



EFFECTS OF ROUTINE PHYSICAL THERAPY WITH AND WITHOUT HIGH INTENSITY INTERVAL TRAINING ON BALANCE, QUALITY OF LIFE AND FUNCTION IN PARKINSON'S DISEASE PATIENTS

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Abstract

Background: Parkinson's disease, is a degenerative neurological disorder, may have an adverse effect on movement, balance, and coordination. Physical therapy, a frequent Parkinson's disease treatment, tries to improve the patient's balance, gait, and general quality of life. High-Intensity Interval Training (HIIT) is a kind of exercise that involves periods of intensive activity followed by periods of relaxation. In helping people with Parkinson's disease improve their balance and lower their risk of collapsing, HIIT may be more beneficial than traditional physical therapy. However, further study is needed to validate these results and determine the best amount and style of physical therapy for Parkinson's disease patients.

Objective(s): The objective of this study was to determine the effects of routine physical therapy with and without high intensity interval training on balance, quality of life and function in Parkinson's disease patients.

Methodology: A randomized clinical trial was carried out by the Department of Physical Therapy at the Link Medical Centre in Lahore. The research included 62 Parkinson's disease patients from the department of physical therapy who were separated into two treatment groups. The most successful way for identifying the severity of a disease was revealed to be a mix of questionnaires, interviews, and exams. The questionnaires collected a variety of demographic information. Data was collected using the 6-minute walk test and the Parkinson's disease questionnaire, and the functional level in basic daily activities was assessed using the Barthel index scale. Furthermore, the Berg balance scale was utilised to assess the balance of Parkinson's disease patients.

Result: The Tests of Normality, both the Kolmogorov-Smirnov and the Shapiro-Wilk, were conducted on all variables for both the Conventional and HIIT groups. For the Conventional Group, the p-values of these tests ranged from 0.046 to 0.289, and for the HIIT Group, they ranged from 0.087 to 0.781. All p-values were greater than the commonly used significance level of 0.05, indicating that we failed to reject the null hypothesis that the data follows a normal distribution for

each test within both groups. Therefore, all data in this study can be considered as parametric, justifying the use of parametric statistical tests for further analysis

Conclusion(s): The study concluded that between-group comparisons reveal HIIT to be significantly more effective than routine physical therapy in enhancing balance and potentially mitigating fall risks for Parkinson's disease patients. Although both modalities improved quality of life and function, the distinctive advantages of HIIT are noteworthy. Continued research is crucial to pinpoint optimal physical therapy strategies for this group, but the current insights highlight the value of high-intensity approaches.

Key Term: Routine physical therapy, high intensity interval training, balance, quality of life, function, Parkinson's disease.

Introduction

Parkinson's disease is a neurological disorder that gradually damages the part of the brain responsible for movement coordination.¹ One of the distinguishing features of this illness is the progressive death of dopamine-producing nerve cells in the substantia nigra.² Dopamine insufficiency causes motor symptoms such as tremors, stiffness, bradykinesia (slow movement), and balance and coordination problems.³ Patients may suffer non-motor symptoms in addition to motor symptoms. Despite the fact that the etiology of Parkinson's disease is unclear, patients have access to a number of therapies that may help them better manage their symptoms and maintain a greater quality of life.⁴ The frequency of Parkinson's disease varies greatly across people and areas, according to my most recent update, which was completed in September 2021.⁵ According to some estimates, Parkinson's disease affects around one percent of people over the age of 60 globally. It is possible that the frequency in certain areas is as high as 2% or 3% of the senior population.⁶

Parkinson's disease is more common among the elderly, which is why age is seen as such a big risk factor. Environmental pollutants, such as pesticides or heavy metals, may raise a person's likelihood of getting Parkinson's disease, according to one theory.⁷ The fundamental pathogenic hallmark of Parkinson's disease is the buildup of aberrant protein aggregates known as Lewy bodies.⁸ This buildup is especially noticeable in the nerve cells that produce dopamine. The protein alpha-synuclein, which is thought to play a role in neurodegeneration, has been found in these Lewy bodies.⁹

The course and symptoms of a person's disease may impair their ability to complete daily duties, participate in social relationships, and retain their independence.¹⁰ The following are some of the elements that may have an influence on a patient's quality of life in Parkinson's disease.¹¹ The intensity of motor symptoms, such as tremors, delayed movement, and difficulties with balance, may affect a person's ability to carry out everyday duties as well as participate in social and recreational activities.¹²

Physiotherapy plays a vital role in the comprehensive management of Parkinson's disease, aiming to improve mobility, balance, and overall functional abilities.¹³ The primary objectives of physiotherapy are to enhance the patient's quality of life, maintain independence in daily activities, and reduce the risk of falls.¹⁴ Through a combination of tailored exercises, balance training, gait training, and strength exercises, physiotherapists work to address the motor symptoms characteristic of Parkinson's disease.¹⁵

It was a check list used by medical practitioners to determine whether or not the symptoms seen were indicative of the condition.¹⁶ On the other hand, we no longer support this viewpoint. Following recent developments, the International Parkinson and Movement Disorder Society has established totally new guidelines. This list contains the most recent information about the condition that has been discovered.¹⁷ Therapists work on balance training to reduce the risk of falls, gait training to enhance walking patterns and mobility, and strengthening exercises to maintain muscle strength and flexibility.¹⁸

Coordination exercises and range of motion exercises are employed to enhance motor control and joint flexibility. Additionally, endurance training and functional training are incorporated to improve stamina and enhance independence in daily activities.¹⁹ This is what makes HIIT so effective at improving anaerobic energy generation. Because anaerobic energy systems are intended for brief, intense bursts of activity, HIIT activities often last less than 30 minutes. HIIT exercises, on the other hand, may go as long as you like.²⁰ The lengths are customizable according on the fitness level of the user. The aerobic system, on the other hand, takes over after 20-45 seconds of physical effort and may last up to 75 seconds. The benchmark for HIIT exercises used to be twenty seconds on, ten seconds off.²¹ However, studies show that young women who engaged in HIIT courses had substantial changes in their body fat distribution.²² Furthermore, some researchers argue that HIIT demands "an extremely high level of subject motivation," and they question whether the general population could safely or practically continue the rigorous nature of the programme.²³

The rationale of study is underlying mechanism of intensive training to slow down Parkinsonism. High-intensity interval training (HIIT) is a form of exercise that involves short bursts of intense activity followed by periods of rest or low-intensity activity. HIIT has been shown to be an effective way to improve cardiovascular fitness and other health markers in various populations. Some studies have also suggested that HIIT may have benefits for PD patients, including improvements in balance and gait Parkinson's disease (PD) is a neurodegenerative disorder that affects movement and cognition, leading to negative impacts on an individual's quality of life and daily activities. Physical therapy (PT) has been shown to be an effective treatment for PD, improving mobility, balance, and overall function

Objective: The objective of this study was to determine the effects of routine physical therapy with and without high intensity interval training on balance, quality of life and function in Parkinson's disease patients.

Methodology

The study employed a Randomized Control Trial design and was conducted at the Physical Therapy Department of Link Medical Center in Lahore. The duration of the study spanned nine months, initiated after the approval of the synopsis. The estimated sample size was 52, accounting for a 20% expected dropout rate. Adjusting for this, the final sample size was 62, with 31 participants allocated to each group. Non-probability Purposive sampling was employed for participant selection, with a physician utilizing cardiopulmonary exercise tests to assess suitability for high-intensity interval training. Inclusion criteria comprised both male and female patients aged between 40 to 80 years, diagnosed with Parkinson's disease, able to walk independently for at least 10 meters, and having not participated in high-intensity interval training within the last six months. Exclusion criteria included comorbidities, cardiac events, cognitive impairment, musculoskeletal issues, uncontrolled hypertension, and contraindications to high-intensity interval training. The study followed a single-blind protocol, with physiotherapists masked to the treatment protocol. Randomization was conducted using computerized methods with online random number generating software. The assessment involved 62 patients with Parkinson's disease recruited into two treatment groups, assessing the severity of the condition through questionnaires, interviews, and evaluations. Data collection procedures included reliable and valid questionnaires covering demographic data, the Barthel index scale for functional status, the 6-minute walk test, and the Parkinson's disease questionnaire for comprehensive evaluation.

Results

Both groups had similar demographics in terms of age, height, weight, BMI, and gender distribution. All data passed the normality tests, indicating it can be analyzed using parametric tests. Both groups showed significant improvements from baseline to Week 4. The HIIT group showed a greater improvement compared to the conventional group, with a significant difference observed at Week 4 (p -value < 0.000). Both groups demonstrated significant improvements from baseline to

Week 4. The HIIT group exhibited a larger improvement compared to the conventional group, with a significant difference observed at Week 4 (p-value < 0.000). Both groups showed significant reductions in scores from baseline to Week 4, indicating a decrease in Parkinson's disease symptoms. The HIIT group demonstrated a larger reduction compared to the conventional group, with a significant difference observed at Week 4 (p-value < 0.000). Both groups exhibited significant improvements in walking distance from baseline to Week 4. The HIIT group showed a greater increase in walking distance compared to the conventional group, with a significant difference observed at Week 4 (p-value < 0.000).

Table 1 Comparative Gender

Gender	Response	Conventional Group		HIIT Group		P Value
		Frequency	Percent	Frequency	Percent	
Male		22	71.0	19	61.3	0.421
Female		9	29.0	12	38.7	
Total		31	100.0	31	100.0	

In the Conventional Group, there were 31 participants, of which 71.0% (22 participants) were male and 29.0% (9 participants) were female. In contrast, the HIIT Group also comprised of 31 participants, with a slightly different gender distribution: 61.3% (19 participants) were male and 38.7% (12 participants) were female. Despite these differences, the gender distribution between the two groups was not statistically significant, as suggested by the p-value of 0.421, indicating that the variation could be attributed to chance.

Table 2 Demographic Variables

Demographic Variables	Conventional Group		HIIT Group		P Value
	Mean	Std. Deviation	Mean	Std. Deviation	
Age	57.87	9.30	59.52	8.95	0.481
Height (cm)	169.23	8.05	169.19	8.82	0.988
Weight (kg)	67.45	11.04	67.58	11.83	0.985
BMI	26.05	2.41	26.08	2.71	0.957

The data from both the Conventional Group and the HIIT Group were analyzed. The results regarding age showed that the mean and std deviation found to be 57.87+9.30 for age in conventional group and 59.52+8.95 for HIIT group, 169.23+8.05 for Height in conventional group and 169.19+8.82 for HIIT group, 67.45+11.04 for weight in conventional group and 67.58+11.83 for HIIT group and 26.05+ 2.41 for BMI in conventional group and 26.08+2.71 for height in HIIT group.

Table 3 Comparative Summary of results

Outcome Measure	Conventional Group	HIIT Group	Difference (HIIT-Conventional)	P-value
Baseline Barthel Index	64.19	64.39	0.20	0.854
Week 4 Barthel Index	73.48	78.03	4.55	0.000
Baseline Berg Balance Scale	30.23	32.32	2.09	0.170
Week 4 Berg Balance Scale	39.94	46.48	6.54	0.000
Baseline Parkinson Disease Questionnaire	64.19	64.39	0.20	0.854
Week 4 Parkinson Disease Questionnaire	38.03	27.06	10.97	0.000
Baseline 6-Minute Walk Test	289.10	289.97	0.87	0.853
Week 4 6-Minute Walk Test	388.19	423.87	35.68	0.000

Both groups showed significant improvements from baseline to Week 4 in all outcome measures, except for the Barthel Index at baseline. The HIIT group consistently demonstrated greater improvements compared to the conventional group, with statistically significant differences observed at Week 4 for all outcome measures.

Table 4 Comparative Summary of Within-Group Changes

Outcome Measure	Conventional Group	Change from Baseline	P-value	HIIT Group	Change from Baseline	P-value
Barthel Index	64.19 (Mean)	9.29 (Increase)	0.000	64.39 (Mean)	13.64 (Increase)	0.000
Berg Balance Scale	30.23 (Mean)	9.71 (Increase)	0.000	32.32 (Mean)	14.16 (Increase)	0.000
Parkinson Disease Questionnaire	64.19 (Mean)	26.16 (Decrease)	0.000	64.39 (Mean)	37.32 (Decrease)	0.000
6-Minute Walk Test	289.10 (Mean)	99.10 (Increase)	0.000	289.97 (Mean)	133.90 (Increase)	0.000

Both groups exhibited statistically significant improvements in all outcome measures from baseline to Week 4. The HIIT group generally demonstrated larger improvements compared to the conventional group, although the magnitude of difference varied across measures.

Discussion.

Parkinson's disease (PD), is a progressive neurodegenerative condition, significantly impacts patients' motor functions, leading to balance and coordination issues. Physical therapy, as an essential rehabilitation method, offers promising outcomes in managing such challenges. However, the potential of incorporating High Intensity Interval Training (HIIT) into physical therapy regimens for PD patients remains largely unexplored. This research delves into this gap, aiming to provide empirical evidence for or against the combined approach.^{24, 25}

With a sample of 62 PD patients experiencing balance and functional complications, the research holds promise for a robust evaluation. Recruited from the physical therapy department, the participants' allocation into two distinct treatment groups allows for the direct comparison of routine physical therapy with the innovative combination of HIIT.^{26, 27} The heterogeneity of the disease necessitates the use of varied assessment tools to capture a holistic view of the participants' status and progress. With an emphasis on reliability, the chosen tools not only focus on demographic specifics but also dive deep into the functional, qualitative, and performance-based aspects of PD.^{28, 29}

Patients in the first treatment group participated in High-Intensity Interval Training (HIIT), which comprised a warm-up phase, high-intensity exercise repetitions alternated with medium-intensity exercises for recovery, and a cool-down time at the end of the session.³⁰ The high-intensity activities were done at or near full effort, whereas the medium-intensity exercises were done at 50% effort. The HIIT workouts included a 2:1 work-to-recovery ratio, such as 30–40 seconds of frenetic sprinting followed by 15-20 seconds of jogging or walking, and this pattern was repeated until the individual was exhausted.³¹⁻³³ A clock or timer was used to keep track of time, repetitions, and intensity level during the HIIT session. The session lasted anything from four to thirty minutes.³⁴ The second treatment group, on the other hand, received regular physical therapy, which included a ten-minute session of heat therapy, ten repetitions of range-of-motion exercises, and three sixty-second stretches. The Independent Samples t-test was then used to determine the variables of interest for both groups' results.^{35, 36} At the start of the trial, there were no significant differences in the Barthel Index and Berg Balance Scale scores, the distances travelled on the 6-Minute Walk Test, or the Parkinson Disease Questionnaire scores between the Conventional and HIIT groups. Significant departures from the norm were found in week 4. The scores achieved by the HIIT Group

and those obtained by the Conventional Group improved statistically significantly. Similarly, at week 4, the HIIT Group outperformed the Conventional Group on the Berg Balance Scale, 6 Minute Walk Test distances, and Parkinson Disease Questionnaire scores.³⁷ Parkinson's disease (PD) symptoms include common and severe imbalance. Patients with Parkinson's disease may improve their balance and postural stability by doing both balance training and strength exercises, rather than only balance training.³⁸ Morris et al. (2009) found the advantages of cognitive training in conjunction with motor training (functional tasks and aerobic training, treadmill walking or stationary cycling) and physical exercise in the prevention of injuries.³⁹ The varied treatment durations (ranging from three to sixty-four weeks) and limited data on follow-up effects may contribute to the diverse study conclusions. Keus et al. provided evidence-based physiotherapy recommendations for Parkinson's disease patients, suggesting that improvements in functioning may occur in four weeks, while enhancing physical competence may require at least eight weeks. However, no specific advice on improving quality of life was given. Based on the findings of the analyzed studies, therapies lasting more than 12 weeks appear to have the potential to bring about a meaningful improvement in an individual's quality of life.⁴⁰

Conclusion

The study concluded that between-group comparisons reveal HIIT to be significantly more effective than routine physical therapy in enhancing balance and potentially mitigating fall risks for Parkinson's disease patients. Although both modalities improved quality of life and function, the distinctive advantages of HIIT are noteworthy. Continued research is crucial to pinpoint optimal physical therapy strategies for this group, but the current insights highlight the value of high-intensity approaches.

The study, while insightful, faces limitations due to its small sample size, which restricts the generalizability of the results. Furthermore, it did not account for variables like medication use and disease severity, which could influence balance, quality of life, and function. The absence of a control group not undergoing physical therapy hampers the ability to distinctly attribute the observed effects to high-intensity interval training (HIIT) alone. In light of these constraints, future research should consider comparing HIIT with lower intensity exercises to discern their relative impacts. To enhance representativeness and reliability, larger sample sizes encompassing a broader spectrum of Parkinson's disease patients in Pakistan are recommended. Including control groups of patients not receiving any physical therapy is also crucial to isolate the effects of the intervention more accurately. Additionally, the reliance on self-reported outcome measures in the study introduces the possibility of response bias, which future studies should aim to mitigate.

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