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Original Article

Which aerobic exercise is more effective in Parkinson's patients? Cycle ergometer versus body weight-supported treadmill

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ABSTRACT

Objectives: The study aimed to evaluate the effects of aerobic exercise applied with bodyweight-supported treadmill (BWSTT) or cycle ergometer (CE) in Parkinson's patients.

Patients and methods: In the prospective single-blind study, 38 Parkinson's patients with Hoehn-Yahr Stage 1-3 were randomized into the CE and BWSTT groups between May 2019 and March 2020. Evaluations before and after six weeks of treatment included a six-min walking test with a software device as the primary outcome and functional balance tests (Tinetti balance and gait test, one-leg stance balance test) as secondary outcomes. Both groups received 40 min of aerobic exercise three days per week with conventional rehabilitation and various methods. CE and BWSTT groups were created. The aerobic exercise program was designed based on treatment recommendations for Parkinson's patients of the American College of Sports Medicine (CE test, with the Karvonen formula, 40-60% reserve). Posttreatment and pretreatment evaluations were compared within and between groups.

Results: The six-week aerobic exercise program was completed by 16 participants (9 males, 7 females; mean age: 65.9±8.1; range, 47 to 78 years) in the CE group and 15 participants (9 males, 6 females; mean age: 62.5±7.5; range, 49 to 79 years) in the BWSTT group. The demographic characteristics of the patients were similar. Primary and secondary outcomes were significantly different after treatment than before treatment in both groups. There were no significant differences between the groups in outcomes.

Conclusion: The results showed that both methods are effective and not superior to each other. Aerobic exercise programs led by experienced clinicians can benefit patients.

Keywords: Cardiac rehabilitation, exercise therapy, Parkinson's disease.

Parkinsonism is a disease that consists of a combination of cardinal symptoms such as rest tremor, rigidity, and bradykinesia, usually with an idiopathic etiology.[1] The incidence of this disease increases with the increase in life expectancy, and the number of patients is projected to double by 2030.[2]

Due to the progressive course of the disease, the patients' functional dependence in activities of daily living gradually increases, and their quality of life (QoL) level decreases.[3,4] Rehabilitation programs applied to restore impaired functions and increase independence and QoL complement the treatment, as well as medical and surgical methods.[5,6] In recent years, the inclusion of aerobic exercise in these practices has been emphasized.[7] This emphasis has been attributed to the fact that aerobic exercise improves the motor and cognitive functions of patients, slows down the degeneration process, and regresses signs and symptoms through plasticity.[8-12]

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In the literature, there is no clarity regarding the superiority of aerobic exercise methods, such as treadmill workout, body weight-supported treadmill training (BWSTT), or cycle ergometer (CE) exercise. Besides treadmill workouts, CE is also recommended to improve the gait function of patients.[3,9,13]

Therefore, the study aimed to objectively evaluate the effects of aerobic exercises carried out with BWSTT or CE on the functional capacity levels of patients with Parkinson's disease and to compare these with each other.

PATIENTS AND METHODS

The prospective, controlled, single-blind clinical trial was conducted at the Trakya University Faculty of Medicine, Department of Physical Medicine and Rehabilitation between May 2019 and March 2020. The study included 38 participants meeting the following criteria: female or male patients between the ages of 40 to 80 years with a diagnosis of idiopathic Parkinson's disease; having regular follow-up by a neurologist; a stable medical treatment for one month; a modified Hoehn and Yahr[14] stage of 1-3; a Mini-Mental State Examination score above 24 points;[15] a motor function rating below 35 points from Unified Parkinson's Disease Rating Scale;[16] being categorized as Class A or Class B according to the American Heart Association risk classification guidelines;[17] having current electrocardiogram, echocardiography, and exercise tests assessed by a cardiologist with the results not contraindicated for the aerobic exercise program. The exclusion criteria were determined as follows: the presence of deep brain stimulation; atypical Parkinson's disease; orthopedic pathology of the lower extremity; any of the diagnoses of active infection or malignancy.

Participants meeting the inclusion criteria were sequentially numbered with a unique number based on the order of enrollment in the first evaluation. Afterward, each number was randomly assigned to an intervention group using a simple randomization method (method steps in order were data, select cases, a random sample of cases, and approximately 50% of cases) by a physician blinded to the participant's clinical evaluation. Finally, the patients were randomly assigned in a one-to-one ratio to the CE group and the BWSTT group (19 participants in each group).

The body compositions of the participants were evaluated using the bioelectrical impedance method with a multifrequency segmental body composition analyzer (Tanita MC-780U; Tokyo, Japan). The patients were classified according to the World Health Organization's (WHO) obesity classification considering the formula of body weight (kg)/height $(m)^2$ at baseline (T1), where the patients with a value between 18.5 and 24.9 were considered normal, those with a value between 25 and 29.9 were considered overweight, and those with a value of 30 and above were considered obese.

The Parkinson's Disease Questionnaire was used to assess the QoL of the participants.[18] This questionnaire consists of 39 questions that examine health dimensions such as mobility, activities of daily living, emotional well-being, stigma, social support, cognitions, communication, and bodily discomfort. The Beck Depression Inventory was applied to the participants to determine their depression risk and measure the level of depressive symptoms.[19]

Forced vital capacity, vital capacity, and related parameters of the participants were evaluated using the spirometry feature of the six-min walk test (6MWT) equipment (Cosmed Spiropalm, Rome, Italy).[20]

Participants were subjected to the exercise test using a CE (Ergoline 800S, Ergoselect 100K system; Bitz, Germany) to determine their aerobic capacity and to plan their aerobic exercise programs. The height of the cycle seat was adjusted so that the knee flexion of the patient was 25°. The test was performed under the supervision of a physician using the WHO protocol (initial power: 25 W; pedaling speed of the patient: 55-65 full rotations per minute; gradual power increase every 3 min).[21,22] Borg Dyspnea scores (each rated 6-20) and muscle fatigue levels were assessed every 3 min by questioning.[23] The exercise test was stopped when reaching the maximum heart rate obtained in the cardiac stress test carried out by the cardiology department [(220-age) × 0.85], when the Borg Dyspnea score was 19-20, or when the muscle fatigue level rose to interfere with pedaling.[24] Maximum heart rate in patients using beta-blockers was determined by the formula (164-0.7 × age).[25] At the end of the test, the maximal oxygen consumption (mL/kg/min), maximal oxygen consumption, and maximal power/weight (watt/kilogram) values of the patient were recorded when the test was completed (Figure 1a). The maximal oxygen consumption (mL/kg/min) was indirectly determined based on the maximal power produced at the end of the exercise test using the following equation:[26] The maximal oxygen consumption (mL/kg/min)= 12.35 × [watts/body weight (kg)] + 3.5.

To ensure the orientation of the participants in the CE group, an aerobic exercise program with a 10 W constant load control for 30 min (5 min of warm-up, 10 min of workout, 5 min of rest, 10 min of workout, and 5 min of cool down) in total was applied in the first week of the rehabilitation program (Figure 1b). To ensure the orientation of the participants in the BWSTT group, an aerobic exercise program with speed and body weight support at which the participants felt most confident and with an inclination angle of 0º for 30 min was applied in the first week of the rehabilitation program (Figure 1c).

A customized aerobic exercise program was determined for each participant in both groups. The maximum heart rate value obtained from the CE exercise test was used in the Karvonen formula (Target heart rate = maximum heart rate-resting heart rate × (40-60%) + resting heart rate) to determine the range of heart rate to be used in the customized aerobic exercise program. This program was initiated in the second week.

The aerobic exercise program of all participants was updated considering their heart rates and blood pressure levels during exercise and questioning their tolerance levels (dyspnea and muscle fatigue) at the end of each exercise week. Aerobic exercise programs were gradually updated by extending the exercise duration to 50 min (5 min of warm-up, 20 min of workout, 5 min of rest, 20 min of workout, 5 min of cool down), and increasing the intensity of exercise to continue the exercise within the determined heart rate range.

The participants followed aerobic exercise programs three days a week for six weeks, for a total of 18 sessions. The participants were evaluated at T1 and at the end of the aerobic exercise program (T2) by a physician who was blinded to the type of aerobic exercise program. The averages of the evaluation results of the participants in both groups at T1 and T2 and the mean differences were determined. The results were compared between the groups.

The participants were subjected to a 6MWT to assess their exercise and walking capacity as the primary outcome. Since most of their daily activities require submaximal effort, the 6MWT successfully shows their functional exercise level.[27] A 6MWT device and a Spiropalm mask (COSMED, Roma, Italy) were appropriately worn by patients who were eligible for testing to monitor their vital signs (heart rate and oxygen saturation). The participants were taken to the start point of the 30-m track. Afterward, they were asked to walk at their own walking pace under the supervision of a physician with the start command (Figure 1d). At the end of the test, the participant was asked to rate the muscle fatigue between 0-10 points (0=no fatigue; 10=the most severe fatigue imaginable) using a numerical scale, and the shortness of breath was rated using the Modified Borg Dyspnea Scale (0=no breathlessness at all; 10=most severe breathlessness); and the data were entered into the device. The distance walked by the participants was calculated in meters and entered into the 6MWT device. The work performed during the test was calculated by multiplying the distance (meters) the patients walked within 6 min by the patient's body weight (kilograms) by eliminating the constant values of the formula.[28] The average

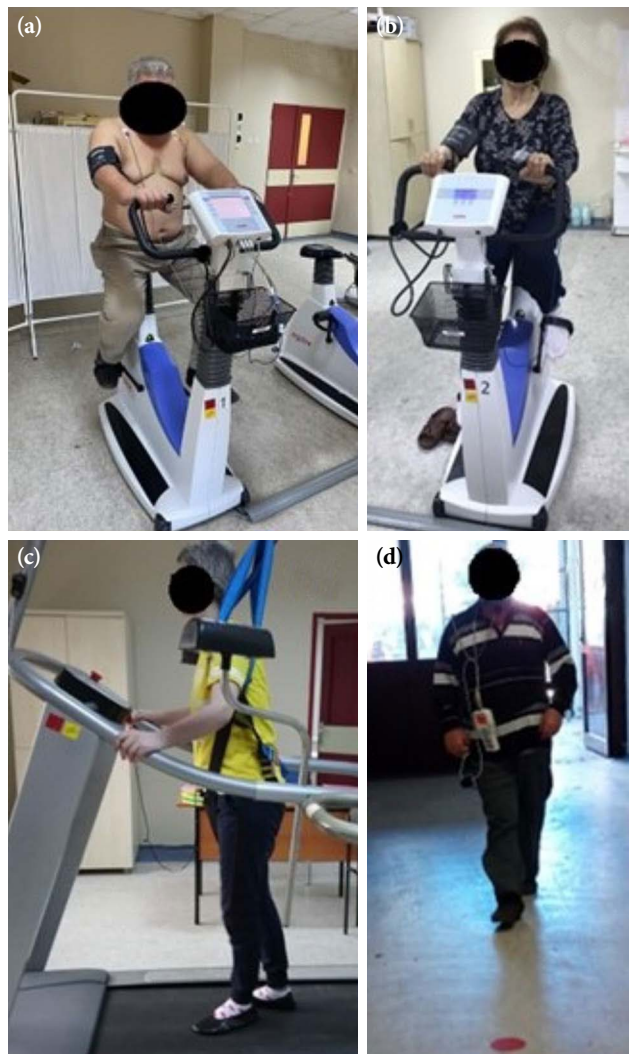

Figure 1. **(a)** Exercise test **(b)** Cycle ergometer exercise **(c)** Body weight-supported treadmill training **(d)** The six-minute walk test.

walking speed during the test was calculated by dividing the distance (meters) the patients walked within 6 min by 360 sec.

The Tinetti balance and gait test consists of 13 items for balance and nine items for gait, and it evaluates the risk of fall.[29] The one-leg stance balance test measures balance and the ability of static standing. It provides information about the individual's risk of fall.[30] If the patient could stand on one leg for 30 sec, they were told that the test was finished.

Statistical analysis

Data were analyzed using IBM SPSS version 20.0 software (IBM Corp., Armonk, NY, USA). The Shapiro-Wilk test was used to test the normality of quantitative values before comparing the two groups. The Mann-Whitney U test and Student's t-test were used to compare the quantitative values of the groups. The Chi-square test was used to compare categorical data. A two-way analysis of variance-type nonparametric analysis of longitudinal data (nparLD) model (2-groups × 2-times) was used to compare group and time effects on the 6-min walk, Tinetti balance and gait, and one-leg stance test results (nparLD Package, RStudio 2023.03.1). The Wilcoxon test was used to analyze the changes in the scores of the participants within the groups before and after the aerobic exercise test. The differences between the pre-exercise and postexercise scores of the groups were calculated. The Mann-Whitney U test was used to compare these differences between the groups. A *p*-value of <0.05 was considered statistically significant.

RESULTS

The six-week aerobic exercise program was completed by 16 participants (9 males, 7 females; mean age: 65.9±8.1; range, 47 to 78 years) in the CE group and 15 participants (9 males, 6 females; mean age: 62.5±7.5; range, 49 to 79 years) in the BWSTT group (Figure 2). No statistically significant difference was found between the groups in terms of sex, age, height, weight, and body mass index (p>0.05). The main characteristics of the participants are presented in Table 1.

No statistically significant difference was found between the groups at T1 in terms of the mean overall scores and the mean mobility subgroup scores of

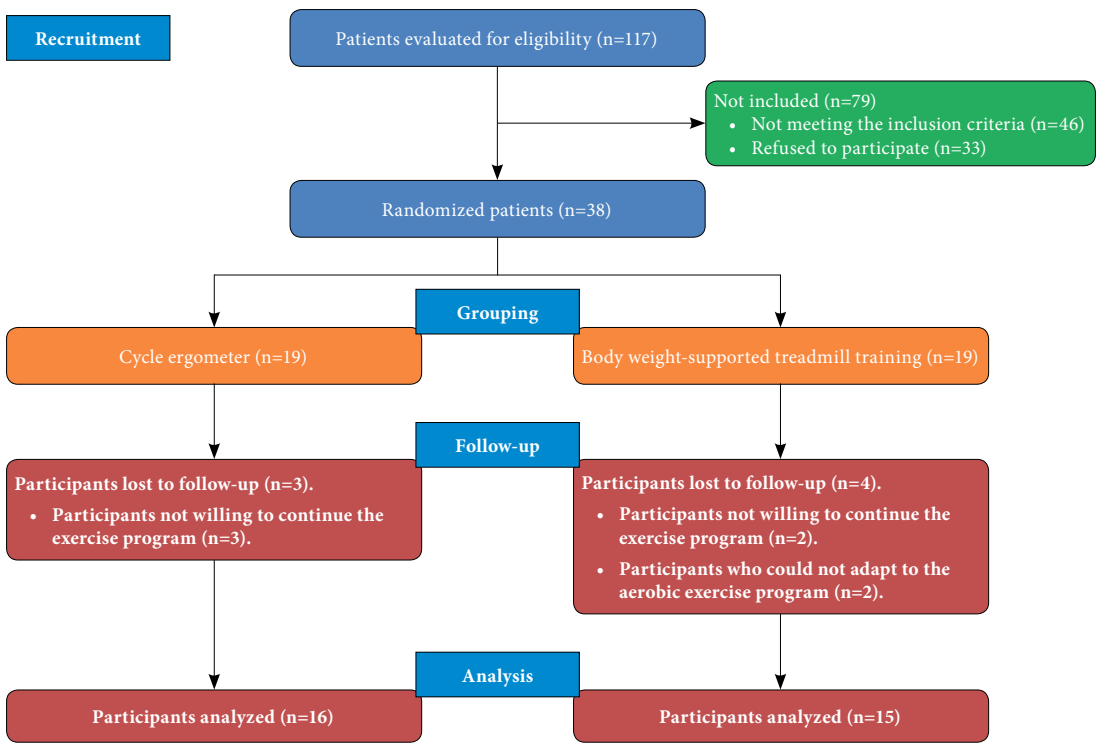

Figure 2. CONSORT 2010 Workflow.
CONSORT: Consolidated Standards of Reporting Trials.

TABLE 1
Participants' characteristics

	CE group (n=16)					BWSTT group (n=15)					
	n	%	Mean±SD	Median	Min-Max	n	%	Mean±SD	Median	Min-Max	*p*
Age (year)			65.9±8.1					62.5±7.5			0.227[b]
Sex											0,586[a]
Female	7					6					
Male	9					9					
Body mass index (kg/m^2)			28.7±4.3					29.3±5.9			0.745[b]
BMI categories											0.961[c]
Underweight	0	0				0	0				
Normal weight	4	25.0				4	26.7				
Overweighed	5	31.3				4	26.7				
Obese	7	43.8				7	46.7				
Hoehn and Yahr Stage											0.259[c]
Stage 1.5	11	68.8				10	66.7				
Stage 2	3	18.8				3	20.0				
Stage 2.5	2	12.5				0	0				
Stage 3	0	0				2	13.3				
Unified Parkinson's Disease Rating Scale											
Motor examination			25.2±1.4	24.5	24-28			25.0±0.9	25	24-26	0.953[d]
Mini-Mental Examination Score			25.2±1.4					25.0±0.9			0.669[b]
Beck Depression Inventory Score			14.0±5.1					15.2±7.2			0.711[d]
Depression stages				2	1-3				2	1-4	0.711[d]
Minimal depression											
Mild depression											
Moderate depression											
Severe depression											
Parkinson's Disease Questionnaire											
Mobility subgroup			19.9±5.69	18.5	11-32			20.3±5.7	20.0	12-31	0.800[d]
Overall score			45.1±14.4	47.5	17-61			46.0±14.3	43	27-70	0.922[d]
Spirometry results											
Forced vital capacity (liter)			3.0±1.0	2.8	1.4-5.1			2.8±0.9	2.6	1.61-4.32	0.446[d]
Forced expiratory volume (liter)			2.2±0.9	2.3	0.6-4.1			2.1±0.7	2.0	1.2-4.1	0.599[d]
Forced expiration rate (%)			73.7±18.1	80.7	27.8-98.2			77.2±13.8	80.3	50.0-95.0	0.682[d]
Peak flow rate (liter/second)			4.7±2.7	4.0	0.7-10.9			3.8±1.7	3.7	1.5-8.1	0.446[d]
Forced mid-expiratory flow rate (liter/second)			2.4±1.5	2.2	0.4-6.3			2.1±1.0	2.0	0.9-4.8	0.682[d]
Exercise test results											
Maximal oxygen consumption (mL/kg/min)			10.0±5.3	9.1	0.0-18.6			10.5±5.0	9.3	5.2-23.1	0.964[d]
Maximal oxygen consumption (MET)			2.9±1.5	2.6	0.0-5.3			3.0±1.4	2.6	1.5-6.6	1.000[d]
Maximal power (Watt)			41.7±30.1	32.0	0.0-93.0			42.2±33.9	28.0	9.0-119.0	0.856[d]
Maximal power/weight (Watt/kilogram)			0.6±0.4	0.5	0.0-1.2			0.6±0.4	0.5	0.1-1.6	1.000[d]
Maximum energy consumption (Kcal/minute)			3.8±2.1	3.5	0.0-7.1			3.9±2.2	2.8	1.7-8.7	0.821[d]

CE: Cycle ergometer aerobic exercise; BWSTT: Body weight-supported treadmill aerobic exercise; SD: Standard deviation; a Yates Chi-squared test; b Student's t-test; c Pearson's Chi-squared test; d Mann-Whitney U test.

TABLE 2
The 6-min walk test, Tinetti balance and gait test, and one-leg stance test results of groups

	CE group (n=16)		BWSTT group (n=15)		
	Median	Min-Max	Median	Min-Max	*p*
6-minute walk test results					
Walking distance (meter)					
Baseline	285.0	135.0-430.0	330.0	170.0-482.0	0.105
Post-intervention	377.5*	265.0-465.0	410.0*	200.0-540.0	0.154
Difference between baseline to post-intervention	−95.0	−220.0-15.0	−50.0	−210.0-25.0	0.294
Group* Time Interaction	Group 0.117		Time <0.001		0.443
Walking speed (meter/360 seconds)					
Baseline	0.8	0.4-1.2	0.9	0.5-1.3	0.105
Post-intervention	1.1*	0.7-1.3	1.2*	0.6-1.5	0.154
Difference between baseline to post-intervention	−0.3	−0.6-0.1	−0.1	−0.6-0.1	0.294
Group* Time Interaction	Group 0.117		Time <0.001		0.443
Work performed by walking for 6 minutes (meter × kilogram)					
Baseline	20363.0	10260.0-40850.0	23744.0	10880.0-40016.0	0.167
Post-intervention	27977.0*	17808.0-40392.0	26871.0*	18400.0-52272.0	0.782
Difference between baseline to post-intervention	6408.8	−18542.0-1442.0	−3314.0	−12256.0-3020.0	0.252
Group* Time Interaction	Group 0.335		Time <0.001		0.090
Degree of breathing difficulty at the end of the test					
Baseline	2.0	0.0-9.0	1.0	0.0-9.0	0.763
Post-intervention	0.0*	0.0-1.0	0.5*	0.0-3.0	0.263
Difference between baseline to post-intervention	1.5	0.0-8.5	0.5	−0.5-7.0	0.267
Group* Time Interaction	Group 0.693		Time <0.001		0.787
The degree of muscle fatigue at the end of the test					
Baseline	1.5	0.0-6.0	2.0	0.0-5.0	0.779
Post-intervention	0.5*	0.0-1.0	0.0*	0.0-2.0	0.419
Difference between baseline to post-intervention	1.0	0.0-5.0	1.0	0.0-5.0	0.764
Group* Time Interaction	Group 0.693		Time <0.001		0.787
Tinetti Balance and Gait Test					
Balance test					
Baseline	16.0	12.0-26.0	20.0	13.0-25.0	0.159
Post-intervention	22.5*	16.0-26.0	25.0*	21.0-26.0	0.113
Difference between baseline to post-intervention	−32.0	−9.0-0.0	−3.0	−9.0-0.0	0.641
Group* Time Interaction	Group 0.122		Time <0.001		0.422
Gait test					
Baseline	5.0	3.0-9.0	5.0	1.0-8.0	0.487
Post-intervention	8.0*	5.0-9.0	8.0*	7.0-9.0	0.932
Difference between baseline to post-intervention	−3.0	−5.0-0.0	−3.0	−6.0-0.0	0.339
Group* Time Interaction	Group 0.641		Time <0.001		0.314
Total					
Baseline	21.0	18.0-34.0	25.0	19.0-33.0	0.301
Post-intervention	30.0*	23.0-35.0	33.0*	29.0-35.0	0.174
Difference between baseline to post-intervention	−5.5	−13.0 - −1.0	-5.0	−11.0 - −2.0	0.662
Group* Time Interaction	Group 0.224		Time <0.001		0.241
One-leg Stance Test					
Duration of standing on the right leg in balance (second)					
Baseline	4.0	0.0-20.0	15.0	1.0-20.0	0.087
Post-intervention	15.5*	2.1-20.0	20.0*	3.0-20.0	0.015
Difference between baseline to post-intervention	−3.27	−20.0-0.0	−3.0	−18.0-0.0	0.706
Group* Time Interaction	Group 0.015		Time <0.001		0.700

TABLE 2
Continued

	CE group (n=16)		BWSTT group (n=15)		
	Median	Min-Max	Median	Min-Max	*p*
Duration of standing on the left leg in balance (second)					
Baseline	6.0	0.0-20.0	10.0	1.0-20.0	0.462
Post-intervention	11.8*	1.9-20.0	20.0*	2.1-20.0	0.074
Difference between baseline to post-intervention	–2.6	–13.0-0.0	–4.3	–18.0-0.0	0.394
Group* Time Interaction	Group 0.180		Time <0.001		0.177

CE: Cycle ergometer aerobic exercise; BWSTT: Body weight-supported treadmill aerobic exercise; * p<0.05 compared with baseline (Wilcoxon Signed-Ranks test); ** Mann-Whitney U test; *** ANOVA-type analysis for nonparametric longitudinal data (nparLD). The interaction was not found to be significant in any of the variables.

the modified Hoehn and Yahr staging, Mini-Mental State Examination, Beck Depression Inventory, and Parkinson's Disease Questionnaire (p>0.05, Table 1).

The groups showed no statistically significant difference at T1 in terms of according to the mean scores of pulmonary capacity and the exercise test (p>0.05, Table 1). Exercise tests were completed by recording all patients' maximum musculoskeletal, pulmonary, or cardiac system responses.

Results of the analysis of variance-type nparLD are shown in Table 2 with *p* values. Group comparisons and group×time interactions were not significant for all of the test results (6MWT, Tinetti test, and one-leg stance test; p>0.05 for all). Time effect was found significant for all of the test results (p<0.001 for all).

According to the results of the 6MWT, an increase was observed in both groups at T2 compared to T1 in terms of walking distance, gait speed, and work performed (p<0.05). Moreover, both groups showed decrease in the level of final breathing difficulty and muscle fatigue at T2 compared to T1 (p<0.05). However, the results of the 6MWT at T1 and T2 showed no difference between the groups (p>0.05, Table 2).

A significant increase was found in both groups at T2 compared to T1 in terms of the mean overall and subgroup scores of the Tinetti balance and gait test and the results of one-leg stance balance test (p<0.05). No difference was found between groups at T1 in terms of the mean overall and subgroup scores of the Tinetti balance and gait test and the mean duration of standing on the right or left leg (p>0.05). No difference was found between the groups at T1 and T2 in terms of the changes in their overall test scores and subgroup scores of the Tinetti balance and gait tests and the change in the duration of standing on the right or left leg (p>0.05, Table 2).

DISCUSSION

The present study revealed that aerobic exercise with both BWSTT and CE improved gait function and balance skills of patients with Parkinson's disease. In forced exercise, which is a type of aerobic exercise, the individual reaches a higher level than their preferred exercise level, and this level is gradually increased. It causes an increase in activity in the cortical and subcortical areas.[31] Several animal and human studies have revealed that forced exercise increases neurotrophic factors and provides neural recovery and neuroplasticity.[12] In the present study, the exercise program was updated weekly, and the patients were allowed to perform aerobic exercise for six weeks with a progressive intensity level. In a pilot study including 29 patients with Parkinson's disease, the patients were subjected to a three-week aerobic exercise program two times a day for 30 min, five days a week. The first group, which consisted of 13 patients, attended a treadmill aerobic exercise, while the second group, which consisted of 16 patients, performed a CE aerobic exercise. Both groups were subjected to exercises at an intensity between 11 and 14 according to the Borg Dyspnea Scale. At the end of the treatment, a significant improvement was observed in both groups in terms of their gait speed and walking distance in the 6MWT. However, similar to our study, no significant difference was found between the two groups.[32]

The participants' balance was functionally evaluated by the Tinetti balance and gait test and statically evaluated by the duration in the one-leg stance test. Balance evaluations are significant parameters that provide information on the course of the disease and the clinical status of the participants.[33] In a study assessing the duration of standing on one leg in patients with Parkinson's disease, postural instability was found

to be more intense in participants with a duration of standing on one leg of 10 sec or shorter and was associated with clinical deterioration.[34] In a study investigating the effects of BWSTT, the patients with Parkinson's disease were divided into three groups of 20.[10] While the first group was included in the exercise program with BWSTT, the second group was subjected to conventional walking exercises. The third group did not receive any rehabilitation program. At the end of the fourth week, an improvement was observed in both the conventional walking rehabilitation group and the BWSTT group compared to the control group in terms of the results of the Tinetti gait test. The improvement in the BWSTT group was found to be more significant compared to that observed in the conventional walking rehabilitation group. On the other hand, only the BWSTT group showed improvement in the Tinetti balance test compared to the control group at the end of the fourth week.[10]

The BWSTT continuously provides sensory stimulation to the participants during the exercise owing to the moving treadmill. Thus, it improves the participants' locomotor system and postural stability.[35] The advantage of the treadmill is that it can provide exercise in a natural walking pattern.[36] Moreover, the continuous visual feedback of the step size by monitoring the moving treadmill improves self-control and motor learning.[10]

Cycling, on the other hand, does not correspond to a routine movement pattern in human life. The function of the lower limb during cycling creates a complex sensory input in the participant, and it coordinates the corticospinal conduction that ends with the motion output by increasing the activity of the basal ganglia.[31] Cycling aerobic exercise applied in the sitting position activates the stabilizer muscles of the body and improves their strength. Thus, it causes an improvement in postural balance.[37] Previous studies on functional cranial magnetic resonance have revealed that cycling stimulates the brain areas that are activated during gait function.[37,38]

It was important that the patient sample in the study groups, which were randomly created, had similar demographic characteristics, modified Hoehn and Yahr staging, Mini-Mental State Examination, QoL, depression risk assessment scores, and aerobic and pulmonary capacity levels. Otherwise, these differences could be a confusing factor in the analysis of the effects of the performed treatments on functional capacity.

In the present study, functional gains of the CE and BWSTT groups were similar. This can be explained by the knowledge that BWSTT and CE exercise techniques, which generate different extrinsic stimuli, stimulate similar functional and neurological pathways, activating the same adaptation mechanism.[37,38]

There are some limitations to this study. The inclusion criteria of being a patient with Parkinson's disease who could walk caused the exclusion of advanced-stage patients from the scope of the study. Therefore, it limited the number of participants included in the study, and no interpretations could be made on the clinical efficacy of the aerobic exercise program in advanced-stage idiopathic Parkinson's disease. The reason for not creating a control group that could be subjected to only the conventional rehabilitation program in the present study was the knowledge in the literature stating that the rehabilitation of idiopathic Parkinson's disease should include an aerobic exercise program. Another limitation of this study is that the program's effectiveness could not be evaluated in the late period after treatment. The participants were advised that they could go on exercising in their social lives by brisk walking with an intensity similar to one performed during the treatment.

In conclusion, the results of this study that revealed similar improvements with CE and BWSTT in terms of both functional capacity evaluated by gait and balance in patients with Parkinson's disease is an important contribution to the literature. Although the loss rates at follow-up were not very different between the groups, the fact that two patients in the BWSTT group discontinued the study because they could not adapt to treadmill exercise may be important in a study population of this size and may support the choice of CE. Further studies are needed to evaluate this situation. The aerobic capacity of each individual and the intensity of the exercise to be applied varies in accordance with the exercise physiology. Accordingly, cycling resistance or treadmill speed should be adjusted individually. Both techniques are effective in Parkinson's disease. It is crucial to include an aerobic exercise program the patient can access and in which the clinician has experience in the rehabilitation of Parkinson's disease.

Ethics Committee Approval: The study protocol was approved by the Trakya University Faculty of Medicine Scientific Research Ethics Committee (date: 11.02.2019, no: 03/10). The study was conducted in accordance with the principles of the Declaration of Helsinki.

Patient Consent for Publication: A written informed consent was obtained from each patient.

Data Sharing Statement: The data that support the findings of this study are available from the corresponding author upon reasonable request.

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