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Effect of Nordic walking on older adult patients with parkinson's disease

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Abstract
Parkinson's disease (PD) is a progressive neurodegenerative disorder that affects motor function with the main features being bradykinesia, tremor, rigidity, and instability.
Aim: The aim of our review is to study the recent literature on the effect of Nordic walking (NW) in older adults with PD.
Method: The Google Scholar, PubMed, and Semantic Scholar databases were searched in English with the following keywords: "Parkinson's disease and Nordic Walking, and Older adults". The search was filtered for clinical studies published in 2015 - 2022.
Results: The review included 10 clinical studies with a total sample of 236 PD patients. All studies found an improvement in their evaluated patient parameters.
Discussion and Conclusions: The NW method is an important tool for PD patients and its use has positive results.

Keywords: Parkinson's disease, Nordic walking, older adults, epidemiology

Introduction
Parkinson's disease (PD) is a progressive neurodegenerative disorder that affects motor function and motor planning in humans [1]. The clinical syndrome was described by James Parkinson in 1817 and is referred to as Parkinson's disease. The disease is characterized by basal ganglia disfunction affecting dopamine production from the neurons [2–5]. Studies have shown that other areas in the brain stem are involved that degenerate before the substantia nigra [1]. Its main symptoms are bradykinesia, tremors, rigidity, and instability accompanied by gait disorders, such as reduced step length and walking speed as well as reduced trunk rotation and arm swing [6]. The symptoms are also non-motor as the disease progresses, such as depression, anxiety, and apathy, but the causes have not been clarified [7]. Despite pharmaceutical and surgical interventions, the symptoms progressively lead to disability [8]. The disease progresses with age, occurs in men more often than in women, and is more common in Western countries. The differences in the appearance of the disease are due to both genetic and environmental factors. A difference in the incidence of the disease between Japanese and African Americans was observed, relative to similar populations in their own country, demonstrating the role of the environment in PD. Other factors such as smoking, drinking coffee, and intense exercise are related to the disease [7-9].
An exercise program could benefit the cardiovascular and musculoskeletal systems of patients with PD and could improve their motor skills, possibly delaying other complications [8, 10]. Nordic walking (NW) is a physical activity where specially designed walking sticks are used to support natural walking [11]. This method started in Finland in the late 1900s to improve the health of sedentary people. It is similar to Nordic skiing and combines the use of the trunk and upper limbs with walking, training the whole body and ensuring a greater energy expenditure than classic walking [12]. Its popularity is increasing and it is considered the fastest growing exercise method in Europe [11]. It is also a safe exercise for people with PD [12].
The aim of our review is to study the recent literature on the effect of NW on older adult patients with PD.

Method
The Google Scholar, PubMed, and Semantic Scholar databases were searched in English with the following keywords: "Parkinson's disease and Nordic Walking, and Older adults". The search was filtered for clinical studies published in 2015 - 2022.

Results

The search process resulted in 10 clinical studies that met our criteria and were included in the review. Below are their main characteristics.

Literature review

A study by Monteiro *et al.* [13] compared the effects of a nine-week program of NW with free walking in patients with PD. The researchers analyzed quality of life, cognitive function, and depressive and motor symptoms. The study involved 33 participants divided into two groups. The first group (n = 16) performed NW, while (n = 17) the second did free walking. The program for both groups was divided into three stages: joint mobilization and walking for three minutes to warm up, followed by 30 to 50 minutes of walking on different surfaces (the NW group used the special walking sticks) with a break of 2-5 minutes, and finally recovery. The walking part increased progressively until it reached 60 minutes during the last training session. Every three sessions participants performed 40 minutes of walking, stretching, and breathing exercises. Significant improvements were found in quality of life ($p<0.05$), according to the World Health Organization Instrument for Quality-of-Life Assessment questionnaire (WHOQOL-BREF/WHOQOL-OLD), in the social participation of the patients, and in their cognitive function, according to the Montreal Cognitive Assessment (MoCA). Depressive symptoms were measured with the Geriatric Depression Scale (GDS-15). Both groups showed improvement in motor symptoms as assessed by the Unified Parkinson's Disease Rating Scale-III (UPDRS-III) with the NW group showing a significant improvement in autonomy.

Another study by Zanardi *et al.* [14] investigated the effects of NW on gait asymmetries in PD patients involving 14 male and female subjects. Kinematic analysis was performed with the Vicon 3D motion analysis system on a three-minute walk before and after the intervention, with data collected at two speeds: 0.28 m·s −1 and 0.83 m·s −1, without the use of walking sticks. The participants were divided into three groups according to the ability of each person as well as the percentage of the distance in the 6-Minute Walking Test (6MWT). Most affected and least affected body side symmetries were assessed with Generalized Estimating Equations (GEE). Peak knee flexion and peak hip abduction were asymmetric before intervention. The 11-week program with NW improved knee ($p = 0.007$) and hip ($p = 0.041$) angular parameters and gait asymmetries.

The study of Matos *et al.* [15] studied the effect of NW on respiratory muscle function in PD patients. Their sample was 22 people who were divided into three groups. One group used breathing exercises to train the muscles, the second group used NW, and the third group performed a combination of both methods. Respiratory function was analyzed using the Mir Minispir® portable spirometry device, as well as quality of life using the Parkinson Disease Questionnaire (PDQ-39). Measurements were taken before and after the intervention, which took place over a period of eight weeks. According to the results, significant differences were found after the intervention in each group but no significant differences between groups. There was an increase in expiratory pressure ($p = 0.008$) and forced vital capacity ($p = 0.011$) as well as an increase in forced mid-expiratory flow in the NW group. Finally, the exercise with NW had positive results in the patients' quality of life ($p<0.05$), according to the results of the PDQ-39.

Moreover, Guseva & Zhukova [16] assessed the effect of an eight-week program on movement disorders in PD patients. The study involved 11 patients, 3 men and 8 women, and the program was carried out during the winter in a field outside the city, in parks, and in the forest. Before the intervention, medical examinations, spirometry, recording of Body Mass Index (BMI), measurement of blood pressure during the performance of functional tests as well as a check on the physical condition of the patients with the 6MWT and the TUG test were performed. The results showed an increase in walking speed in the third session as well as an increase in step length in the sixth session. Due to an improvement in walking parameters, motor function of the patients also improved, according to the UPDRS. The researchers concluded that NW was effective in the treatment of PD patients.

Yet another study by Monteiro *et al.* [13] focused on the effects of NW in relation to free walking by examining motor symptoms, balance as well as functional mobility of the patients. Two groups were created where after a short adaptation period, the 16 patients performed NW for a period of 6 weeks, in contrast to the remaining 17 patients who performed free walking. The program included a five-minute warm-up, the main part, and a five-minute recovery. Initially they walked at a speed of 0.5 km/h and every 30 seconds there was an increase of 0.5km/h until they reached a comfortable speed for them. Improvements were observed ($p<0.035$) in the balance tests performed with the Berg Balance Scale (BBS) as well as in the speed measurement tests (TUGSS - $p<0.001$; TUGFS - $p<0.001$). A significant improvement was also found in the functional mobility of the patients greatly affecting their motor symptoms, which could lead to a reduction in the risk of falling. The researchers argue that a structured training program would be extremely important to improve the PD patients' physical condition, therefore NW is considered a valuable method in the rehabilitation of patients.

A similar study by Szefler-Derela *et al.* [17] involved 40 patients, who followed a six-week intervention. The participants were equally divided into two groups, one did NW and the other received standard rehabilitation. The first group session consisted of a 5-10-minute warm-up, 60 minutes of NW and a 5-10-minute cool down as well. The second group followed a 45-minute program of stretching to improve gross movements and balance, flexibility, and muscle strength exercises. According to the results of the Dynamic Gait Index and the TUG test, the quality of walking improved as well as the balance in the patients with PD after the intervention with an average of 8.0. Improvements were also observed in their quality of life based on the answers to the PDQ-39, as well as in their UPDRS scores.

The work of Franzoni *et al.* [18] investigated the effect of a nine-week program with NW compared to free walking on static and functional balance. The 25 participants were allocated to two groups, one did NW (n = 14) and the other free walking (n = 11). The duration of the program was nine weeks for both groups, who were evaluated before and after the intervention. Each training consisted of three stages. In the first part the groups performed warm-up stretches to mobilize the joints, in the second part they performed NW or free walking, followed finally by the recovery stage. The

tests were performed on three different days with a gap of 48-72 hours. Patients were assessed pre- and post-intervention on motor symptoms, disease level, and functional balance. On the second day, anthropometric assessments were carried out on a special platform and on the third day, static measurements were carried out on a dynamic floor. The duration of each test was 30 seconds and was repeated by each patient three times, with eyes closed and eyes open. The BBS results showed an improvement in the functional balance of the patients as well as an improvement in their proprioception. The study evidence is important for the rehabilitation of patients with PD as improvements in parameters can reduce the risk of falling.

The effect of NW on the functional balance and walking ability of PD patients on a treadmill was evaluated by Bang & Shin [19]. The sample was 20 patients, who were equally divided into two groups. The first group performed NW, while the second followed treadmill training. The program lasted four weeks with five one-hour sessions per week. The training sessions were performed on a level treadmill where the maximum speed for each patient was measured during the first training session. Each patient started their program for five minutes at 50% of their maximum speed and then the speed was increased every 1-2 minutes holding a maximum speed for ten seconds always in cooperation with them so as not to endanger them, followed by a period of walking at a slow pace until their heart rate returned to normal. The program ended with deep breathing and stretching. The results of measurements from the BBS showed an improvement in balance ability and the TUG test, the 10-meter walk test (10MWT), and the 6MWT showed an improvement in walking. The use of NW improves trunk posture and overall balance during walking, and thus could be incorporated into a rehabilitation program.

Another study by Zhou *et al.* [20] examined the effect of NW after a six-week program on gait parameters in PD patients. The study included 12 patients (nine men and three women) and 12 healthy older adults. After learning the technique, they were asked to perform a 60-minute session three to four times per week. Each session consisted of a 5-10-minute warm-up, 45 minutes of walking or two sessions of 20 minutes, and 5-10 minutes of static stretching for recovery. Gait analysis was performed on a five-meter corridor where three trials were performed with the special sticks and three trials without them. Parameters such as step length, walking speed, and single-leg support time were recorded. The results showed greater absorption in the knee of the affected leg in the group that used the special sticks. Furthermore, NW improved gait characteristics such as step length and single-leg stance time, which positively affected the posture of PD patients and could be beneficial for improving gait.

Finally, Warlop *et al.* [21] assessed the effect of NW on dynamic stability during walking. The 14 PD patients who participated, after practicing (three sessions) in the NW, performed twice a 12-minute walk with the special sticks and twice without them. Evaluated parameters were step length as well as walking speed and pace. Structured gait diversity, revealed by the presence of long-range autocorrelations (LRA), was associated with dynamic gait balance. Dynamic balance was defined as the ability to maintain functional mobility regardless of the presence of internal and external disturbances, which is an element of a healthy locomotor system.Gait rate, gait speed, step length and temporal organization (i.e., LRA) of step length variability were studied over 512 consecutive gait cycles using a one-dimensional accelerometer placed on the malleus of the more affected side. All patients exhibited LRA, therefore this gait pattern with rhythmic upper body movement may improve dynamic stability during walking.

Discussion and Conclusions

In our review, a related search was performed to study the effects of NW in PD patients. In the articles studied, a difference was observed in the age categories as well as the gender of the patients, parameters that prevent the comparison of the articles. An important drawback in our study was the different criteria for participation or exclusion of patients in each study, as well as the different protocols and evaluation tests. Different gait parameters were also assessed in each article, which prevents comparison between articles but does not negate the main positive effect observed. Studying the articles there are commonalities that can be discussed. There was an improvement according to the study by Warlop *et al.* [21] in important factors of walking such as step length and speed, as well as in the research by Zhou *et al.* [20], who also observed an increase in single-leg support. Guseva & Zhukova [16] were led to the same positive evidence in their research. The significant improvement in balance in patients is confirmed by the results of four studies. Franzoni *et al.* [18] argue that the data of their study is very important for avoiding falls as there was an improvement in the proprioception of each patient. The research by Szefler-Derela *et al.* [17] and the study by Monteiro *et al.* [13] show the same positive data after the intervention in the patients. Finally, the research of Bang & Shin [19] also presented an improvement in balance even though it was performed on a treadmill and not in a natural environment. In a different research by Matos *et al.* [15], the results were positive in the respiratory functions of the patients. However, more specialized research is necessary to be able to draw safe conclusions. Additionally, in a research by Zanardi *et al.* [14] asymmetries that were recorded before the intervention with NW were improved. Finally, important evidence for the improvement of the non-motor symptoms manifested by the disease was presented by Monteiro *et al.* [13], who found improvements in the psychological status, depressive symptoms, social participation, and cognitive function of the patients. In conclusion, the NW method is an important tool for PD patients. Certainly, studies with the same rating scales and common parameters should be performed. However, the evidence shows that the use of this particular gait has mainly positive results in PD patients.

Conflict of Interest
Not available

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Not available

References

1. Kalia LV, Lang AE. Parkinson's disease. *Lancet*. 2015;386(9996):896-912. DOI:10.1016/S0140-6736(14)61393-3
2. Suchowersky O, Furtado S. Parkinson ' S Disease : Etiology and Treatment. Adv Neurol. Published online; c1997.
3. Kottaras A, Lytras D, Kottaras S, Iakovidis P. The

Effect of Aquatic Physiotherapy on Functioning, Balance Performance, Motor Performance and Health-related Quality of Life in Patients with Parkinson's Disease: A Review of. Crit Rev Phys Rehabil Med. 2021;33(1):65-84. DOI:10.1615/critrevphysrehabilmed.2021038050
4. Kottaras A, Lytras D, Iakovidis P, Chatziprodromidou IP, Myrogiannis IS, Apostolou T. The Effect of Therapeutic Exercise on the Clinical Picture and Quality of Life of Patients with Parkinson's Disease: A Narrative Review and Update of Evidence-Based Physiotherapy Practice.; c2022. www.begellhouse.com
5. Iakovidis P, Lytras D, Kasimis K, Fetlis A, Ntinou SR, Chatzikonstantinou P. Effect of resistance exercises on gait of middle-aged and older adults with Parkinson ' s disease. Int. J Adv Res Med. 2023;5(1):25-28.
6. Armstrong MJ, Okun MS. Diagnosis and Treatment of Parkinson Disease: A Review. JAMA - J Am Med Assoc. 2020;323(6):548-560. DOI:10.1001/jama.2019.22360.
7. Chen SY, Tsai ST. The epidemiology of Parkinson's disease. Tzu Chi Med J. 2010;22(2):73-81. DOI:10.1016/S1016-3190(10)60044-4
8. Keus S, Munneke M, Graziano Paltamaa J, Pelosin E, Domingos J, Brühlmann S, *et al*. European Physiotherapy Guideline for Parkinson's Disease. 1th editio. Parkinson Net KNGF; c2014. DOI:10.1002/mds.26688.
9. Xu X, Fu Z, Le W. Exercise and Parkinson's Disease. 1st ed. Elsevier Inc.; c2019, 147. DOI:10.1016/bs.irn.2019.06.003
10. Tomlinson CL, Herd CP, Clarke CE, Meek C, Patel S, Stowe R, *et al*. Physiotherapy for parkinson's disease: A comparison of techniques. Cochrane Database Syst Rev. 2014;2014(6):1-119. DOI:10.1002/14651858.CD002815.pub2
11. Padulo J, Iuliano E, Dello Iacono A, Milić M, Rizzi M, Ardigò LP. Nordic walking versus natural walking: an easy approach to comparing metabolic demands. Int. J Perform Anal Sport. 2018;18(5):686-692. DOI:10.1080/24748668.2018.1514565
12. Cugusi L, Solla P, Serpe R, Carzedda T, Piras L, Oggianu M, *et al*. Effects of a Nordic Walking program on motor and non-motor symptoms, functional performance and body composition in patients with Parkinson's disease. Neuro Rehabilitation. 2015;37(2):245-254. DOI:10.3233/NRE-151257.
13. Monteiro EP, Franzoni LT, Cubillos DM, de Oliveira Fagundes A, Carvalho AR, *et al*. Effects of Nordic walking training on functional parameters in Parkinson's disease: a randomized controlled clinical trial. Sc. and J Med Sci. Sport. 2017;27(3):351-358. DOI:10.1111/sms.12652
14. Zanardi APJ, Martinez FG, da Silva ES, Casal MZ, Martins VF, Passos-Monteiro E, *et al*. Effects of nordicwalking on gait symmetry in mild Parkinson's disease. Symmetry (Basel). 2019;11(12):1-10. DOI:10.3390/SYM11121481.
15. Matos LM, da Veiga RG, Santos AGPS, Dias CP, Santos, LLS, Rocha RSB, *et al*. Influence of Nordic Walking and Respiratory Muscle Training in Patients with Parkinson : Randomized Clinical Trial. Heal Sci. J. 2020;2:1-8. DOI:10.36648/1791-809X.S2.008
16. Guseva O, Zhukova N. Nordic walking in winter as the multitask training in patients with Parkinson's disease. J Neurol Psychiatry. 2021;121(1):38-42.
17. Szefler-Derela J, Arkuszewski M, Knapik A, Wasiuk-Zowada D, Gorzkowska A, Krzystanek E. Effectiveness of 6-week nordic walking training on functional performance, gait quality, and quality of life in Parkinson's disease. Med. 2020;56(7):1-10. DOI:10.3390/medicina56070356
18. Franzoni LT, Monteiro EP, Oliveira HB, da Rosa RG, Costa RR, Rieder C, *et al*. A 9-Week Nordic and Free Walking Improve Postural Balance in Parkinson's Disease. Sport Med Int Open. 2018;02(02):E28-E34. DOI:10.1055/s-0043-124757
19. Bang DH, Shin WS. Effects of an intensive Nordic walking intervention on the balance function and walking ability of individuals with Parkinson's disease: a randomized controlled pilot trial. Aging Clin. Exp. Res. 2017;29(5):993-999. DOI:10.1007/s40520-016-0648-9
20. Zhou L, Gougeon MA, Nantel J. Nordic walking improves gait power profiles at the knee joint in Parkinson's disease. J Aging Phys Act. 2018;26(1):84-88. DOI:10.1123/japa.2017-0031
21. Warlop T, Detrembleur C, Buxes Lopez M, Crevecoeur F, Bollens B, Stoquart G, *et al*. Nordic walking can improve dynamic stability of human gait in Parkinson disease. Ann Phys Rehabil Med. 2015;58:e73. DOI:10.1016/j.rehab.2015.07.180

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