitalized twice as often due to COVID-19 than people in the most active group (who exercised regularly).

The positive effect of aerobic exercises (in particular, recreational jogging, as one of the most affordable physical exercises for independent training) aimed at developing endurance has been emphasized by many scientists [7, 8]. Thus, recreational jogging reduces blood cholesterol levels and thus helps prevent atherosclerosis; increases the stroke volume of the heart, which increases the lumen of the heart vessels and after several years of running practice, their lumen becomes twice as large; improves blood circulation in the lower extremities due to muscle contractions and active pushing of blood towards the heart (muscle pump), which helps prevent varicose veins; after jogging, the arteries of the leg muscles and skin capillaries remain dilated for a long time, which helps to normalize blood pressure; during running, an average of 700 kilocalories is consumed in one hour, respectively, 2100 kilocalories are consumed in 3 hours of slow jogging [9].

The works of many scientists [10, 13] note that strength exercises contribute to promoting the level of health; aesthetic self-improvement due to the proportionality and symmetry of muscles and the overall harmonious development of all muscle groups; correction of the body structure, including the elimination of its defects, recovery from injuries, increasing working capacity; formation of a harmonious physique. Strength exercises have a beneficial effect on the muscles and osteo-ligamentous apparatus of a person; help to improve the proportionality of the body; form a relaxed, correct posture. In addition, correct posture not only makes the body attractive but also creates favorable conditions for the functioning of internal organs. Scientists [14] have found that neuroses, psycho-emotional overload, and difficulties in adapting to the conditions of educational and professional activities in people with a low level of strength development occur five times more often than in people with a well-developed muscular system. Strength exercises also contribute to the development of other physical qualities (speed, flexibility, coordination of movements), and improve physical working capacity [15, 16]. Strength exercises performed with bending and vigorous straightening of the body significantly contribute to strengthening the muscles of the back, torso, and abs i. e. the formation of a muscle "corset" that allows you to "pump" blood around the spine and improve all internal organs [14].

The above suggests that regular independent performance of physical exercises of various focuses during distance learning will contribute to the development of physical qualities, maintaining a high level of functional capabilities of all body systems of students and their overall health. In addition, switching students to physical exercises will help to restore their psycho-emotional state during the intense study, and improve their well-being, mood as well as success in learning the material.

The results obtained in our research confirm the findings of many scientists regarding the positive impact of physical exercises on promoting people's health who lead a sedentary lifestyle. This category of people includes university students during forced distance learning. It has been found that, regardless of the focus of physical exercises, their regular performance helps to maintain the indicators of the main systems of the students' body at a sufficient level, and normalize their body weight, which ensures the prevention of most diseases.

CONCLUSIONS

It was found that students who regularly engaged in physical exercises during distance learning did not significantly deteriorate their health indicators and correspond to age norms. At the same time, strength training sessions have a positive effect on body mass index and strength index, while endurance training sessions have a positive effect on body mass index, vital index, and index of Robinson. Students who did not exercise showed a significant deterioration in all health indicators.

It was found that distance learning resulted in a significant decrease in students' physical activity. It was found that students who did not exercise on their own had an increase in body weight, which can cause many diseases. It was proved that regular independent physical exercises are one of the main means of maintaining and promoting the health of students during their distance learning.

Prospects for further research are aimed at the scientific substantiation of the program of independent physical exercises for students during their distance learning.

References

1. Romero-Blanco C, Rodríguez-Almagro J, Onieva-Zafra MD, Parra-Fernández ML, Prado-Laguna MDC, Hernández-Martínez A. Physical activity and sedentary lifestyle in university students: Changes during confinement due to the COVID-19 Pandemic. Int J Environ Res Public Health. 2020;17(18):6567. doi:10.3390/ijerph17186567
2. Griban G, Moskalenko N, Adyrkhaiev S et al. Dependence of students' health on the organization of their motor activity in higher educational institutions. Acta Balneol. 2022;5 (171):445-450. doi: 10.36740/ABAL202205112
3. Luciano F, Cenacchi V, Vegro V, Pavei G. COVID-19 lockdown: Physical activity, sedentary behaviour and sleep in Italian medicine students. Eur J Sport Sci. 2021;21(10):1459-1468. doi:10.1080/17461391.2020.1842910
4. Wilson OWA, Holland KE, Elliott LD, Duffey M, Bopp M. The Impact of the COVID-19 Pandemic on US College Students' Physical Activity and Mental Health. J Phys Act Health. 2021;18(3):272-278. doi:10.1123/jpah.2020-0325

5. Boukrim M, Obtel M, Kasouati J, Achbani A, Razine R. Covid-19 and Confinement: Effect on Weight Load, Physical Activity and Eating Behavior of Higher Education Students in Southern Morocco. Ann Glob Health. 2021;87(1):7. doi:10.5334/aogh.3144
6. Guo YF, Liao MQ, Cai WL, et al. Physical activity, screen exposure and sleep among students during the pandemic of COVID-19. Sci Rep. 2021;11(1):8529. doi:10.1038/s41598-021-88071-4
7. Li F, Huang Y, Luo Y, He J. Comparative study on the effect of various aerobic exercises on college students' weight loss based on deep learning analysis. Comput Intell Neurosci. 2022;2022:6825919. doi:10.1155/2022/6825919
8. Li L. Effects of Aerobic Exercise on Sleep Quality and Mental Health of College Students. Occup Ther Int. 2022;2022:8366857. doi:10.1155/2022/8366857
9. Lu Y, Wiltshire HD, Baker JS, Wang Q. The effects of running compared with functional high-intensity interval training on body composition and aerobic fitness in female university students. Int J Environ Res Public Health. 2021;18(21):11312. doi:10.3390/ijerph182111312
10. Wan X, Li S, Best TM, Liu H, Li H, Yu B. Effects of flexibility and strength training on peak hamstring musculotendinous strains during sprinting. J Sport Health Sci. 2021;10(2):222-229. doi:10.1016/j.jshs.2020.08.001
11. Velten J, Bieda A, Scholten S, Wannemüller A, Margraf J. Lifestyle choices and mental health: a longitudinal survey with German and Chinese students. BMC Public Health. 2018;18(1):632. doi:10.1186/s12889-018-5526-2
12. Bin Abdulrahman KA, Khalaf AM, Bin Abbas FB, Alanezi OT. The lifestyle of Saudi medical students. Int J Environ Res Public Health. 2021;18(15):7869. doi:10.3390/ijerph18157869
13. Prontenko K, Griban G, Yavorska T et al. (2020). Dynamics of respiratory system indices of cadets of higher military educational institutions during kettlebell lifting training. Inter J Appl Exer Physiol. 2020;9(1):16-24.
14. Kim B, Yim J. Core stability and hip exercises improve physical function and activity in patients with non-specific low back pain: A randomized controlled trial. Tohoku J Exp Med. 2020;251(3):193-206. doi:10.1620/tjem.251.193
15. Griban G, Dovgan N, Tamozhanska G et al. State of physical fitness of the students of Ukrainian higher educational institutions. Inter J Appl Exer Physiol. 2020;9(5):16-26.
16. Tymoshenko O, Arefiev V, Griban G et al. Characteristics of the motivational value-based attitude of students towards physical education. Revista Dilemas Contemporáneos: Educación, Política y Valores. 2019;11. Período: Octubre, 2019.

ORCID AND CONTRIBUTIONSHIP*

Nadiia M. Havrylova – 0000-0002-0293-1576 [A]
Svitlana M. Uskova – 0000-0002-9641-0367 [B]
Viktor V. Nazymok – 0000-0002-2278-5932 [D]
Serhii A. Abramov – 0000-0002-6661-1678 [B]
Anatolii V. Lukachyna – 0000-0002-2943-5185 [C]
Nataliia V. Ivaniuta – 0000-0001-6403-5358 [E]
Nataliia Liakhova – 0000-0003-0503-9935 [F]

CONFLICT OF INTEREST

The Authors declare no conflict of interest

RECEIVED: 11.12.2022
ACCEPTED: 24.03.2023

ADDRESS FOR CORRESPONDENCE

Nataliia Liakhova
Poltava State Medical University, Poltava, Ukraine,
e-mail: NataNew2017@ukr.net

*Contribution:
A – Research concept and design, B – Collection and/or assembly of data,C – Data analysis and interpretation, D – Writing the article, E – Critical review of the article, F – Final approval of article