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THE IMPACT OF PHYSICAL ACTIVITY FOR SENIOR FALL PREVENTION USING NORTHERN WALKING

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Abstract: *Falling is one of the main problems in the lives of older people. Falls experienced affect the further life of seniors and limit their physical activity. Nordic walking can be used as a means of preventing repeated falls and promoting physical activity. Nordic walking in Lithuania is still a new and completely unexplored methodology, the full benefits of walking have not yet been proven, and little research has been done. Aim of the research was to investigate the improvement of physical activity and fall prevention in the elderly using Nordic walking.Methods of the research: Desmond Fall Risk Questionnaire; Berg Balance Scale and balance samples of Schmitz; The quality of life Questionnaire (SF-36). Results: After 7 weeks of exercises, the risk of fall decreased for all subjects. Physical activity increased statistically after doing Nordic walking, the average physical activity of the study group increased. Control groups results also improved. Conclusions: Physical activity improved statistically significantly ($p < 0.05$) The frequency of falls decreased statistically significantly ($p < 0.05$). The static and dynamic balance of the elderly improved statistically significantly ($p < 0.05$). The risk of falling after NW was statistically significantly reduced ($p < 0.05$).*

Key words: ***Trauma, Elderly, Physical Therapy., Rehabilitation*.**

INTRODUCTION

Agingis a natural process common to all living nature and human. Aging is an inevitable stage ofl ife, whic hcan be called the process of change of biological, social and cognitive functions (Garlauskaitė A., et al., 2015). Physiological changes cause psychological difficulties, increase the fear of falling, people become more closed, afraid to perform their daily activities (Lim E., 2016). Loss of muscle mass and strength can be caused by malnutrition, too many calories can lead to obesity or over weight, which affects physical activity. Hormonal changes also affect the human body. Altered blood testosterone levels, vascular thrombosis, changes in muscle strength and mass (Rocha S.V., et al., 2016). Successful agingis a life long process that requires physical activity, disease prevention, and health (Martin P., et al., 2014). Collapses and related injuries are a serious global health problem experienced by individual sovertheage of 65 (Frieson C.W., et al., 2018). Falling is not only associated with morbidity or mortality but also up to 60% of injuries sustained during a fall can have long-term effects on a person's independence, which can later lead to major dailya ctivity limitations and activea ccess to long-term health care (Prometti P., et al., 2016). The problem of aging is oftenad dressed, but the problem of the risk of collapse is not addressed and collapse prevention is not applied. Collapses in adult hood can lead to loss of independence, disability, orevendeath (Ishigaki E., et al., 2014). To prevent recurrences and reduce the number of falls, multifactorial interventions include the analysis of the home environment and the elimination of causes of falls, vision testing and evaluation, review and adjustment of medications, and targeted exercise programs (IshigakiE., et al., 2014). However, collapse is most of ten determinedby a combination of several factors (Abreu D. R., et al., 2016).Disorders of coordination, balance, and gaitcharacterized by emotional, mental, and neurological factors (Cifu D. X., et al., 2018). Physiotherapy and its methodologies help to avoid the risk of collapse in the elderly and the elderly (Prata M.G., et al., 2015). Regular physical activity reduces the fear of falling, increases self-confidence, strengthens all muscle groups, and improves quality of life (Royset B., et al., 2019). Nordic walking is a great way to improve your quality of life. Nordic walking is a form of physical activity suitable for

older people to improve their health and reduce the risk of falling. The International Nordic Walking Association states that the basic principle of Nordic walking is natural and graceful movements (Tschentscher M., et al., 2013). NW (Nordic Walking) is a fast-learning, simple, safe, inexpensive, stability-promoting, health-promoting form of physical activity that can practiced by people of all ages. During physical activity, all the muscles of the body activated, 90% of the muscles of the whole bodywork during walking. The use of special sticks forces the muscles of the shoulders, arms and torso to work (Hagner - Derengowska M., et al., 2015). There is also a decrease in body weight, blood cholesterol, and torso volumes (Fischer M.J., et al., 2015). NW can help increase the amplitude of movements and promote the emergence of decreased functions (Fischer M.J., et al., 2015). Nordic walking is one of the forms of physical education of applied physical activity that can be practiced for rehabilitation or recreation purposes: recovery of physical skills, improvement of psychological state and social perception. The benefits of Nordic walking for people with various health conditions are proven by many studies. HR can help increase the amplitude of movements and promote the recovery of decreased functions. The study found that in women with breast cancer, HRT reduces pain sensitivity, improves lymph flow, and is a safe form of physical activity (Fischer M.J., et al., 2015).

RESEARCH PARTICIPANTS AND METHODS

Research Bioethics The research protocol was formally approved by the Bio Ethics Committee of Klaipeda University, in September 2019 and carried out according to the Helsinki Declaration. Respondents participated in the quantitative study voluntarily; all submitted questionnaires and questionnaires were anonymous and did not require them to write either their name or surname, they filled in everything independently without the help of the researcher. All participants signed the informed consent form to ensure that the information they provided was correct. The research was carried out in accordance with the ethical aspects of the research: the principles of anonymity, respect, confidentiality. The anonymity of the subjects is guaranteed that their personal data will not be mentioned anywhere, the data obtained during the study will be used only in a general form. The principle of voluntariness,

where individuals participate in a study voluntarily, may at any time refuse to participate in the study and terminate their participation. The principle of respect, when the subjects are introduced to the purpose of the research, to acquaint with how the research will be carried out, is shown by filling in sample questionnaires. All subjects were third-age students (seniors) of Klaipeda University. The study included n = 16 patients, n=3 were aged 50 to 60 years, n= 9 were aged 61 to 70 years, and n=4 patients were aged 71 to 80 years. The mean age of the subjects was (68 ±5, 8) years. The groups are homogeneous. The participants in the study had to meet the following criteria: The gender distribution of the subjects is formed, everything will depend on the existing people and the desire to participate in the study; Age 60 - 78 years; Having balance, coordination disorders; Signed consent to participate in the study. Without diseases or disorders significantly restricting the function of movement. Participants who did not meet criteria's were excluded from the research: Participants under: 60 years of age; did not sign consent to participate in the study; Inability to move independently; Suffering from severe heart disease.

Research instruments: Desmond Fall Risk Questionnaire (Desmond A. L., 2000). Designed to identify factors influencing the risk of collapse. The questionnaire consisted of 15 questions. Each question can be positive or negative. A positive answer indicates the factors influencing the risk of collapse. A negative answer negates the potential risk of falling that increases that person's fall.

Berg Balance Scale (Berg K., et al., 1992); Designed to assess static and dynamic body balance. The scale consists of 14 tasks that performed while sitting and standing. It is a reliable and valid assessment method for examining the risk of falls in the elderly. The test assesses the patient's ability to maintain a position with a smaller support area when sitting, standing with both feet on one side. The patient's ability to change position is also determined. All tasks are evaluated with points from 0 to 4. The highest score of 4 evaluates the patient's ability to perform movements freely and independently, to maintain a certain body position for the required period of time. 0 points fail to complete the given task. The maximum score on the whole scale is 56 points. A score of 41-56 indicates a low probability of collapse, 21-40 a moderate

probability of collapse, and a score of 20 or less indicates that the patient has severe imbalance and coordination and this has a high probability of collapse.

SF - 36 quality of life questionnaire (Ware J.E., et al., 1992). Consisting of 36 questions covering eight areas of life: activity, activity limitation due to physical ailments, activity limitation due to emotional disorders, social connections, emotional state, vitality, general health, and pain. The questionnaire assesses the well-being of four weeks. Points score the answers to the questions. Each category and area is rated from 0 to 100 using a calculation algorithm. The higher the score, the better the quality of life (100 points indicates the best rating). The questions of the physical activity category are evaluated from 1 to 3 points, the maximum number of points is 100. The "SF - 36" questionnaire is standardized, i. y. all respondents answer the same questions by choosing the answer that suits them best from the presented answer variants.

Balance samples of Schmitz(Arnold B.L., and Schmitz R.J., 1998) To assess functional skills related to body balance and its control. The test consists of 14 tasks, 7 of which assess static equilibrium, the other seven assess dynamic equilibrium. Throughout the test, the patient's ability to maintain a normal position with their feet shoulder-width apart, compressed, or standing on one leg is assessed. The patient's ability to maintain an unexpectedly disturbed balance when the investigator pushes the patient forward, backward, or sideways is also assessed. Assessing the dynamic balance, the patient must go foot to foot, go to the sides, change the direction of walking according to commands, go in a circle on the toes on the heels. Test for evaluations 5-point system: maximum score 4 when a person maintains a normal static and dynamic balance during the task. 3 points - more difficult to perform movements or maintained position, inaccuracies occur during the movement. 2 points - difficult to maintain body position, movements are rhythmic and become even more inaccurate with increasing speed of performance. 1 point - very difficult to maintain body position, movements are arrhythmic, inaccurate, tremors occur, side movements. A minimum of 0 points for not performing the requested movements did not maintain either static or dynamic equilibrium. The duration of the whole test is 10 - 15 minutes. The maximum score of the test is 56 points.

Researchprogress The research was performed in Klaipeda seaside forest-park from 04.11.2019 to 20.12.2019. For both groups, the Nordic walk lasted 7 weeks. Classes were held in the forest on established routes. One session lasted 90 minutes. Nordic walking technique was applied. Respondents in the study were given two methods to reduce the risk of falling: Nordic walking and balance exercises. Warm-up and stretching exercises were performed before each walk. After studying, the factors influencing the risk of falls and assessing the static and dynamic balance and physical activity of both groups, Nordic walking activities were started. Subjects were divided into two groups: 8 women in the control group and 8 in the study group. Classes were held three times a week for the study group and twice a week for the control group. The study group used Nordic walking and balance exercises, while the control group used only Nordic walking. Participants of Nordic walking were taught. All research participants were tested twice. The first test was performed before the start of the sessions, the second time after the end of all sessions after seven weeks. Statistical data analysis was performed using Microsoft Office Excel 2016 software package, Microsoft Office Word 2007 and SPSS 17.0 software. The characteristics of the results were reviewed by calculating the arithmetic mean, standard deviation, sampling error. The reliability of the results was determined by using a significance level α (p) <0.05 (95% reliability).

RESULTS

Desmond fall risk questionnaire data. The questionnaire identifies potential collapse risk factors. The table presents data on risk factors for human falls. To the first question, "Have you collapsed or stumbled this year?" Half of the group, i.e. 50 percent answered in the affirmative. In the control group, 37.5 percent answered positively subjects. The research group to the second question, "Are you afraid of falling and this limits your activity?" 62.5 percent. responded with a positive control of 37.5 percent. 25% experience dizziness or a feeling of dizziness when lowering or flipping their head in bed. research and 50 percent. control groups. When walking in the dark or between store stalls, both groups also feel constrained by 50 percent each. If Question 3, 4 or 5 is answered in the affirmative, a vestibular disorder can be

judged, in which case patients are more likely to be guided by vision while maintaining body position while walking or performing certain activities. When asked whether the feet or toes were freezing or numb, both groups also answered 62.5 percent. Only 12.5 percent of the study group answered the question whether you wear glasses. Those who lose balance or feel weakness and dizziness on standing up are named by 37.5 percent. subjects and 50 percent. control groups. Those taking medication for depression or to improve sleep said 50 percent. research and 12.5 percent. control group individuals. Those taking more than four prescription drugs per day in both the study and control groups reported 12.5 percent. Leg stiffness was not mentioned by any group. 50 percent the study groups indicate that they cannot go in a straight line, pull to one side or the other, and the control groups of the study groups indicate 37.5 percent. Regular physical activity for more than 6 months was reported by the study group at 50%. control 62.5 percent. Proper physical activity and motivation and active participation are essential to prevent falls and improve fall prevention. The last question about improving balance and mobility was mentioned by 87.5% of the study group and 100% by the control group.

Table 1 Desmond collapse risk data

Question	Researchgroup		Controlgroup		Difference between groups
	Taip	Ne	Taip	Ne	
1. Have you fallen or stumbled this year?	50%	50%	37.5%	62.5 %	p>0,05
2. Are you afraid of falling and does this limit your activity?	62.5%	37.5%	37.5%	62.5 %	p<0,05
3. Do you experience dizziness or a tingling sensation when you lie down, lower your head, or turn over in bed?	25%	75%	50%	50%	p>0,05
4. Do you feel unsteady or constrained while walking between queues in a store	37.5%	62.5%	12.5%	87.5	p<0,05

or places where there are a lot of other people?				%	
5. Do you have difficulty walking in the dark or on uneven surfaces such as gravel roads or sloping sidewalks	50%	50%	50%	50%	p>0,05
6. Do you feel frequent colds or heating, numbness, or itching of your feet or toes?	62.5%	37.5%	62.5%	37.5 %	p<0,05
7. Do you wear bifocal or trifocal glasses or is your vision noticeably better in one eye?	12.5%	87.5%	----	100%	p<0,05
8. Do you lose your balance or feel weak or dizzy when you stand up?	37.5%	62.5%	50%	50%	p<0,05
9. Are you taking medication for depression, anxiety, nervousness, pain, or sleep?	50%	50%	12.5%	87.5 %	p<0,05
10. Do you take more than 4 prescription medications per day?	12.5%	87.5%	12.5%	87.5 %	p>0,05
11. Do you feel like your feet aren't going where you want to go?	-----	100%	-----	100%	p<0,05
12. Do you feel like you can't walk in a straight line or pull in one direction?	50%	50%	37.5%	62.5 %	p<0,05
13. Do you exercise regularly for more than 6 months?	50%	50%	62.5%	37.5 %	p<0,05
14. Do you think that no one really understands how strongly dizziness and balance problems affect your quality of	----	100%	25%	75%	p<0,05

life?					
15. Are you interested in improving your balance and mobility?	87.5%	12.5%	100%	----	p<0,05

Berg Balance Scale. Figure 1 shows the scores of the Berg equilibrium scale of the experimental and control groups during testing I and II. The average of the results of the balance test of the experimental group during the first test was 46.75 ± 4.17 points, after the application of balance training exercises and Nordic walking the balance increased statistically significantly to 51.87 ± 3.30 points (p <0.05). In the study group, the highest score on the Berg Body Balance Scale in Test I was 54 points and the lowest was 42 points. During the second test, the highest was 56 and the lowest was 47 points. The mean of the Berg equilibrium scale of the control group in Test I was 48.75 ± 4.01 points, and in Test II the control group treated with Nordic walking only did not increase statistically significantly by 51.37 ± 3.29 (p >0.05) points. In Test I, the highest scale score was 52 and the lowest was 40. In Test II, the highest score was 54 and the lowest was 45 points. The equilibrium results of the study group improved by 5,126 points after 7 weeks, while the control group increased by 2,625 points. The change after 7 weeks between the study and control groups was statistically significant (p <0.05).

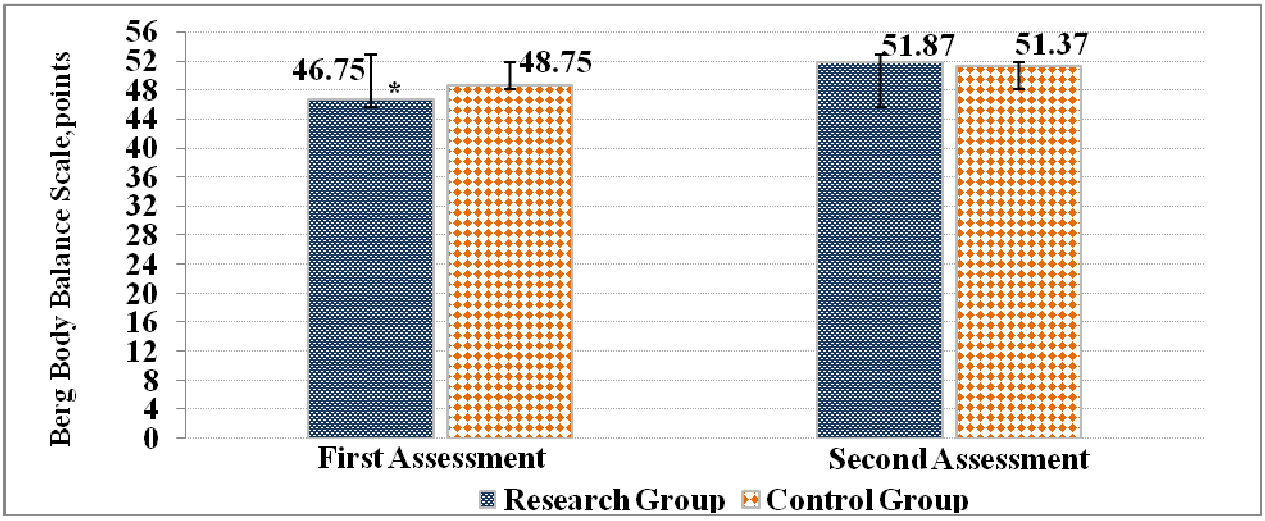

Fig. 1 The mean of the Berg body balance scale of the research and control groups during tests I and II * p <0.05, comparing the results of tests I and II. SF-36 (part of physical activity) results.

SF-36.Quality of Life Fig. 2 shows the physical activity indices of the experimental and control groups in points I and II during testing. The average of the results of the physical activity test of the experimental group during the first test was 70.625 ± 14.83 points, after the activities in the final test the physical activity increased statistically to 88 ± 8.62 points (p <0.05). The highest assessment of physical activity in the study group during testing I was 100 points, the lowest - 45 points. During testing II, the maximum is 100 points, the minimum is 75 points. The mean of the physical activity test of the control group in the first test was 79.375 ± 13.25 points, and the mean of the repeated test in the second test increased statistically significantly by 91.25 ± 5.12 (p <0.05) points. During the first test, the highest score was 95 points and the lowest was 60 points. During the second test, the highest score was 100 points and the lowest was 75 points.

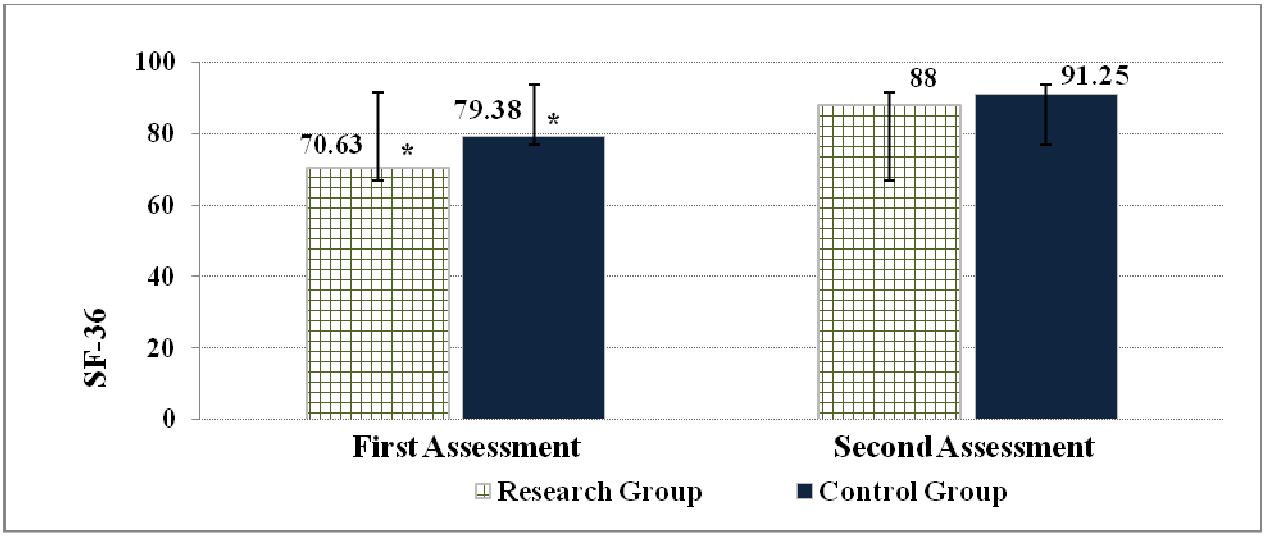

Fig. 2 Mean scale of physical activity scales of experimental and control groups during tests I and II * p <0.05, comparing the results of tests I and II Results of equilibrium samples.

Balance samples of Schmitz. Assessment results shows atFig. 3 the scores of the equilibrium samples of the experimental and control groups during the first and second tests. The mean of the equilibrium test results of the study group during the first test was 48.125 ± 2.61 points, after seven weeks of Nordic walking after the second test the equilibrium test result statistically increased to 51.75 ± 1.91 points ($p < 0.05$). From the research group, the highest score was 51 and the lowest was 44 during the first evaluation. In the second test, the highest score was 54 and the lowest was 49 points. The mean of the first test of the equilibrium samples of the control group increased by 49 ± 2.72 points, and the mean of the retest increased statistically to 51.875 ± 1.98 ($p < 0.05$) points. During the first test, a maximum of 52 points, a minimum of 43 points. During retesting, the highest was 54 points, the lowest was 47.

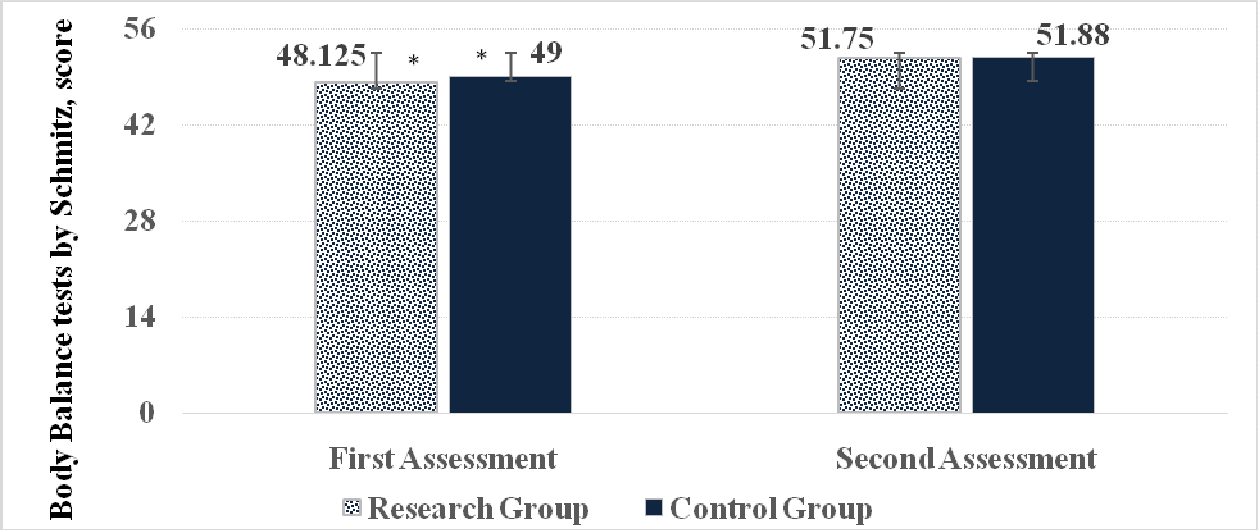

Fig. 3 Equilibrium samples of experimental and control groups during tests I and II * $p < 0.05$, comparing the results of tests I and II

Discussion. One aspect of aging is muscle loss otherwise still sarcopenia. As muscle mass decreases, so does muscle strength, which is associated with loss of function and disability. All of these factors complicate the functional movement of people. It becomes difficult for a person to get up from a sitting position, take care of personal hygieneand perform routine household chores (Papa E.V., et al., 2017). Loss of muscle mass increases the likelihood of collapse risk and the onset of independence (Santilli

V., et al., 2014). Reducing the number of falls requires continuous preventive physical activity programs that have a positive effect on fall prevention, improve balance, and increase muscle strength (Ishigaki E., et al., 2014). According Royset B., et al., during falls, there are bruises, fractures, which in the fairy tale deteriorates the quality of life, after injuries there is a fear of walking, and the risk of falling again increases. In the study, the authors argue that balance training and muscle strength exercises are very important in preventing collapse. Constant maintenance of physical activity and fall prevention reduces the fear of falling, encourages self-movement, and increases self-confidence (Royset B., et al., 2019). In most studies, gender is very often singled out as a risk of collapse. White and co-authors in their study tried to investigate the reasons why women are more likely to experience falls than men. It has been found that overweight women have a faster deterioration in balance and gait changes. Women are more likely to develop chronic diseases and experience fatigue more quickly than men (WhiteA.M., et al., 2018).Only older women with balance problems were included in the study. Some patients experienced at least one collapse per year. Almost all subjects who experienced collapses also experienced the consequences of collapses such as bruises, dips, or fractures. The aging process determines social, economic and health problems that complicate the lives of older people and affect their quality of life. As external environmental conditions change, the body's system changes, so external environmental factors can be used as health-promoting factors. Active physical exercise belongs to the group of external factors (Dunn S., et al., 2013). Nordic walking was used as a methodology in the study. Nordic walking is a form of physical activity that uses special sticks designed for this purpose; they are used for hand resistance. Nordic walking increases gait speed and cardiovascular metabolism (Takeschima N., et al., 2013). Nordic walking is a great way to improve your quality of life. The International Nordic Walking Association states that the basic principle of Nordic walking is natural and graceful movements (Tschentscher M., et al., 2013). Nordic walking is one of the forms of physical education of applied physical activity that can be used for rehabilitation or recreational purposes: recovery of physical skills, improvement of psychological state and social perception. The benefits of Nordic walking for people with various health conditions are proven by

many studies. HR can help increase the amplitude of movements and promote the recovery of decreased functions (Fischer M.J., et al., 2015). Nordic walking can be an engagement in the physical activity of all people because it is a safe physical activity that is easily accessible and has a positive impact on people's physical, mental, and social health (Tschentscher M., et al., 2013).

Physical activity reduces the risk of falls and the fear of falling. After analyzing the data of the study, statistically significant correlations were observed between the subjects' fear of collapse and physical activity ($p < 0.05$). People with low physical activity are statistically more likely to experience falls than people with moderate physical activity. Statistically significant correlations between falls and physical activity were also observed ($p < 0.05$). All subjects with low physical activity were more likely to experience falls than those with moderate to high physical activity ($p < 0.05$). In a study conducted with co-authors, A. Harnish points out that in order to reduce the risk of falls in the elderly, it is very important to pay attention to the duration of the program, the variety of exercises, the choice of appropriate workload (Harnish A., et al., 2016).

One way to increase physical activity is Nordic walking. During Nordic walking, more upper body muscles are involved in the work, which is involved without direct human perception. After seven weeks of Nordic walking exercises, there was a statistically significant improvement in the physical activity of all subjects ($p < 0.05$). With the improvement of physical activity, the risk of falls also decreased statistically significantly ($p < 0.05$). In the balance samples, the most difficult for the subjects was to go in a straight line leg to foot, not to swing 360 degrees around its axis, easily losing balance when suddenly pushed. In the Berg equilibrium samples, the most difficult for the subjects was to pick up the object from the ground without falling sideways, forward or backward. It was also difficult to stand on one leg or walk abruptly to change direction. Some patients had difficulty climbing the stairs, climbing only the introductory step, and climbing only to the second floor holding behind the handrails. After the applied balance exercises and Nordic walking, the balance of all subjects improved statistically significantly ($p < 0.05$). The change in equilibrium in the study group was statistically significant than in the control group. Nordic walking

and balance exercises three times a week were more beneficial for the study group and a greater change was found than for the control group, which was treated twice a week. According to the questions answered by the SF - 36 life questionnaire before and after the Nordic walk, it can be stated that the increase in physical activity, improved balance and coordination, and the decrease in falls resulted in a statistically significant improvement in the quality of life of the subjects ($p < 0.05$). In summary, properly identified risk factors for falls, accurately assessed motor skills and appropriate physical activity, intensity, duration and frequency can have a positive effect on balance and coordination, reduce the risk and fear of falls, improve quality of life.

Conclusions

Physical activity improved statistically significantly ($p < 0.05$) after evaluating physical activity before the study and after the Nordic walking methodology. Improved physical activity reduces the risk of falling and improves the quality of life. Increased physical activity has a positive effect on fall prevention. The higher the physical activity, the lower the risk of falling. As the frequency of physical activity increased, the frequency of falls decreased statistically significantly ($p < 0.05$). After seven weeks of Nordic walking sessions, the static and dynamic balance of the elderly improved statistically significantly ($p < 0.05$). Improved static and dynamic balance improved patient and coordination. As physical activity increases, the risk of falling decreases, people's quality of life improves, people become motivated, more active, discover the fullness of life, reveal themselves. The risk of collapse after CT was statistically significantly reduced ($p < 0.05$).

Practical recommendations: Nordic walking originated in 1997. In Finland and quickly became popular not only in Finland, in Germany, Norway, Sweden, France. Nordic walking to Lithuania came about 2007, and the first courses took place in that year. The abundance of research papers only tentatively helps to select appropriate forms of physical activity. Researching, using and integrating new methods will always remain an issue. In order to improve the physical and mental health of people

of different ages, integrated rehabilitation methods are needed, especially after the COVID-19 pandemic. So Nordic walking is a very effective tool that can be easily transported, easily adapted to different weather and geographical conditions to a different population groups.

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