

Physical activity characteristics of female students with various diseases

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Published online: February 28, 2022

(Accepted for publication February 15, 2022)

DOI:10.7752/jpes.2022.02057

Abstract:

A person's physical activity is one of the main non-drug means of improving and strengthening his health. The issues of the relationship of students' doing physical education at a special medical group weekly physical activity with the type of disease have not been sufficiently studied. *The aim* is to evaluate weekly physical activity, morphofunctional indicators and physical fitness of female students with various diseases in a year after the PE classes termination at the university. *Materials and methods*. During performing the research project 120 Russian girls aged 18-19, who had previously been engaged in physical education in a special medical group for 2 years were examined. Their weekly physical activity was studied using the IPAQ-SF questionnaire. The level of metabolic equivalent has been determined. The assessment of anthropometric, functional indicators of the cardiorespiratory system and motor qualities is given. *Research results*. It was found that a year after the training sessions termination at the Department of Physical Culture, girls with visual diseases have the greatest weekly physical activity. The lowest level of metabolic equivalent was registered in girls with cardiovascular diseases and pathology of the respiratory system. They also have the lowest indicators of functional body fitness. Girls with cardiorespiratory pathology have the lowest values of physical fitness tests. Therefore, they have a risk of further deterioration of somatic health. *Conclusion*. A year after the compulsory PE classes termination at the university, female students with pathology of the cardiorespiratory system organs had the lowest indicators of weekly physical activity, the level of metabolic equivalent, morphofunctional indicators and motor qualities, compared with the results of girls' with other diseases screening. Until the end of compulsory PE classes, teachers of physical culture departments need to increase female students' motivation for physical activity, especially among girls with diseases of the cardiovascular and respiratory systems to improve the quality of health throughout life.

Key Words: female students, a special medical group, physical activity, morphofunctional indicators

Introduction

It is known that regular physical activity is necessary to maintain and improve a person's psychosomatic health, especially at a young age (Budzynski-Seymour et al., 2020; Glazkova et al., 2020). Education in educational institutions places high demands on students' physical, somatic and mental health. There are scientific literature data on the positive impact of physical activity on young people's health in various countries (Savko, & Hojempo, 2018; Zurita-Ortega et al., 2019; Zhang et al., 2019).

An analysis of scientific literature sources in recent years indicates that a significant part of students in educational institutions have serious health abnormalities and somatic diseases of various nosology (Katzmarzyk et al., 2017; Santana et al., 2017; Yang, Dong, 2017). At the same time, health deterioration begins to be registered even at school age (Krasnozhan, 2017).

Data from Fleming et al. (2014) associate this fact with low physical activity, Hills et al. (2015) - with the academic school curriculum overload and the low quality of physical education.

According to Gerber et al. (2017), Collins et al. (2017) the number of students with health abnormalities can reach half of the total number of students. Every fifth student is exempt from PE classes for health reasons, many have disabilities and limited health opportunities (Glazkova et al., 2020). The reasons for students' health deterioration are information overload (Kudryavtsev et al., 2016), psycho-emotional stress

during training (Tabacco, 2018), low physical activity (Olafsdottir et al., 2016; Chekhov et al., 2020), violation of a healthy lifestyle foundations and the emergence of socially negative habits (Kolokoltsev et al., 2018; Pengpid et al., 2019), leading to serious non-communicable diseases.development.

A contingent of students with various non-communicable diseases is allocated to a special medical group for physical education, where, taking into account the disease, they engage in physical culture of a health-improving orientation. Classes for such students have a special organization and technology (Mozolev, 2020) due to the presence of chronic diseases. A PE teacher is obliged to use such pedagogical technologies for conducting a training session, which take into account the volume, intensity and direction of physical activity.

An important place in physical education organization in a special medical group is occupied by the preliminary selection of physical exercises that can increase physical activity and the quality of life of students with different classes of diseases.

Despite extensive research, there are urgent tasks, aimed at improving the content of PE curricula for students with various diseases (Koryahin, 2018). To do this, it is necessary to detail the issues of studying the features of morphofunctional characteristics and motor capabilities of students with chronic diseases. The issues of assessing the weekly motor activity level of students of a special medical group (Momot et al., 2020) and the relationship of physical activity with the type of disease remain insufficiently studied

Research aim is to evaluate weekly physical activity, morphofunctional indicators and physical fitness of female students with various diseases in a year after the PE classes termination at the university.

Material & methods

The research project work was carried out at the University of Russia in the 2020-2021 academic year. 120 girls (aged 18-19) were examined, who in the previous 2019-2020 academic year were engaged in physical education at the university in a special medical group and had physical activity restrictions due to non-communicable chronic somatic diseases.

Our project involved girls with pathology of the visual organs (group A, n=14), with pathology of the genitourinary system (group B, n=7), with pathology of the musculoskeletal system (group C, n=38), with pathology of the respiratory organs (group D, n=16) and with pathology of the cardiovascular system (group E, n=45).

According to International Standards for Anthropometric Assessment (2001), in each case, the following were measured: standing height, cm and body weight, kg; chest and waist circumference, cm. Then the functional parameters of systolic and diastolic blood pressure, mmHg; muscle strength of the right and left hand, kg. Martinet-Kushelevsky, Stange and Genche tests were conducted. The Robinson Index was calculated in conventional units: $IRob = (HR \times SBP) / 100$ c.u. HR - heart rate before exercise load, beats/10 s; SBP - systolic blood pressure, mmHg.

According to PCFSN motor tests, the president's challenge: Physical fitness test (2011) investigated the physical fitness of girls for speed (30 m run of the high start, s); endurance (1000 m run, min, s); flexibility (Standing Forward Bend, cm); strength endurance of upper shoulder girdle muscles (Cadence Push-Up Test, number of times); strength endurance of trunk muscles (Eurofit Sit Up Test for 60 sec., number of times); dynamic strength of the lower extremities muscles (Standing long jump, cm).

According to the number of points, the volume of the girls' weekly motor activity was estimated using the Short Form International Questionnaire on Physical Activity, (IPAQ- SF), Craid et al. (2003).

The level of metabolic equivalent (MET) was determined by the number of weekly energy consumption. The group with a high level of MET included girls who had 3 or more days of intense physical activity (PA) per week, lasting more than 20 minutes. Girls who had 3 or more days of high PA per week, but lasting less than 20 minutes, or at least 5 days of moderate intensity PA or daily walking, lasting at least 30 minutes, were included in the group with an average level of MET. The group with a low level of PA intensity included female students who did not have the above criteria.

The materials were statistically processed using licensed programs STATISTICA 10.0, MS Excel 2010. The reliability of the difference in the indicators values was determined using the Student's t criterion ($p < 0.05$). According to the Helsinki Declaration (2008), our research does not violate the protocol of conducting biomedical experiments.

Results

The weekly motor activity of female students with various diseases was evaluated in points using the IPAQ-SF questionnaire, Table 1.

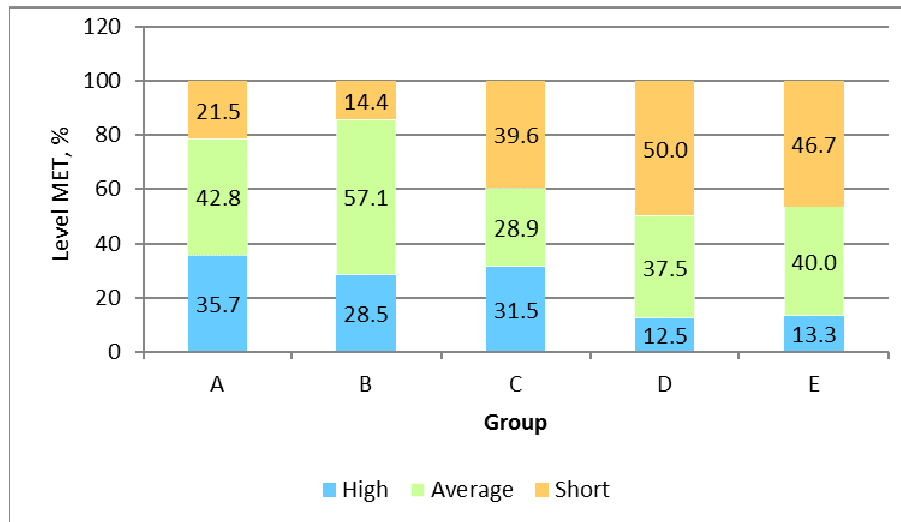
Table 1. The female students' weekly physical activity assessment (M±m)

Group number Disease	Questions of IPAQ-SF questionnaire						
	Number of days with intense physical activity per week	Duration of intensive* physical activity per day	Number of days of non-intensive physical activity per week	Duration of non-intensive physical activity per day	How many days a week do you walk	How much time a day do you walk	How many hours a day do you spend in a sitting position
A Vision	2.77±0.19	4.37±0.35	3.82±0.33	2.28±0.35	6.37±0.19	3.64±0.3	2.75±0.25
Total score 26.0±0.21							
B Genitourinary system	2.38±0.41	3.71±1.04	3.14±0.50	2.28±0.64	6.14±0.45	3.85±0.7	2.6±0.58
Total score 24.1±0.24							
C Musculo-skeletal system	1.74±0.20	2.86±0.35	3.28±0.32	2.5±0.33	5.92±0.25	2.34±0.3	1.81±0.24
Total score 20.45±0.16							
D Respiratory system	1.65±0.22	2.18±0.50	3.68±0.54	1.87±0.42	4.75±0.14	2.17±0.6	1.43±0.28
Total score 17.73±0.13							
E Cardio-vascular system	1.54±0.37	1.85±0.44	2.42±0.58	2.21±0.68	4.28±0.37	2.11±0.4	1.57±0.40
Total score 15.98±0.11							

* intensive physical activity lasting > 20 minutes, after which the pulse rises > 20%

Girls with visual organ diseases (group A) have the highest number of points (26.0±0.21) of weekly physical activity. This is 7.3% more than the number of points in students with diseases of the genitourinary system (group B), 21.3% more than in girls of group C, 31.8% more than in girls of group D and 38.5% more than in girls of group E, $p < 0.05$.

The distribution of female students with different diseases according to the level of metabolic equivalent is shown in the figure.



Note. Group: A- vision; B – genitourinary system; C – musculoskeletal system; D – respiratory system; E- cardiovascular system.

Fig. Number of female students with different levels of metabolic equivalent (%).

The girls of group D with respiratory pathology and group E with pathology of the cardiovascular system have a low level of metabolic equivalent. In these groups, a low level of weekly physical activity and MET of girls was established (Table 1, Figure). Further, we studied the peculiarities of morphofunctional indicators in female students with various diseases (Table 2).

Table 2. Values of the girls' morphofunctional indicators (M±m)

Indicators		Disease group				
		A (n=14)	B (n=7)	C (n=38)	D (n=16)	E (n=45)
Anthropometry						
Standing height, cm		163.73±1.86	164.75±2.05	166.24±0.94	165.5±1.16	166.62±1.02
Body weight, kg		59.36±1.58	55.0±2.31	59.05±2.17	58.93±3.05	63.4±3.15
Circumference, cm	chest	87.8±1.81	87.84±1.43	82.17±1.09	82.62±2.20*	80.62±1.32**
	waist	70.6±2.50	63.62±1.66	75.24±1.26	76.03±1.69*	78.17±1.6**
Physiometry						
Muscle strength of the hand, kg	left	27.33±1.10	26.0±1.30	26.31±0.72	25.42±1.44	23.30±0.79**
	right	31.46±3.09	29.6±1.11	28.07±1.27	27.75±1.33	27.62±0.45**
Blood pressure, mmHg	systolic	114.28±3.73	112.75±3.22	114.28±2.11	116.13±1.38	123.3±3.26**
	diastolic	74.07±2.69	78.75±3.65	75.05±1.48	74.0±2.68	76.46±1.30
Martinet-Kushlevsk y's test (20 squats for 30 s), beats/10 s	pulse before load	13.84±0.68	14.46±0.42	15.62±1.52	15.84±1.21*	17.53±0.45**
	pulse after load	22.76±0.53	21.25±1.46	23.55±0.59	25.14±0.97*	27.89±1.01**
	pulse recovery time after exercise, s	92.30±9.18	90.0±15.0	93.07±4.51	103.2±12.75	106.5±5.09**
Robinson index, c.u		94.8±3.34	97.82±3.87	107.1±2.24	110.36±1.2*	129.7±3.73**
Stange test, s		48.76±6.53	47.15±1.84	45.37±6.14	41.5±4.97	43.26±2.59
Genche test, s		31.33±3.34	30.25±3.46	30.21±2.76	25.08±2.00*	25.24±1.23**

Note. * - significant difference between groups A and D; ** - significant difference between groups A and E, p<0.05

It was found that there are no significant differences between the length and body weight of girls with different diseases, p>0.05. In girls with diseases of the musculoskeletal (group C), respiratory (group D) and cardiovascular (group E) systems, the value of the chest circumference index was significantly less, the waist circumference was significantly greater than in girls with pathology of the visual organs (group A) and genitourinary system (group B), p<0.05. The largest reliable values of strength ability indicators (dynamometry) were found in girls with diseases of the visual organs (group A) and genitourinary system (group B), compared with girls of group E, p<0.05.

The highest values of the pulse index before physical activity, after it and the pulse recovery time were found in girls with diseases of the cardiovascular system (group E), p<0.05. They have the lowest reliable value of the IRob index (systolic heart function) - 129.76±3.73 conventional units, which is 26.9% lower than in girls with eye disease (group A) and 24.6% lower than in girls with pathology of the genitourinary system (group B), p<0.05.

There are no significant differences between the values of this indicator in the girls of group E with the indicators of girls from C and D groups. Analysis of the results of the Stange and Genche breathing tests showed that girls with respiratory pathology (group D) have the lowest hypoxic resistance of the body (Table 2).

According to our data, girls of groups A and B have the highest functional readiness. The lowest indicators of functional fitness of the body were found in girls with diseases of the respiratory and cardiovascular systems (groups D and E, respectively). This is reflected in the values of motor tests indicators of girls with this pathology (Table 3).

Table 3. Values of girls' with different diseases motor tests indicators (M ±m)

№	Indicators	Group				
		A (n=14)	B (n=7)	C (n=38)	D (n=16)	E (n=45)
1	30 m run, s	4.60±0.16	5.27±0.14	5.85±0.28	5.74±0.16*	5.88±0.11**
2	1000 m run, min, s	6.42±0.41	6.47±0.26	6.66±0.09	6.94±0.20	7.23±0.21**
3	Eurofit Sit Up Test for 30 sec., number of times	19.10±0.83	18.12±1.64	17.0±0.79	16.12±1.63	16.42±0.87
4	Sitting Forward Bend, cm	16.37±1.46	14.66±2.99	13.51±1.02	13.5±1.85	10.48±1.34**
5	Standing long jump, cm	160.71±4.14	160.3±5.54	155.89±2.54	153.20±3.17*	149.8±4.26**
6	Cadence Push-Up Test, number of times	22.37±1.85	20.78±2.31	20.77±1.30	19.92±1.78	16.47±1.05**

Note. * - significant difference between groups A and D; ** - significant difference between groups A and E, p<0.05

Students' of the special medical group results of the motor qualities testing analysis showed that the fastest, most enduring, flexible, with the most developed dynamic strength of the leg muscles and speed-strength endurance of the arm muscles were the girls of group A with visual organs diseases (p<0.05).

Dicussion

According to Momot et al. (2020), physical education of students with physical activity limitations due to non-communicable chronic somatic diseases occupies a special place in the health-saving system in educational institutions.

We agree with the report of Koryahin (2018) that for differentiated use of physical activity in training sessions in a special medical group, a comprehensive study of factors related to morphofunctional features of the body and physical activity of such students is necessary. The state of a person's physical activity depends on the normal, joint work of the cardiovascular, respiratory and muscular systems of his body (Kolokoltsev et al., 2018).

According to our data, in 1 year after completing physical education at the university, the most physically inactive students were girls with diseases of the cardiovascular and respiratory systems. They had the lowest average score of weekly physical activity and the level of metabolic equivalent, compared with the results of female students with other diseases. Girls with low weekly physical activity have insufficient exercise load tolerance. This is evidenced by the results of the Martine-Kushelevsky tests, low indicators of Stange and Genche hypoxic samples, a low level of the Robinson index, which characterizes the systolic work of the heart. Similar results of the study of the cardiovascular system were obtained in the works of Mozolev (2020), Thomas Reyes-Amigo et al. (2021), Zharska et al. (2021).

In our opinion, the presence of a certain disease in the female students examined by us affects and limits the performance of the usual amount of weekly physical activity.

In comparison with the results of the girls with other diseases we examined, low results of the weekly physical activity questionnaire and their motor qualities testing were recorded in the groups of girls with diseases of the cardiovascular and respiratory systems. They had the lowest indicators of dynamic and speed-strength abilities, speed, endurance and general flexibility. We believe that the presence of the highest waist circumference in girls of group D and E is the result of insufficient volume of their weekly physical activity. According to Lazăr Andreea - Gabriela, Mihăilescu Nicolae (2018), this indicator shows hypokinesia and low quality of human life.

Our research confirmed the scientific views on the need to identify girls with diseases of the cardiovascular and respiratory systems in the risk group for further deterioration of somatic health (Mozolev, 2020) if they do not comply with the weekly physical activity regime recommended by WHO.

Conclusions

As a result of the screening, which was conducted a year after the termination of compulsory PE classes at the university, a significant difference in the quantitative characteristics of the physical activity of the research project participants was established. A group of girls with diseases of the cardiovascular and respiratory systems had the lowest level of metabolic equivalent and weekly physical activity. They were found to have significantly fewer days with intense physical activity and the time of its performance, they were more often in a sitting position than girls with diseases of the visual organs and genitourinary system ($p < 0.05$).

High values of pulse indices before and after exercise load, pulse recovery time, Robinson index, low indicators of Stange and Genche hypoxic tests and strength dynamometry of the both hands muscles confirm that girls with diseases of the cardiovascular and respiratory organs have significantly lower functional characteristics of the cardiorespiratory and muscular systems than girls with diseases of the organs of vision and genitourinary systems, $p < 0.05$. The results of testing the motor qualities of female students showed that the fastest, most enduring, flexible, with the most developed dynamic strength of the leg muscles and speed-strength endurance of the arm muscles were girls with pathology of the visual organs, compared with students with other somatic diseases, $p < 0.05$.

We believe that until the end of compulsory PE classes in a special medical group, teachers of the departments of physical culture of the educational institution need to increase the female students' motivation for aerobic motor activity, especially among girls with diseases of the cardiovascular and respiratory systems to improve the quality of their health throughout life.

Conflicts of interest. The author declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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