RESEARCH PAPER

Effect Of An 8-Week Aerobic Training Program On Functional Activity, Balance, And Quality Of Life In Individuals With Parkinson's Disease- A Case Study

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Keywords: Parkinson's Disease, Aerobic Exercise, Functional Activity, Balance, QOL
How to cite this article: Shirsat S, Dabholkar T. Effect Of An 8-Week Aerobic Training Program On Functional Activity, Balance, And Quality Of Life In Individuals With Parkinson's Disease- A Case Study. Int J Drug Deliv Technol. 2026;16(15s): 176-180. DOI: 10.25258/ijddt.16.15s.20

Introduction

Parkinson's disease (PD) is the second most prevalent neurodegenerative disorder worldwide, and it has progressively increased over the last few decades. (1) In population above 60 - 65 years of age, the prevalence reaches as high as 9.34 per 1,000 individuals, underscoring the public health urgency for effective interventions. (2)

International Classification of Functioning, Disability and Health (ICF) framework highlights that people with PD often find difficulties in activities and social participation to be their main concerns, rather than just motor symptoms. (3,4) As the condition progresses, it increasingly impairs the ability to perform Activities of Daily Living (ADLs), leading to reduced independence and a decline in quality of life (QoL). (5,6)

Physiotherapy forms an integral component in managing Parkinson's disease (PD). Exercises like stretching to reduce rigidity, strengthening to enhance muscle strength, coordination exercises to improve movement control, and balance training to prevent falls and correct posture. (7–9) These physiotherapeutic interventions have been shown to improve mobility, gait stability, and functional independence in individuals with PD. (10,11)

Aerobic exercise has emerged as a valuable adjunct to conventional physiotherapy, with evidence supporting its role in improving cardiovascular fitness, walking capacity, and overall functional performance in individuals with Parkinson's disease. (12) Aerobic exercise offers important neuroprotective and neurotrophic benefits for people with PD, helping to alleviate both motor symptoms as well as non-motor issues like sleep disturbances, mood changes, and cognitive difficulties. (13-16) Several studies have demonstrated that moderate-intensity aerobic exercise improves balance, gait speed, and walking endurance in individuals with PD. (17,18) However, improvements in physical performance measures have not consistently translated into significant enhancements in quality of life or independence in activities of daily living. (19,20)

Despite the known benefits of aerobic exercise, many individuals with PD face practical barriers such as limited access to specialized equipment including treadmills and cycle ergometers, which restrict participation in structured aerobic exercise programs. (21,22) This creates a need for a flexible and personalized aerobic exercise routine that matches each person's functional level and can be done anywhere without special equipment. (22) To address these challenges, the present study implemented an 8-week aerobic exercise program that ensured participants could exercise safely and comfortably across varied settings at any given point of time. The program commenced with moderate intensity at 40% of Heart Rate Reserve (HRR) and progressed gradually to 55% HRR over 8 weeks, in accordance with established exercise prescription guidelines. (23) Simple, large-joint movements combined with metronome cueing were incorporated to facilitate rhythmic movement patterns and achievement of target aerobic intensity. (24,25)

The aim of the study was to assess the effect of 8-week aerobic training program on Functional Activity, Balance, and Quality of Life in Individuals with Parkinson's disease. This progressive plan aimed to encourage adherence to aerobic exercise while maximizing the benefits of aerobic exercise in PD.

Procedure:

Individual with Parkinsons disease was screened based on inclusion criteria and falling under Hoehn and Yahr classification 2 (Bilateral or midline involvement without impairment of balance). Self- validated questionnaire on physical activity was administered which included components such as demographic data of the patient, duration since the patient is suffering from Parkinson's disease, family history, personal history, daily routine and work environment. During the study, participant was instructed to take his Parkinsons medications regularly and was assessed/treated during his 'ON' phase of medication, 1 to 2.5 hours after taking medication. The Parkinson medication and the dosage remained

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unchanged during the study duration. Patient was explained about the entire procedure of the study. Informed consent was obtained from the patient.
Physical Activity Readiness Questionnaire (PAR-Q) was taken to understand the physical readiness of the patient.
6 Minute Walk Test was performed which is a sub-maximal test. To find response to exercise in terms of: Blood Pressure, Pulse Rate and SPO2 in Parkinson patients during intervention. Pre intervention evaluation of Activities of Daily Living, Balance and Quality of life was done using ADL part of Unified Parkinsons Disease Rating Scale, Bergs Balance Test, and Parkinsons Disease Quality of Life Questionnaire – 39 respectively. The protocol was given for 3 days per week for 8 weeks (ACSM's Guidelines). Target heart rate was calculated using Karvonen's formula (moderate intensity 40% to <60% of Heart Rate Reserved). To monitor patient's exertion, breathlessness and fatigue during the session, Borg Scale was used. A score up to 13 on a scale of 20 was permitted (ACSM's Guidelines).
The aerobic exercise protocol was given at moderate intensity of 40% of Heart Rate Reserved using metronome cuing to maintain the intensity. Gradual increase in intensity by about 5% each week was done, ensuring participants safety and comfort. The duration of the Aerobic exercise session was 40 Mins. Of which 5 mins was warm up, 30 mins of Aerobic exercise and 5 mins of cool down. Throughout each exercise session, heart rate monitoring was performed using a smartwatch. The patient was instructed to immediately inform any form of discomfort like shortness of breath, leg cramps, wheezing, claudication, onset of angina- like symptoms, dizziness,
failure of HR to increase with increased exercise intensities, or physical or verbal manifestations of severe fatigue. In the event of any such symptoms, the exercise session was terminated immediately.

Patient Information
A 72-year-old male, retired from Army, was enrolled in an 8-week aerobic training program. Based on the Hoehn and Yahr scale, his disease severity was classified as Grade 1.

Table 1 Presents details of hemodynamic parameters at the end of each week in relation to the aerobic exercise protocol implemented from Week 1 through Week 8.

Week		**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Heart Rate (bpm)	Pre-Session	87	86	83	88	87	86	87	86
	During Session	106	107	112	111	114	114	113	115
	Post-Session	94	94	93	97	96	94	97	96
SpO2 %	Pre-Session	96	97	94	98	96	97	94	98
	Post-Session	97	98	98	96	97	99	97	98
BP (mmhg)	Pre-Session	124/ 78	124/80	128/80	124/74	122/76	124/74	122/76	124/80
	Post-Session	122/ 72	126/78	126/80	124/78	124/82	122/78	124/74	124/78
Rate of Perceive Exertion (Borg Scale)	Post - Session	13	12	13	12	13	12	13	13
Metronome Beats	During Session	107	107	111	111	115	115	118	118
Intensity of HRR	During Session	40%	40%	45%	45%	50%	50%	55%	55%
Warmup	5 mins	✓	✓	✓	✓	✓	✓	✓	✓
Marching	1 min	✓	✓	✓	✓	✓	✓	✓	✓
High knees	1 min	✓	✓	✓	✓	✓	✓	✓	✓

High knees with touching opposite knee	1 min	✓	✓	✓	✓	✓	✓	✓	✓
Side stepping	1 min	✓	✓	✓	✓	✓	✓	✓	✓
Foot raised behind, touching with opposite hand (Chest lifted, head up)	1 min	✓	✓	✓	✓	✓	✓	✓	✓
Box Step: 2 steps forward, 2 steps backward	1 min	✓	✓	✓	✓	✓	✓	✓	✓
Oblique stepping: Front and back 2 steps	1 min	✓	✓	✓	✓	✓	✓	✓	✓
Interval									
Head turns	10 secs	✓	✓	✓	✓	✓	✓	✓	✓
Neck flexion and extension	10 secs	✓	✓	✓	✓	✓	✓	✓	✓
Shoulder rolls	10 secs	✓	✓	✓	✓	✓	✓	✓	✓

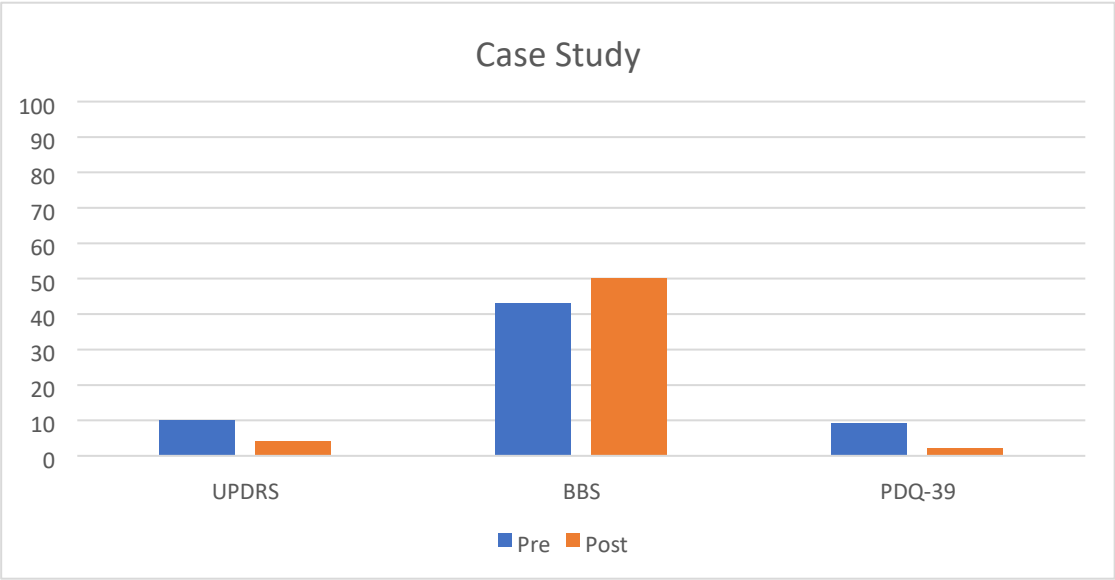
Discussion:

The study aimed to assess the effect of 8- week aerobic training program on functional activity, balance and quality of life in individuals with Parkinson's disease. The findings of the study suggest significant improvements across all domains following an 8-week tailored aerobic exercise program in an individual with Parkinson's disease (PD).

Table 2: Outcome Measures

Case	UPDRS	BBS	PDQ-39
Pre	10	43	9%
Post	4	50	2%

Graph 1:



Improvements in Activities of Daily Living (ADLs), as measured by the Unified Parkinson's Disease Rating Scale (UPDRS) part II, indicate enhanced independence in self-care and routine functional tasks. [26]
These improvements in ADL may be attributed to improved motor control, enhanced cardiovascular endurance, and exercise induced neuroplastic adaptations associated with aerobic training in individuals with PD. [15,16]
Improved balance observed in this study may have facilitated safer and more efficient movement during daily activities, further supporting functional independence. [10]
Balance outcomes showed a statistically significant increase in Berg Balance Scale (BBS) scores indicating enhanced postural control and reduced fall risk.[8] These findings are consistent with prior literature demonstrating that moderate-intensity aerobic exercise can improve balance by enhancing neuromuscular coordination and proprioceptive function in individuals with PD. [9,18] The progressive and task-oriented aerobic exercise protocol, incorporating large-amplitude movements and rhythmic cueing, likely facilitated these balance improvements by promoting motor learning and movement efficiency. [24,25]

Quality of Life (QoL), assessed via the Parkinson's Disease Questionnaire-39 (PDQ-39), showed a significant reduction in mean percentage scores, reflecting better overall health perceptions and emotional well-being. [4] This is consistent with studies indicating aerobic exercise improves mood, sleep quality, and cognitive symptoms, which collectively enhance QoL in individuals with PD. [12,14,27] The participant's positive adaptation to the exercise regimen and increased physical competence may also boost self-efficacy and reduce diseaserelated anxiety, contributing to improved QoL. [20]

The benefits observed across Balance, ADLs, and QoL domains likely relate to the program's tailored nature, which did not require specialized equipment, thus enhancing adherence and safety. [21] The moderate intensity range (40-60% Heart Rate Reserve) was well tolerated, ensuring feasible implementation in similar populations where access to clinical-grade exercise facilities is limited. [23]

Overall, the findings of this case study support the role of individualized aerobic exercise not only in improving motor performance but also in translating these gains into meaningful functional and quality-of-life improvements in individuals with Parkinson's disease. [4,8,18]

Conclusion:
We concluded that the moderate-intensity aerobic exercise program of 40% to 55% of HRR was well tolerated by the individual with Parkinson's disease and there were clinically significant improvements in functional activity, balance and quality of life.

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