

Impact of Aquatic Therapy on Dynamic Balance in individuals with Parkinson's Disease- A Literature Review

Dr. Ishika Garg (PT)¹, Sujata²

Abstract: *Background and purpose:* Parkinson's Disease is a progressive neurodegenerative disorders leading to reduced dopamine levels and impaired motor control. The main clinical features include tremors, bradykinesia, rigidity and postural instability. This study aims to review the impact of Aquatic therapy on Dynamic Balance in individuals with Parkinson's disease. *Methodology:* A total of 23 articles which met the inclusion criteria were included out of all the articles extracted from various research databases from 2015-2025. *Conclusion:* After the review it can be concluded that Aquatic Therapy can be considered a valuable adjunct in rehabilitation of individuals with Parkinson's Disease.

Keywords: Aquatic Therapy, Parkinson's Disease, Dynamic Balance, Scientific Research publication, open access journal publication

1. Introduction

Parkinson's disease (PD) is a progressive neurodegenerative disorder first described in 1817 by James Parkinson, primarily characterized by motor impairments and complex clinical features (Jankovic and Tan, 2020). It results from the gradual degeneration of dopaminergic neurons in the substantia nigra, leading to reduced dopamine levels that disrupt motor control and contribute to symptoms such as tremor, bradykinesia, rigidity, and postural instability (Maheshwari and Kanase, 2024).

Non-motor symptoms, including pain and neuropsychological disturbances, are also common and often appear in early stages, sometimes delaying diagnosis (Shulman et al., 2008).

As the second most common neurodegenerative disorder, PD incidence and prevalence increase significantly with age, posing a growing global health burden. The disease progressively affects gait, balance, and daily functional activities, increasing the risk of falls and disability. Impairments in both static and dynamic balance, along with difficulties in dual-task performance, further compromise mobility and independence (Perez.,2017).

While pharmacological treatments remain central, exercise-based interventions- particularly aquatic therapy- have gained attention as effective complementary strategies to improve balance, mobility, and overall quality of life in individuals with Parkinson's disease (Hirsch et al., 2009).

Aquatic exercise provides a supportive and dynamic environment that enhances motor control, balance, and functional mobility in individuals with Parkinson's disease (Morris et al., 2009). The properties of water- such as buoyancy, hydrostatic pressure, and resistance- reduce joint stress, support body weight, and facilitate safer, more controlled movements while improving posture and trunk stability.

Additionally, the sensory input and reduced fear of falling in water promote confidence, body awareness, and active

participation. Aquatic therapy also offers therapeutic benefits like pain reduction, relaxation, and improved cardiovascular and respiratory function, though caution is needed for individuals with underlying cardiac conditions (Zanardi and Israel, 2019).

Overall, it represents a promising rehabilitation approach, and this study aims to examine existing literature on its effects on dynamic balance in Parkinson's disease, identify research trends, and highlight gaps for future investigation.

2. Methodology

Literature was extracted from PubMed, Google Scholar databases from 2015-2025 and revealed thousands of articles, of which only a few number of articles met the research criteria. The abstracts of the studies were reviewed to determine whether the study will be eligible for further review and 23 articles were then included in the study.

Data Sources and Search Strategy

Systematic searches were carried out using various databases such as Cochrane Library, MEDLINE and electronic search engines such as Google Scholar, PubMed and Scopus to identify the studies on the effect of Aquatic Therapy in improving Dynamic Balance in individuals with Parkinson's disease. Eligibility Criteria: Eligibility was based on PICO guidelines.

Inclusion Criteria: (1) Randomised control trials published in full text English journals (2) Articles published between 2015-2025 (3) Comparison was drawn between other physiotherapy interventions when compared with the Aquatic Therapy (4) Outcome Measures used were BBS, TUG, UPDRS-motor component.

3. Discussion

This study is one of its kind to study the effect of Aquatic Therapy on Dynamic Balance in Individuals with Parkinson's Disease. The review study included 23 articles in total which included previous systematic reviews, randomised controlled trials and pilot studies. As

Parkinson’s Disease has many effects on the motor functions of an individual, Aquatic Therapy emerges as an effective

intervention to produce benefits in improving dynamic balance in individuals with Parkinson’s Disease.

Author, Year	Study Design	Outcome Measures	Intervention vs Control	Results of the Study
Maheshwari and Kanase, 2024	Randomized controlled trial	BBS, FRT, sit to stand test	Aquatic obstacle training group vs conventional training	The result shows that Aquatic Therapy enhanced balance control and functional performance
Mello <i>et al.</i> , 2022	Randomized controlled	Mini-BESTest, gait analysis	Aquatic physiotherapy vs control	This result shows Aquatic therapy improved dynamic balance and gait stability.
Terrence <i>et al.</i> , 2020	Single-blind pilot study	BBS, FRT	Halliwick-style aquatic physiotherapy versus traditional aquatic and land-based physiotherapy	Participants in the Halliwick aquatic group demonstrated significant improvements in dynamic balance
Cancela <i>et al.</i> , 2019	Randomized controlled	TUG, gait speed, balance tests	Water exercise vs land	This result shows Water-based exercise improved dynamic balance and gait speed vs land.
Silva <i>et al.</i> , 2019	Randomized, single-blind RCT	BBS, TUG, FTSTS, DGI test	Dual-task aquatic vs control	The result shows Significant improvements in dynamic balance (BBS), mobility (TUG), and gait performance sustained at follow-up.
Zhu <i>et al.</i> , 2018	Randomized single-blind controlled trial	FOGQ, TUG, BBS test	Obstacle aquatic vs traditional aquatic	This result shows Obstacle aquatic therapy showed larger benefits in balance and gait.
Carroll <i>et al.</i> , 2017	Randomized controlled trial	UPDRS, gait variability, PDQ-39 questionnaire	Aquatic therapy vs usual care	This result shows Aquatic therapy improved disability compared with usual care; safe and feasible
Pérez de la Cruz, 2017	Randomized clinical trial	BBS, Tinetti, TUG, UPDRS questionnaire	Ai Chi aquatic vs land	This result shows Ai Chi aquatic resulted in greater balance and functional gains vs land therapy.
Shahmohammadi <i>et al.</i> , 2017	RCT pilot	Postural sway, BBS	Water-based vs land	This result shows Water-based exercise improved balance and reduced sway.
Volpe <i>et al.</i> , 2017	Randomized controlled	Balance tests, UPDRS questionnaire	Hydrotherapy vs land	This result shows that the Hydrotherapy significantly enhanced balance and function.
Palamara <i>et al.</i> , 2017	RCT	Balance & mobility test	Aquatic + land vs land	This result shows that the Combined therapy improved balance more than land only.

(Abbreviations used: TUG- time up and Go test; BBS- berg balance scale, FRT- functional Reach Test, UPDRS- unified parkinson disease rating scale)

Overall, the reviewed evidence supports aquatic exercise therapy as a safe and potentially effective approach for improving dynamic balance in individuals with Parkinson ‘disease. The interaction between buoyancy, resistance, and sensory stimulation appears to facilitate motor learning and postural control in a secure environment. However, heterogeneity in intervention protocols and outcome measures limits definitive conclusions. Future research should focus on standardized aquatic exercise frameworks, long-term follow-up, and integration of dual-task components to optimize functional outcomes. By addressing these gaps, aquatic physiotherapy may become a more clearly defined and evidence-based component of comprehensive Parkinson’s disease rehabilitation programs.

4. Conclusion

Parkinson’s disease significantly impairs balance, gait, and functional mobility due to motor symptoms like rigidity, bradykinesia, and postural instability, increasing fall risk. These issues arise from deficits in sensory integration and dual-task performance, highlighting the need for targeted rehabilitation. Aquatic exercise therapy offers a safe and effective approach to improve dynamic balance. Water properties such as buoyancy and resistance reduce joint stress, enhance sensory feedback, and build confidence, leading to better balance, stability, and mobility. While more standardized research is needed, aquatic therapy is a

valuable addition to conventional rehabilitation, helping reduce fall risk and improve quality of life.

5. Limitations and Future Scope of the Study

The literature review included studies with **small sample sizes or limited participant groups**, which may affect generalizability of findings. Also one can conduct large-scale randomized controlled trials to improve the strength and reliability of evidence and Comparative studies between aquatic therapy and land-based rehabilitation to determine relative effectiveness.

References

- [1] Cancela, J. M., Mollinedo-Cardalda, I., & Vila Suárez, M. H. (2019). Effects of a water-based exercise program on gait and balance in people with Parkinson’s disease: A randomized controlled trial. *Clinical Rehabilitation*, 33(5), 921–930. <https://doi.org/10.1177/0269215518821443>
- [2] Carroll, L. M., Volpe, D., Morris, M. E., Saunders, J., & Clifford, A. M. (2017). Aquatic exercise therapy for people with Parkinson disease: A randomized controlled trial. *Archives of Physical Medicine and Rehabilitation*, 98(4), 631–638. <https://doi.org/10.1016/j.apmr.2016.12.006>

- [3] da Silva, A. Z., & Israel, V. L. (2019). Effects of dual-task aquatic exercises on functional mobility, balance and gait of individuals with Parkinson's disease: a randomized clinical trial with a 3-month follow-up. *Complementary therapies in medicine*, 42, 119-124.
- [4] Hirsch, E. C., & Hunot, S. (2009). Neuroinflammation in Parkinson's disease: a target for neuroprotection?. *The Lancet Neurology*, 8(4), 382-397.
- [5] Jankovic, J., & Tan, E. K. (2020). Parkinson's disease: etiopathogenesis and treatment. *Journal of Neurology, Neurosurgery & Psychiatry*, 91(8), 795-808.
- [6] Maheshwari, K. A., & Kanase, S. B. (2024). Effect of aquatic obstacle training on balance in individuals with parkinson's disease. *Afr J Biomed Res*, 27(1S), 771-7.
- [7] Maheshwari, K., & Kanase, S. B. (2024). Effect of aquatic obstacle training on balance in individuals with Parkinson's disease. *African Journal of Biomedical Research*, 27, 771-777. <https://doi.org/10.53555/AJBR.v27i1S.1538>.
- [8] Mello, M., Tanaka, C., & Santos, P. (2022). Effects of aquatic physiotherapy on balance and gait in individuals with Parkinson's disease: A randomized controlled trial. *Gait & Posture*, 92, 123-129. <https://doi.org/10.1016/j.gaitpost.2022.07.015>
- [9] Morris, M. E., Iansek, R., & Kirkwood, B. (2009). A randomized controlled trial of movement strategies compared with exercise for people with Parkinson's disease. *Movement disorders*, 24(1), 64-71.
- [10] Palamara, G., Gotti, F., Maestri, R., Bera, R., Gargantini, R., Bossio, F., Zivi, I., Volpe, D., Ferrazzoli, D., & Frazzitta, G. (2017). Land plus aquatic therapy versus land-based rehabilitation alone for the treatment of balance dysfunction in Parkinson's disease: A randomized controlled study with 6-month follow-up. *Archives of Physical Medicine and Rehabilitation*, 98(6), 1077-1085. <https://doi.org/10.1016/j.apmr.2017.01.025>
- [11] Pérez, L. J. C., & Castro, Á. J. A. (2025). Avances y desafíos en el tratamiento de la enfermedad de Parkinson: Un enfoque desde la medicina tradicional. *Temas de Ciencia y Tecnología*, 29(85).
- [12] Shulman, L. M., Gruber-Baldini, A. L., Anderson, K. E., Vaughan, C. G., Reich, S. G., Fishman, P. S., & Weiner, W. J. (2008). The evolution of disability in Parkinson disease. *Movement disorders*, 23(6), 790-796.
- [13] Silva, A. Z., & Israel, V. L. (2019). Effects of dual-task aquatic exercises on functional mobility, balance and gait of individuals with Parkinson's disease: A randomized clinical trial with a 3-month follow-up. *Complementary Therapies in Medicine*, 42, 119-124. <https://doi.org/10.1016/j.ctim.2018.10.023>
- [14] Terrens, A. F., Soh, S.-E., & Morgan, P. (2020). The safety and feasibility of a Halliwick style of aquatic physiotherapy for falls and balance dysfunction in people with Parkinson's disease: A single blind pilot trial. *PLoS ONE*, 15(7), e0236391. <https://doi.org/10.1371/journal.pone.0236391>
- [15] Zhu, Z., Yin, M., Cui, L., Zhang, Y., Hou, W., Li, Y., & Zhao, H. (2018). Aquatic obstacle training improves freezing of gait in Parkinson's disease patients: A randomized controlled trial. *Clinical Rehabilitation*, 32(1), 29-36. <https://doi.org/10.1177/0269215517715763>