

The efficacy of Nordic walking in enhancing the physical health of female students with chronic diseases

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Abstract:

Efforts aimed at enhancing the health of young individuals through physical education are a pressing concern for specialists in this area. **Research objective:** To increase the daily physical activity level and physical fitness of students with somatic diseases through the implementation of Nordic walking. **Materials and methods:** The study was conducted among female students of Irkutsk National Research Technical University (Russia) over the course of one academic year. Fifty girls aged 17–19 participated, with various chronic somatic diseases identified through medical examinations. The students were divided into a control group (CG, n=20) and an experimental group (EG, n=30). Traditional physical education and wellness classes were conducted twice a week for two hours for all students. Additionally, girls in the EG were encouraged to engage in Nordic walking four times a week for at least 20 min during their free time, in addition to their regular physical education classes. Every month, the time for Nordic walking was increased by 5 minutes. A high-stakes test of the motor activity for all female students was conducted using the motor activity questionnaire "MAQ – 23+" ("ОДА – 23+"). The state of the CG and girls EG motor qualities was studied using high-stakes testing. **Results.** At the end of the research project, the average physical activity score increased 2.1 times from 51.0±8.0 to 106.6±11.8 points, $p < 0.05$ among the students of the experimental group, where Scandinavian walking was used during the day, in the control one this increase was 40.7% (from 51.1±8.3 to 71.9±9.8 points). There is an increase in the direct indicators of physical activity of female students and the walking time and distance. At the same time, the increase in the values of physical fitness indicators was greater in the girls of the experimental group, where Scandinavian walking was used during the day, compared with the results in the girls of the control one. By the end of the project, students with a good level of health status are registered among EG girls. **Conclusions.** The results of the conducted research project can be recommended for use in planning physical activity of young people to improve their health and physical condition.

Key Words: physical education (PE), female students, physical activity, Nordic walking, physical condition

Introduction

The achievements of recent years in the field of medicine and physical education have significantly improved some medical and demographic indicators in many countries of the world. There is a decrease in mortality rates, an increase in life expectancy and an improvement in the quality of life. Despite the positive results achieved in the diagnosis, treatment and prevention of many human somatic diseases, the problem of improving the younger generation's health continues to be relevant and in demand (Li, 2022).

Numerous scientific sources provide materials that indicate the preserved negative dynamics of young people's somatic, physical, mental and moral health indicators (Martin, & Naziruddin, 2020). An increase in the number of students with various diseases is recorded (Katzmarzyk et al., 2018; Tortella et al., 2021; Tomás Reyes-Amigo, 2021) and low physical fitness characteristics (Badau et al., 2021). At the same time, a decrease in students' quality of life is recorded (Santini et al., 2020; Park et al., 2020), which complicates the educational process of their professional training (Abilleira-González et al., 2019). One of the factors determining young

people's quality of life is low level of physical activity (Martin, & Nasiruddin, 2020; Kolokoltsev et al., 2022). Some researchers believe that this is due to the high academic workload of students, which makes it difficult to engage in physical education or sports (Gerber et al., 2017; Eksterowicz, & Napierała, 2020). Low motivation of young people for physical activity also plays a role (Savitsky, 2018; Bano et al., 2020).

It is known that motor activity should be present in the daily routine not only for healthy students (Chen et al., 2020; Dominski, & Brandt, 2020; Setiakarnawijaya et al., 2021), but also, most importantly, among people with diseases of various genesis (Prontenko et al., 2020). The PE classes organization in separate study groups for students with disabilities allows for a more individualized use of physical education tools and methods for the improvement such students' health (Glazkova et al., 2020; Momot et al., 2020). Individualization implies strict exercise performance, taking into account the nature of the disease and the level of physical condition (Gumenyuk et al., 2021).

Despite the PE and wellness classes conducted, their effectiveness is not always high. It is due to the greater academic nature of the classes (Tuan, 2019) and the insufficient number of study hours for physical education in the study load grid. It is not possible to increase the number of study hours due to economic, logistical, and personnel conditions. Therefore, it is necessary to constantly search for ways to increase the level of physical activity of students (Miroshnichenko et al., 2019; Nesterchuk et al., 2020). The literature presents a large number of technological, pedagogical, methodological and other techniques, aimed at improving the effectiveness of physical culture, including wellness. Nordic (Scandinavian) walking is one of the effective methods of improving human health and normalizing the activity of the cardiorespiratory system (Kukkonen-Harjula et al., 2007). It has become a popular type of physical activity among healthy people, as a means of recreation and improvement of functional indicators. The positive effect on the body is manifested by a decrease in the heart rate at rest, normalization of blood pressure, reduction of stress and depression. The positive effect of Nordic Walking on the component composition of the body, in increasing overall endurance and strength abilities, has been established (Grigoletto et al., 2022). Such physical activity can act as a means that can improve sick people's health (Aliberti, 2023). It is known that Nordic walking is effective in diseases of the cardiovascular and musculoskeletal systems, diabetes, and obesity (Tschentscher et al., 2013). Therefore, the use of such motor activity for students who have diseases is grounded. At the same time, this issue is not fully covered in the scientific literature, which reduces the health potential of this physical activity. In this regard, the study of Nordic walking use in female students having health problems seems relevant and timely. We believe that the expansion of motor activity using Nordic walking in female students with various diseases will increase their physical activity and their level of somatic health.

Research aim is to increase the level of daily physical activity and physical fitness of students with somatic diseases using Nordic walking.

Material & methods

The research project was conducted among female students of Irkutsk National Research Technical University (Russia) for one academic year. The project involved 50 female students aged 17-19 (18.2±1.4 years). According to the medical examination results, the girls were diagnosed with various chronic somatic diseases of the cardiovascular, respiratory, musculoskeletal, endocrine, genitourinary and nervous systems. These students were included in the Special Medical Group (SMG) for PE classes. The training sessions in this group provided for strict monitoring of the dosage of physical activity by the PE teacher.

While performing the research project, the girls were divided into a control group (CG, n=20) and an experimental group (EG, n= 30). In both groups, PE and wellness classes were held 2 times a week, each for 2 academic hours (90 minutes). All the students gave their written consent to participate in the experiment. The conducted project does not violate the ethical principles of human research, which are set out in the Helsinki Declaration of 2008.

In EG, girls were recommended to practice Nordic walking 4 times a week in their free time for at least 20 minutes in addition to PE classes. Each month, the time of Nordic walking was increased by 5 minutes, which by the end of the project allowed to increase the time of each workout to 60 minutes. At the beginning of the research, a seminar was organized for EG girls, where they were introduced to the rules of Nordic walking, methods and techniques, requirements for sticks, clothes and shoes for training. The teacher monitored the completion of the Nordic walking task by viewing pedometer reports on each student's smartphone on the daily number of steps taken.

A high-stakes test of all female students' motor activity was conducted using the motor activity questionnaire "MAQ – 23+" (Bubnova, & Aronov, 2016). This questionnaire contains 23 questions and is designed to assess the motor activity of people who have concomitant pathology. Thus, this questionnaire is most adapted to assess the physical activity of students who have a somatic disease and are assigned to a special medical group. With an appropriate recalculation coefficient, the respondents' answers were evaluated in points.

The state of the CG and EG girls' motor qualities was studied using high-stakes testing. At the beginning and at the end of the research project, generally accepted tests for assessing the physical fitness of

girls were used (PCFSN, President's Council on Fitness, Sports, and Nutrition, 2011). The assessment of the girls' speed qualities, general endurance, speed and strength endurance of the trunk muscles, dynamic strength of the lower extremities muscles and the state of spine and hip joints flexibility is given.

The digital material obtained in the project was processed using the package of applied statistical programs Statistica 10.1 and MS Excel 2016. Parametric research methods were used to calculate the arithmetic mean and its error. The reliability of the difference in the values of the indicators was determined by the Student's t-criterion. The difference was considered significant at $p < 0.05$.

Results

The results of the high-stakes testing of physical activity of CG and EG students are presented in Table 1.

Table 1. The values of the student's answers to the main and auxiliary questions of physical activity, points (M±m)

No of ques-tios	The question of the questionnaire		CG (n=20)		EG (n= 30)	
			At the beginning of the project	At the end of the project	At the beginning of the project	At the end of the project
1	Physical activity at the university		1.4±0.3	1.4±0.3	1.4±0.2	1.4±0.2
2	Do you register psychoemotional loads		3.0±0.5	3.0±0.5	3.0±0.4	3.0±0.4
3	Physical activity outside studying hours	I try to do physical activities and loads	0.9±0.03	-	0.9±0.01	-
		I lead an active lifestyle, I am physically active	-	-	-	5.7±0.8
		I take walks in the open air	-	-	-	3.5±0.5
4	The number of this behavior (times per week)		1.7±0.7	1.7±0.7	1.7±0.6	7.4±1.4
5	Walking, minutes per day	≤ 60 minutes	2.3±0.4	2.3±0.4	2.3±0.3	-
		≥ 60 minutes	-	-	-	5.5±0.7
6	Walking, pace (fast/slow)		3.8±0.6	3.8±0.6	3.8±0.5	3.8±0.5
7	How long can you walk without stopping		3.6±0.5	3.9±0.5	3.6±0.4	6.5±1.2
8	The reason for stops while Walking	Shortness of breath, palpitations, fatigue, dizziness	1.9±0.8	1.9±0.8	1.9±0.7	-
		Pain in the legs or other deterioration of well-being	3.8±0.6	3.8±0.6	3.8±0.5	1.2±0.1
9	The distance you walk throughout the day	≤ 1 km	2.0±0.3	2.0±0.3	2.0±0.2	-
		≥ 1 km	-	-	-	3.5±0.4
10	How many kilometers do you walk per day?		3.5±0.5	5.5±1.1	3.5±0.4	7.0±1.4
11	Use of the elevator	I always use the elevator	1.2±0.1	1.2±0.1	1.2±0.1	1.2±0.06
		I do not use the elevator	-	5.8±0.9	-	5.8±0.7
12	Degree of physical activity	Average intensity	0.2±0.03	-	0.2±0.01	-
		High	-	3.4±0.5	-	3.4±0.4
13	Physical health (fitness)	Good	-	-	-	4.9±0.7
		Average	3.7±0.8	3.7±0.8	3.7±0.7	3.7±0.7
		Bad	0.7±0.02	0.7±0.02	0.7±0.01	-
14	Change in physical activity in the last year, yes/no		-	5.2±1.0	-	5.2±0.9
15	Physical training at the moment, yes/no		-	5.3±1.2	-	5.3±1.0
16	Organizational form of physical activity	Organized	4.2±0.8	4.2±0.8	4.2±0.7	4.2±0.7
		Individually	-	-	-	5.3±0.6
17	What does your home physical activity include?	Gymnastic exercises	1.0±0.06	1.0±0.06	1.0±0.05	1.0±0.05
		Walking, running	-	-	-	1.0±0.06
		Skiing, swimming	1.0±0.07	1.0±0.07	1.0±0.06	1.0±0.06
18	How many times a week do you train?		3.8±0.7	3.8±0.7	3.8±0.6	6.1±1.4
19	The duration of such training		3.2±0.5	3.2±0.5	3.2±0.3	5.9±1.3
20	If you do not exercise, then specify the reason		0.4±0.03	0.4±0.03	0.4±0.02	0.4±0.02
21	Do you spend more than 5 hours a day at your computer?		0.2±0.02	0.2±0.02	0.2±0.01	0.2±0.01
22	How much time do you spend in the car per day?		1.5±0.3	1.5±0.3	1.5±0.2	1.5±0.2
23	Physical activity at home		2.0±0.6	2.0±0.6	2.0±0.5	2.0±0.5
Total physical activity score			51.1±8.3	71.9±9.8	51.0±8.0	106.6±11.8

The total physical activity of the CG and EG students at the beginning of the project was approximately the same (51.1±8.3 and 51.0±8.0 points), respectively, $p > 0.05$. The students of both groups register physical activity only in PE classes, there are no elements of an active lifestyle, outdoor walks, and there is a slight duration of walking. According to the questionnaire survey, there are no students with good physical condition.

At the end of the project, an increase in the value of the physical activity indicator was noted in both observation groups. In CG, the increase in the value of the indicator was 40.7% (from 51.1±8.3 to 71.9±9.8 points), $p < 0.05$. Among EG students, the increase in the indicator value was 2.1 times greater and amounted to 109.0% (from 51.0±8.0 to 106.6±11.8 points), $p < 0.05$. At the beginning of the experiment, according to the sum of the points, the girls of both observation groups were classified as "low" physical activity. At the end of the research project, the CG girls switched to the «moderate» degree of physical activity, the EG students had the «high» degree in terms of total points.

Girls in EG, compared to CG, began to lead an active lifestyle, spend more time outdoors doing Nordic Walking, the number and time of daily training increased, as a result of which the distance traveled on foot increased. Among the EG girls, students with a good level of health status and those with poor health began to register. There is no such dynamics of health status among CG girls.

In order to detail the issues related to the physical activity of female students, we have excluded secondary and auxiliary questions from the analysis (№ 2, 8, 13, 16-17, 20-23), Table 2.

Table 2. The sum of the direct physical activity and walking points among the students at the beginning and at the end of the project, points (M±m)

Physical activity	CG (n= 20)		EG (n= 30)	
	At the beginning of the project	At the end of the project	At the beginning of the project	At the end of the project
Direct physical activity, excluding secondary and auxiliary questions No 2, 8, 13, 16-17, 20-23	27.6±4.2	48.5±5.3*	27.6±4.0	77.2±7.6*
Walking (including questions No 5-11)	22.1±3.9	30.2±4.6	22.1±3.6	34.5±4.8*

Note. * - the significance of differences in the values of indicators at the beginning and end of the project, $p < 0.05$.

At the beginning of the research project, the direct physical activity of the female students in both observation groups did not differ from each other, $p > 0.05$. At the end of the project, there was an increase in direct physical activity in CG girls by 75.7%, $p > 0.05$, in EG the increase was 2.8 times greater than at the beginning of the project and amounted to 77.2%, $p < 0.05$. The EG also showed a 56.1% increase in the value of the indicator associated with walking, $p < 0.05$. In CG girls, this increase was less and amounted to 36.6%, $p > 0.05$. These data indicate that the inclusion of Nordic walking in the daily lifestyle made it possible to more effectively increase the female students' motor activity compared with girls whose physical activity was limited only to educational classes of an elective course of physical culture and sports.

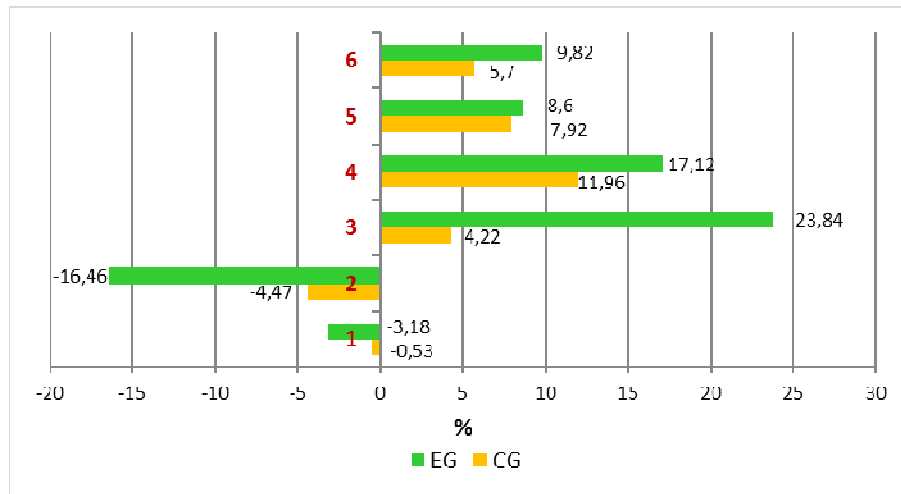
The inclusion of Nordic walking in the EG girls' daily routine allowed them to significantly increase their physical fitness in most motor tests. The high-stakes state of the motor tests values of girls CG and EG is presented in Table 2.

Table 2. The values of the girls' physical fitness indicators before and after the experiment (M±m)

Test No	Test	Control group (n=20)		Experimental group (n=30)	
		Beginning of the observation	End of the observation	Beginning of the observation	End of the observation
1	Running 30 m from a standing start, s	5.64±0.07	5.61±0.08*	5.66±0.07	5.48±0.05*
2	Running 1000 m, m/s	7:38±0:34	7:05±0:34	7:53±0:36	6:29±0:17*
3	Push-ups from (standing on) the knees, number of times in 1 min	19.65±2.12	20.48±2.56	18.45±2.11	22.85±0.79*
4	Abdominalcrunch, number of times in 1 min	26.08±1.14	29.20±1.43*	25.23±1.62	29.55±2.03*
5	Standing long jump, cm	155.04±4.44	167.32±5.26*	153.22±3.63	166.4±5.48*
6	Bending forward from a standing position, cm	17.5±0.93	18.5±0.93	17.0±0.73	18.67±1.26

Note. * - significant difference between the values of the indicators at the beginning and at the end of the observation, $p < 0.05$.

By the end of the experiment, an increase in physical fitness was noted among the girls of both observation groups, as evidenced by higher values of indicators in all motor tests. Among the CG girls, a significant increase in the values of indicators is recorded in three out of six tests, in the EG, a significant increase is recorded in five out of six tests. At the same time, the increase in the values of physical fitness indicators was significantly greater in EG girls, where Nordic walking was used during the day, Figure 1.



Note. 1, 2, 3, 4, 5, 6 – motor tests numbers

Fig. 1. The increase in the values of indicators in motor tests at the end of the observation

A higher increase in the values of the indicators in the tests is recorded in the girls of the experimental group compared with the results of the students in the control one. The greatest increase is recorded in EG girls in tests No 3 ("Push-ups from (standing on) the knees"), No 4 ("Abdominal crunch") and test No 2 ("Running 1000 m"). EG girls have a significant improvement in speed qualities. It is indicated by a 6-fold reduction in the distance passing time in the "Running 30 m from a standing start" test compared to CG girls (-3.18 and -0.53%, respectively), Figure 1.

The conducted research shows that the use of Nordic walking in the studying day mode of female students who have deviations in their health status is an effective means of increasing their motor activity, improving physical fitness and improving their health status.

Dicussion

The existing problems in the studying young people's health in many countries of the world necessitate the search for effective means, methods and forms of improving their level (Katzmarzyk et al., 2018; Martin, & Naziruddin, 2020; Tortella et al., 2021; Thomas Reyes-Amigo, 2021). Optimal physical activity is an effective drug-free means of improving health and physical condition (Chen et al., 2020; Daufinsky, & Brandt, 2020; Setiarnawijaya et al., 2021).

Nordic walking has become very popular among the population of many countries of the world. It was proposed for the training of ski athletes during the off-season in the Scandinavian countries (Kukkonen-Harjula et al., 2007). According to numerous researchers, a positive effect of this form of physical activity has been noted on the morphofunctional indicators of people engaged in sports (Grigoletto et al., 2022) and health status (Aliberti, 2023). There is evidence of positive results of using Nordic walking in various diseases of the cardiovascular and musculoskeletal systems, diabetes and obesity (Tschentscher et al., 2013).

In this research, Nordic walking was used by us to increase physical activity and physical fitness in female students who were diagnosed with various diseases of the cardiovascular, musculoskeletal, endocrine and other systems. Nordic walking was used by girls in their free time at least 4 times a week throughout the studying year in addition to compulsory PE classes. For health reasons, all the girls attended elective physical education courses as part of a special medical group.

To assess the state of female students' physical activity, the motor activity questionnaire "MAQ-23+" was used, which was proposed by scientists M.G. Bubnova, & D.M. Aronov (2016). According to the authors, the MAQ-23+ questionnaire is designed to study and analyze physical activity in people with diseases. We believe that it is more adapted to assess the physical activity of female students who have a chronic somatic disease, therefore it was used by us in a research project.

The use of Nordic walking in the day mode of the students in the experimental group at the end of the project showed a significant increase in the values in the answers to questions that describe physical activity compared with the girls of the control one, in whose day mode there were no elements of such walking. At the end of the research project, among EG students, the average physical activity score increased 2.1 times from 51.0 ± 8.0 to 106.6 ± 11.8 points, $p < 0.05$, in CG this increase was 1.7 times (from 51.1 ± 8.3 to 71.9 ± 9.8 points). According to the gradation of physical activity proposed by the authors of the questionnaire (Bubnova, Aronov,

2016), by the end of the project, the level of physical activity of the girls in the experimental group was classified as «high», the students of the control group entered the «moderate» gradation.

The positive impact of Nordic walking was manifested in the fact that girls in EG, compared to CG, began to lead an active lifestyle, spend more time outdoors, increased the number and time of daily training, resulting in an increase in the distance traveled on foot. At the end of the research project, among the girls who were engaged in Nordic walking, students with a «good» health status began to register and there were no students with a «bad» level. These data do not contradict the studies of other authors who noted an improvement in the health status of people engaged in Nordic walking (Tschencher et al., 2013; Aliberti, 2023).

In addition to the positive effect on the motor activity and health status of girls who used Nordic walking, by the end of the experiment, an increase in the female students' physical fitness was found. It is indicated by higher values of indicators in all motor tests. A significant increase in the values of indicators is recorded in five out of six motor tests in girls of the experimental group compared with the results obtained in students of the control one. At the same time, the increase in the values of physical fitness indicators was greater in EG girls, where Nordic walking was used during the day. The data obtained by us are consistent with the results of a study by other authors. According to A. Grigoletto et al. (2022) in people who practice Nordic walking, an increase in overall endurance and strength qualities was found against the background of an improvement in the component composition of the body. We believe that the positive effect of Nordic walking is due to the inclusion of more than 80% of human skeletal muscles in aerobic physical work, which effectively trains not only the muscular, but also the cardiorespiratory system. An increase in motivation for physical activity of a person associated with regular physical activity in the form of Nordic walking plays a positive role, as noted by S. Aliberti (2023).

The conducted research project made it possible to establish the positive effect of Nordic walking on physical activity, physical fitness and health in female students with chronic somatic diseases. This form of physical activity can be recommended in the daily routine of people with chronic diseases.

Conclusions

The data obtained during the research project indicate the high effectiveness of increasing the physical activity of female students who have chronic somatic diseases when using Nordic walking in addition to traditional PE classes. At the end of the research project among the students of the experimental group, where Nordic walking was used 4 times a week during the studying year, the average physical activity score increased 2.1 times from 51.0 ± 8.0 to 106.6 ± 11.8 points, $p < 0.05$, in the control group this increase was 1.7 times (from 51.1 ± 8.3 to 71.9 ± 9.8 points). There is an increase in the direct indicators of physical activity of female students, walking time and distance. At the same time, the increase in the values of physical fitness indicators was greater in the girls of the experimental group, where Nordic walking was used during the day, compared with the results in the girls of the control one. By the end of the project, students with a «good» health status are registered among EG girls and there are no students with a «bad» level.

The research showed that Nordic walking can be used to increase physical activity, physical condition and health levels in students with disabilities.

Conflicts of interest. The authors declare no conflict of interest.

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