

*REVIEW Article*

## Beyond Medication: A Systematic Review of the Role of Dance Therapy in Managing Parkinson's Disease

Muhammad Usama<sup>1</sup>, Muhammad Ikrama<sup>1,\*</sup>, Maryam Humayon<sup>1</sup>, Shifa Israr<sup>1</sup>

<sup>1</sup> Services Institute of Medical Sciences, Lahore, Pakistan

\* Corresponding author: Dr. Muhammad Ikrama, Services Institute of Medical Sciences, Lahore, Pakistan,;  
Email: ikpolymath@gmail.com.

Submitted: Apr 13, 2023; Revised: Oct 10, 2023; Accepted: Jan 28, 2024; Published: Jan xx, 2024

Citation: Usama M, Ikrama M, Humayon M, Israr S. Beyond Medication: A Systematic Review of the Role of Dance Therapy in Managing Parkinson's Disease. *Discoveries Reports* 2024; 7: e43. DOI: 10.15190/drep.2024.2

### ABSTRACT

Parkinson's disease (PD) is a common and complex neurodegenerative disorder with diverse symptoms and causes. It affects both motor and non-motor functions and reduces the quality of life of patients and caregivers. Dance therapy is a novel therapeutic approach that combines physical and mental exercises to enhance motor and non-motor functions in PD patients. However, the research on this topic has several gaps and challenges. This systematic review aims to assess the effectiveness and limitations of dance therapy as a treatment for PD. The review included 17 clinical trials examining the impact of various types of dances on different aspects of PD, such as physical and mental performance, mood, anxiety, walking speed, balance, and quality of life. The review found that dance therapy is an effective intervention that can improve motor and non-motor functions in patients with PD. However, the current research is constrained by the absence of standardized protocols and lack of large-scale trials thus limiting the reproducibility and generalizability of the results. Future research on dance therapy for PD should aim to develop standardized protocols and outcome measures, conduct large-scale and long-term clinical trials, explore the mechanisms of dance therapy effects using multi-modal methods, and increase the availability and affordability of dance therapy programs. These efforts will help confirm the

effectiveness of dance therapy for PD conclusively and promote its wider use as a therapeutic approach.

### Keywords

Dance Therapy; Gait; Parkinson Disease; Quality of Life; Rehabilitation.

### Abbreviations

Parkinson's disease (PD); Hoehn and Yahr (H and Y); Mini Mental State Examination (MMSE); Frontal Assessment Battery (FAB); Montreal Cognitive Assessment (MoCA); Clinical Global Impression of Change (CGI-C); Parkinson's Disease Questionnaire-39 (PDQ-39); Parkinson's disease Quality of Life questionnaire (PDQL); Quality of Life (QoL); Parkinson's Disease Fatigue Scale (PFS); Mental Rotation Task (MRT); VAFS: Visual Analog Fatigue Scale (VAFS); Beck Depression Inventory (BDI); Fatigue Severity Scale (FSS); Apathy Scale (AS); Freezing of Gait Questionnaire (FOG Q); Starkstein Apathy Scale (SAS); Self-rating Depression Scale (SDS); 6-min walking test (6MWT); Timed Up and Go (TUG); Back Scratch Test (BST); Sit-and-Reach Test (SRT); Standing-Start 180° turn test (SS180); Berg Balance Scale (BBS); Five Times Sit-to-Stand Test (FTSST); Mini-Balance Evaluation Systems Test (Mini-BESTest); Physical Activity Scale for the Elderly (PASE); Movement Disorder Society-Sponsored

Revision of the Unified Parkinson's Disease Rating Scale (MDS-UPDRS).

## INTRODUCTION

Parkinson's disease (PD), a condition that is widely recognized within the medical community, presents itself through a diverse array of clinical symptoms and etiologies. This particular neurodegenerative affliction has been rapidly increasing in prevalence, and its impact on those affected cannot be overstated<sup>1</sup>. Parkinson's disease is caused by a combination of different factors, and its main feature is the gradual degeneration of a specific part of the brain, the substantia nigra. This is accompanied by the buildup of  $\alpha$ -synuclein in Lewy bodies. This debilitating condition arises from a confluence of genetic predispositions and environmental influences, highlighting the multifaceted nature of its pathogenesis. It can cause a variety of movement related symptoms, such as bradykinesia, akinesia, tremor and rigidity as well as other motor dysfunctions such as gait disturbance, handwriting impairment, decreased grip strength, and speech difficulties, these motor symptoms can lead to falls and potential life threatening injuries<sup>2,3</sup>. Parkinson's disease is not just limited to motor symptoms, but also has a profound impact on a patient's mood and emotional state, including apathy, anhedonia, depression, and cognitive dysfunction, which can lead to hallucinations and complex behavioral disorders<sup>4</sup>. These non-motor symptoms further demonstrate the wide-ranging and devastating effects of this debilitating condition, all of these symptoms contribute to poorer quality of life of both the patients and their caregivers, underscoring the need for effective treatments and support for those affected<sup>5</sup>.

The conventional therapy for Parkinson's disease involves the use of pharmacological agents, such as daily oral carbidopa/levodopa or dopamine agonists, to replace dopamine and alleviate motor symptoms. However, many patients also turn to complementary and alternative medicine and integrative approaches to enhance their overall health and well-being because the effectiveness of traditional treatments for Parkinson's disease can deteriorate over the course of the disease, leading to limitations and decreased efficacy. This progressive nature of Parkinson's disease underscores the need for ongoing research and innovation in developing new and more effective treatments<sup>6</sup>.

There are a range of non-pharmacological approaches that can help alleviate the symptoms of Parkinson's disease, including exercise and physical therapy, dance, cognitive-behavioral therapy, gait training, speech therapy, and practices such as yoga. These interventions not only address movement and gait disturbances, but also aim to promote overall well-being and enhance the quality of life for the affected. By utilizing a multifaceted and holistic approach to treatment, individuals with Parkinson's can gain greater control over their symptoms and lead more fulfilling lives.

The utilization of creative therapies, such as art and singing, and exercise in the treatment of this disorder is gaining recognition as a powerful tool of self-expression, management and empowerment for those affected. Studies have demonstrated that exercise plays an important role in improving mobility and addressing non-motor symptoms such as mood and cognition<sup>7</sup>. Dance which is a unique blend of physical and mental activity, has demonstrated its ability to address motor impairments and in the past two decades it has gained importance in treating motor symptoms of Parkinson's<sup>8</sup>.

The transformative power of dance extends beyond physical well-being, with research demonstrating its ability to improve gait velocity and stride length (distance covered by one step during walking), in patients with PD. The art of dance, including waltz, ballet, tango etc, is a rich tapestry of sensory and motor experiences that promote a multitude of cueing strategies. The powerful rhythms of the music provide auditory cues that help to initiate and execute movement, while the visual cues of coordinating steps with a partner or following their footwork can increase step size and link movement sequences. This combination of auditory and visual cues in dance can aid in reducing freezing of gait which is a common symptom in Parkinson's disease, through enhancing motor training. Through its dynamic and varied nature, dance becomes a potent tool for developing and improving physical, cognitive, and emotional well-being<sup>9</sup>.

Although there has been a significant amount of research conducted on the use of dance therapy to alleviate symptoms of PD, there is still a lack of consensus among researchers on the specific mechanisms and effects of this therapeutic approach. This highlights the importance of continuing to explore the topic through further research, which could help to provide a clearer understanding of the

potential benefits of dance therapy for Parkinson's patients.

Additionally, having strong, reliable evidence supporting the use of dance therapy is crucial for ensuring that patients with Parkinson's receive the most effective treatment possible. Conducting more research would allow for the gathering of additional evidence and a deeper understanding of how dance therapy can be utilized in clinical practice. The main objective of this systematic review is to critically evaluate the available literature on the effects of dance therapy on motor and non-motor symptoms in people with PD and to provide a comprehensive overview of the current state of knowledge in this area, while discussing the gaps or inconsistencies in the literature.

## MATERIALS AND METHODS

### *Literature search strategy*

A comprehensive electronic literature search was performed from the day of idea inception till 20th December 2022, utilizing databases including PubMed, Cochrane Library and ScienceDirect spanning the years 2015 to 2022. The search process utilized a combination of following terms and Medical Subject Headings (MeSH) to yield the desired results: (Parkinson\*) AND ((Dance) OR (Dancing)) in Title/Abstracts/Key. The searches included articles in English only.

### *Eligibility criteria*

This review considered both non-random and randomized-controlled trials published in peer-reviewed journals, which encompass the highest standards of academic rigor and credibility. This review was comprehensive in scope, encompassing studies of any type of dance practiced in various regions. The focus was on examining the effects of dance on elderly individuals with established diagnosis of Parkinson's disease, regardless of gender. Only English journals were selected, published between January 2015 to December 2022.

### *Outcome*

The outcome includes improvements in both the physical manifestations of PD patients and their

subjective experiences and perceptions, as reflected in clinical results and patient satisfaction.

### *Study Selection*

For the study selection process, the reviewers (MU, MI, MH, SI) independently screened the titles and/or abstracts of the identified papers and excluded studies that were irrelevant. The studies that met the eligibility criteria were then read in full by the same reviewers, and their suitability was assessed independently. In the case of disagreements, consensus was sought among the reviewers. If a consensus could not be reached, the decision of the first author (MU) was accepted. Unpublished studies were not included in the review. The criteria used for selecting papers were that they had to focus on Parkinson's patients and any dance style could be used. Papers that included other therapies like yoga, exercise, and music were not included.

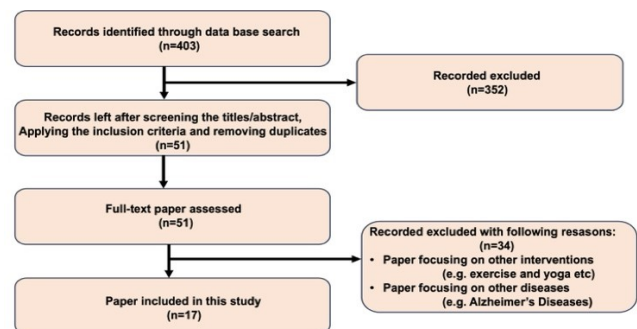


Figure 1. Study selection flowchart

## RESULTS

Dance therapy has emerged as a potential therapeutic intervention for PD in recent years. Numerous studies have been carried out to evaluate how dance therapy affects different symptoms related to Parkinson's disease. These studies have investigated a range of areas, including, but not limited to physical and mental function, depression, anxiety, walking speed, balance, and overall quality of life. Tables 1 and 2 provide a summary of the paper's findings.

### *Safety and Feasibility*

Is dance therapy safe for elderly patients with Parkinson's? A study by Kristi Michels et al. suggests that it is<sup>10</sup>. The study aimed to probe the therapeutic

potential of dance therapy (DT) as a mind-body approach for PD. Thirteen individuals participated in the study, divided into two groups with a 2:1 ratio, with 9 participants receiving DT and 4 in a support group. Through comprehensive assessments before and after the intervention, including attendance and various questionnaires and scales, the study sought to evaluate the effects of DT on various aspects of PD and participant experience. The results indicated that DT classes were not only well-attended and safe, but also greatly appreciated by participants, offering promising evidence for the feasibility of dance as a potential therapeutic intervention for PD<sup>10</sup>.

Even local folk dances have been deemed feasible for patients with PD. For instance, a trial by Joanne Shanahan et al. did show that the Irish set dancing is not only feasible but enjoyable for patients with PD<sup>11</sup>. The participants in the study reported enjoying the dance classes and experiencing improvements in several aspects of their health. Although no significant improvements were observed in functional endurance, the participants maintained their pre-assessment results. This may be due to the relatively low dosage of the intervention, which was only 130 minutes of dancing per week over eight weeks. The study suggested that a higher dosage may be necessary to significantly improve motor impairment, as the results showed a trend towards improvement<sup>11</sup>.

A study found that Zumba, a form of dance, is not only a safe but also enjoyable activity for individuals with PD<sup>12</sup>. The study included participants with different levels of disease severity and showed that all dance styles had similar levels of intensity. As the sessions progressed, the participants increased their activity levels. The study's positive results and high compliance suggest that a larger scale trial could be, and should be, conducted to evaluate this at a larger scale and assess the long-term effects of it on both the motor and non-motor symptoms<sup>12</sup>.

Overall, the studies reviewed here, and several other studies suggest that dance therapy is a safe, enjoyable, and feasible therapy for PD patients<sup>13,14</sup>. However, more comprehensive research was deemed necessary to determine whether actual benefits of dance therapy existed or not.

### *Therapeutic Effects of Dance*

A study conducted by Hiroko Hashimoto et al. aimed to provide a deeper understanding of the impact of dance therapy and PD exercise on Parkinson's

patients<sup>15</sup>. The study, conducted over 12 weeks, involved a PD exercise group and a dance group participating in a weekly 60-minute session, while a control group continued with their regular activities. The results revealed that dance therapy was able to improve not only motor and cognitive functions, but also mental symptoms, whereas PD exercise only improved motor and cognitive functions. Despite the fact that the study was limited by an uneven ratio of males and females, the weekly frequency of dance therapy was manageable for subjects and holds promise for future rehabilitation efforts<sup>15</sup>.

One study revealed a significant benefit for depression and anxiety symptoms in PD patients, but its effect on cognitive function was either minimal or not observed<sup>16</sup>. While the study demonstrated a noteworthy enhancement in the quality of life of its participants, the source of this improvement remains a subject of contention. Some argue that it stems from the increased physical activity that results from participating in a social group activity like dance, while others posit that the improvement is due to the positive impact dance has on the motor and non-motor symptoms of PD. Nonetheless, the study was limited by its sample size and non-random allocation, emphasizing the need for a more rigorous examination of the effects of the intervention<sup>16</sup>.

Finally, a study examined changes in balance, gait speed, and quality of life in participants with PD who took part in a 12-week dance program<sup>17</sup>. The study found notable improvements in gait speed and balance over a long-term period, while quality of life remained the same. These findings suggest that the dance program can lead to improvements in motor skills over both short and long periods, highlighting the potential of dance therapy as a feasible and enjoyable intervention for Parkinson's patients. However, the study was once again limited by its small sample size and short duration<sup>17</sup>.

### *Different Dance Styles and their Effects*

#### *Sardinian Folk Dance*

Paolo Solla et al. carried out a pilot trial to explore how Sardinian folk dance (Ballu Sardu or BS) affects people with PD. The study's findings indicated that Ballu Sardu was safe and practical, and had beneficial effects on both the motor and non-motor symptoms in individuals with PD. The study also discovered a significant increase in lower limb dynamic strength in the group that participated in Ballu Sardu.

**Table 1.** Overview of Studies Investigating the Impact of Dance on Parkinson's Disease (Part 1)

Authors	Year	Study Design	Intervention	No.	Measuring Instruments	Results
<b>Kristi Michels et al.</b>	2018	RCT	Dance	13	H and Y Scale, MDS-UPDRS, PDQ-39, MoCA, FSS.VAFS BBS, VAFS, TUG, BDI Exit Satisfaction Survey	Dance is feasible. Improvement in motor symptoms with patients being satisfied with the results <sup>10</sup> .
<b>Joanne Shanahan et al.</b>	2015	RCT	Irish set dancing	10	UPDRS-3, PDQ-39, 6-min walk test, BBS, exit questionnaire	Feasible option, no significant improvements were observed in functional endurance <sup>11</sup> .
<b>A. Delestrat et al.</b>	2016	Uncontrolled Feasibility Study	Zumba Gold	11	Tri-axial accelerometers, two-way ANOVA, MDS-UPDRS III, IV, Hand Y Scale, Schwab and England scale, MMSE, PASE, 10MWT, 2MWT	Zumba dance is safe for Elderly with Parkinson's disease <sup>12</sup> .
<b>Michail Elpidoforou et al.</b>	2022	Pilot trial	structured dance program	16	PDQ-8, BDI-II, PFS-16, PFS-16, BBS, BMI	Safe and Feasible option with significant improvements in the measures assessed <sup>13</sup> .
<b>Shubha Lihala et al.</b>	2021	Feasibility Study	Dance	10	UPDRS-III, H and Y Scale, PDQ-39, MoCA	It is a feasible option <sup>14</sup> .
<b>Hiroko Hashimoto et al.</b>	2015	Quasi-Randomized Pilot Trial	Dance	46	BBS, TUG, FAB, AS, MRT, UPDRS, SDS	Improvement of motor, cognitive functions and mental symptoms <sup>15</sup> .
<b>H.H.N. Kalyani et al.</b>	2019	Quasi-experimental Study	Dance	33	MDS-UPDRS, Trail Making Test, NIH Toolbox cognition battery, PDQ-39, Hospital Anxiety and Depression Scale	Significant decrease in the manifestation of depression and anxiety symptoms. Quality of life also improved. No improvement in cognitive function <sup>16</sup> .
<b>Karolina A. Bearss et al.</b>	2017	Quasi-experimental-non-controlled study	Dance	9	BBS, TUG, QoL Scale, questionnaire of wellbeing by Westheimer et al.	Significant long-term improvements in balance and gait speed <sup>17</sup> .
<b>Silvia Rios Romenets et al.</b>	2015	Randomized-controlled study	Argentine Tango	40	MDS-UPDRS-3, TUG, Mini-BESTest, Dual Task TUG, FOG-Q, MoCA, BDI, CGI-C, AS, Krupp Fatigue Severity Scale, PDQ-39, Purdue pegboard, Exit Questionnaire	No significant improvement in motor symptoms, however, a positive effect on balance and cognition <sup>18</sup> .

Additionally, participants who engaged in Ballu Sardu demonstrated significant enhancements in upper body mobility and cognitive abilities. Once again, the study was limited and nothing conclusive can be said solely based on its findings<sup>19</sup>.

#### *Latin American Dance*

Sophia Hulbert and Ann Ashburn's study indicates that a 10-week, twice a week ballroom and Latin American dance program can significantly improve the coordination of body segments during turning in patients with PD. Dance enhances body segment coupling during turning, reducing excessive pelvic rotation and promoting efficient turning. These findings imply that dance may serve as a beneficial intervention for improving coordination and alleviating symptoms of Parkinson's disease. However, further research is needed to determine the impact of gender, disease severity, and duration on outcomes<sup>20</sup>.

#### *Binary and Quaternary Rhythm Dances*

A clinical trial by Jessica Moratelli et al. explored the effects of binary and quaternary rhythm dances on patients with PD. The trial showed that both interventions can be effective in complementing treatment for people with PD. The study found that the quaternary group demonstrated superiority in some areas, such as total UPDRS score, writing, and hygiene. However, the study, once again, had limitations such as a small sample size and the inability to include a control group for comparison. Nonetheless, the findings suggested that both binary and quaternary rhythm dances can help increase individuals' ability to move and may provide unpredictable movement patterns that can benefit those with Parkinson's disease<sup>21</sup>.

#### *Ballroom Dancing*

D. Kunkel et al. investigated the potential benefits of ballroom dancing as a form of physical activity for individuals with PD<sup>22</sup>. Although mostly insignificant results were found due to the small sample size, the study suggested some trends that presented a mixed view of the effect. However, one important finding was that the dance group participants walked an average of 20 meters further than the control group in the 6-minute walk test. From interviews, it became evident that participants experienced social benefits from the activity, enjoying the sense of accomplishment in mastering dancing and interacting

with others. This study suggests that dancing may be a promising form of physical activity for people with PD<sup>22</sup>.

#### *Turo*

Hwa-Jin Lee et al. looked at the effects of a dance called Turo (also known as Qi Dance) on Parkinson's patients. The results showed improvements in UPDRS score, daily activities of the patients, and motor examination scores in the Turo group<sup>23</sup>. Turo program seems to be efficient and cost-effective rehabilitative treatment for patients with PD. Additionally, patients in the Turo PD group reported feeling more motivated to engage in physical activity, experienced a sense of community and social connectedness, and enjoyed the mind-body aspects of the program. However, the study did have some limitations, such as a small sample size, low training frequency, and lack of a placebo control group. Despite these limitations, the results highlight the potential of dance programs like Turo in improving the overall well-being of PD patients<sup>23</sup>.

#### *Irish Set Dancing*

Joanne Shanahan et al. investigated the impact of Irish Set dancing on PD patients after determining that it was feasible<sup>11</sup>. According to the exit questionnaire, the participants found the intervention to be enjoyable and reported positive changes in their health. Although there were no major differences between the groups regarding the outcome measures, the slight trend towards significance observed after the 10-week intervention may still be noteworthy in a clinical setting.

Notably, the dance group exhibited a more significant improvement in their quality of life compared to the control group. The results suggested that interventions with longer duration may have a more positive impact, providing ample time for participants to automatize motor skills and intensify the intervention. However, the study's short duration may explain the lack of improvement in balance among patients, as it did not allow sufficient time for participants to learn and perform a range of multidirectional and turning movements.

It is also important to note that compliance was relatively low, and the modest sample size of this trial is a limitation to its generalizability. Nevertheless, the study provides good evidence for the potential

**Table 1.** Overview of Studies Investigating the Impact of Dance on Parkinson's Disease (Part 2)

Authors	Year	Study Design	Intervention	Number of Participants	Measuring Instruments	Results
<b>Paolo Solla et al.</b>	2019	Randomized Controlled Trial	Sardinian Folk Dance	20	UPDRS, 6MWT, TUG, FTSST, MoCA, BST, SRT, Instrumented gait analysis, SAS, BBS, PFS-16, BDI	Ballu Sardu had positive impacts on both functioning and non-motor symptoms <sup>19</sup> .
<b>Sophia Hulbert et al.</b>	2017	Randomized Controlled Trial	Latin American Dance	27	Turn Test (SS180), 3-dimensional motion analysis	Latin American dance program can significantly improve the coordination of body segments during turning in individuals with Parkinson's disease <sup>20</sup> .
<b>J'essica Moratelli et al.</b>	2021	Randomized Clinical Trial	Binary and Quaternary Rhythm Dances	31	Personal and clinical information, MMSE, H and Y Scale, pdq-39, MoCA, UPDRS	Both binary and quaternary rhythm dances showed improvements in the symptoms and quality of life of patients <sup>21</sup> .
<b>D Kunkel et al.</b>	2017	Randomized Controlled Trial	Ballroom Dance	51	BBS, Spinal Mouse, SS180, TUG, PDQ-39, ABC Questionnaire, Phone-FITT, Euroquol-5D	Insignificant effects apart from subjective social benefits reported by patients <sup>22</sup> .
<b>Hwa-Jin Lee et al.</b>	2018	Randomized Controlled Trial	Turo (Qi Dance)	32	UPDRS, PDQL, BBS, BDI	Improvement in the overall UPDRS score and everyday activities <sup>23</sup> .
<b>Joanne Shanahan et al.</b>	2017	Randomized Controlled Trial	Irish set dancing	90	Measures of feasibility, mini-BESTest, UPDRS, PDQ-39, 6MWT,	Insignificant findings <sup>24</sup> .
<b>Débora B. Rabinovich et al.</b>	2021	Unblinded Clinical Trial	Argentine tango	8 PD patients	MDS-UPDRS-III, 15-item Likert Questionnaire Scale, Exit interview	Significant improvement in motor symptoms <sup>25</sup> .
<b>Tumay Tunur et al.</b>	2019	Prospective uncontrolled pilot study	Augmented reality-based dance intervention	7	H and Y scale, MDS-UPDRS, MoCA, Google glass, Moving Through Glass Application	Mobile dance classes are a feasible option for patients with Parkinsons <sup>26</sup> .

benefits of dance programs in improving the overall health and well-being of PD patients<sup>24</sup>.

### *Tango*

In a study by Débora B. Rabinovich et al. Patients who participated in a two-week Argentine tango program showed improvements in motor symptoms. Additionally, an exit questionnaire after the trial

indicated improvements in ability to walk, mobility, sleep, mood and performing activities of daily living. The activity also fostered confidence and relatedness among participants. However, like the aforementioned trials, the dosage of the intervention requires further examination to determine its peak potential quantitatively. Two-week Tango classes at a high intensity level showed improvements in motor symptoms with no observed side effects. High dose

Tango was not only beneficial for the people who had previously attended a weekly tango class, but also those who had not taken the classes before<sup>25</sup>.

### *Mobile Dance Classes*

Exciting findings from a pilot study by Tumay Tunur et al. suggest that mobile dance classes with AR (Augmented Reality) devices like Google Glass could be a practical and effective option for individuals with PD. Participants experienced improved stability and potentially reduced fall risk. Notably, participants expressed high satisfaction with the intervention, and there were no safety concerns or adverse events reported. These results suggest that home-based augmented reality interventions could significantly improve the quality of life for people with PD<sup>26</sup>.

## **CONCLUSION**

Parkinson's disease is a multifaceted neurodegenerative condition that greatly impacts the lives of patients and their caregivers. Use of dance therapy as a therapeutic modality represents a promising avenue for addressing both motor and non-motor symptoms in PD. This systematic review has examined 17 clinical trials encompassing a range of dance forms to evaluate the safety and efficacy of dance therapy in enhancing various facets of PD, including physical and mental performance, mood, anxiety, walking speed, balance and overall quality of life.

The findings of this review suggest that dance therapy can indeed serve as a novel intervention to ameliorate PD. However, it is essential to acknowledge that the existing research landscape is not without limitations. The absence of standardized protocols and the heterogeneity in the types, frequency, duration, intensity, and assessment tools of dance therapy across studies hinder the reproducibility and generalizability of the observed benefits. Therefore, there is a pressing need for consensus on the optimal parameters and indicators of dance therapy for PD.

Furthermore, the lack of high-quality and long-term randomized controlled trials with adequate sample size, randomization, blinding and follow-up has been a notable limitation. Most studies on dance therapy for PD are small, short-term, and exhibit low methodological quality, as evident by the review. Robust evidence from rigorous trials is essential to

definitively establish the efficacy of dance therapy for PD.

Moreover, the mechanisms and mediators of dance therapy effects remain poorly understood. It is unclear how dance therapy influences the neurophysiological, psychological, and social aspects of PD patients and what factors may enhance or reduce its benefits. To address this, future research should employ comprehensive and multidisciplinary approaches, utilizing methods such as neuroimaging, biomarkers, behavioral measures and qualitative research.

Lastly, the accessibility and affordability of dance therapy programs present significant challenges, with barriers such as transportation, cost, availability, stigma and motivation hindering participation. To overcome these issues, innovative delivery modes like online platforms, mobile dance classes, telehealth, and community-based settings should be explored and promoted, increasing awareness and availability for PD patients and their caregivers.

## **Conflict of Interest**

The authors have no relevant financial or non-financial interests to disclose.

## **Acknowledgements**

This research did not receive any specific grant from funding any agency.

## **References**

1. Alves Da Rocha P, McClelland J, Morris ME. Complementary physical therapies for movement disorders in Parkinson's disease: a systematic review. *Eur J Phys Rehabil Med.* 2015;51(6):693-704.
2. Moustafa AA, Chakravarthy S, Phillips JR, Gupta A, Keri S, Polner B, et al. Motor symptoms in Parkinson's disease: A unified framework. *Neuroscience & Biobehavioral Reviews.* 2016;68:727-40.
3. Agosta F, Gatti R, Sarasso E, Volonté MA, Canu E, Meani A, et al. Brain plasticity in Parkinson's disease with freezing of gait induced by action observation training. *J Neurol.* 2017;264(1):88-101.
4. Poewe W. Non-motor symptoms in Parkinson's disease. *Eur J Neurol.* 2008;15 Suppl 1:14-20.
5. Kuhlman GD, Flanigan JL, Sperling SA, Barrett MJ. Predictors of health-related quality of life in



- Parkinson's disease. *Parkinsonism & Related Disorders*. 2019;65:86-90.
6. Mancini M, Fling BW, Gendreau A, Lapidus J, Horak FB, Chung K, et al. Effect of augmenting cholinergic function on gait and balance. *BMC Neurology*. 2015;15(1):264.
  7. Stuckenschneider T, Askew CD, Meneses AL, Baake R, Weber J, Schneider S. The Effect of Different Exercise Modes on Domain-Specific Cognitive Function in Patients Suffering from Parkinson's Disease: A Systematic Review of Randomized Controlled Trials. *J Parkinsons Dis*. 2019;9(1):73-95.
  8. McGill A, Houston S, Lee RYW. Dance for Parkinson's: A new framework for research on its physical, mental, emotional, and social benefits. *Complementary Therapies in Medicine*. 2014;22(3):426-32.
  9. Mak MKY, Wong-Yu ISK. Exercise for Parkinson's disease. *Int Rev Neurobiol*. 2019;147:1-44.
  10. Michels K, Dubaz O, Hornthal E, Bega D. "Dance Therapy" as a psychotherapeutic movement intervention in Parkinson's disease. *Complementary Therapies in Medicine*. 2018;40:248-52.
  11. Shanahan J, Morris ME, Bhriain ON, Volpe D, Richardson M, Clifford AM. Is Irish set dancing feasible for people with Parkinson's disease in Ireland? *Complement Ther Clin Pract*. 2015;21(1):47-51.
  12. Delextrat A, Bateman J, Esser P, Targen N, Dawes H. The potential benefits of Zumba Gold(®) in people with mild-to-moderate Parkinson's: Feasibility and effects of dance styles and number of sessions. *Complement Ther Med*. 2016;27:68-73.
  13. Elpidoforou M, Bakalidou D, Drakopoulou M, Kavga A, Chrysovitsanou C, Stefanis L. Effects of a structured dance program in Parkinson's disease. A Greek pilot study. *Complementary Therapies in Clinical Practice*. 2022;46:101528.
  14. Lihala S, Mitra S, Neogy S, Datta N, Choudhury S, Chatterjee K, et al. Dance movement therapy in rehabilitation of Parkinson's disease – A feasibility study. *Journal of Bodywork and Movement Therapies*. 2021;26:12-7.
  15. Hashimoto H, Takabatake S, Miyaguchi H, Nakanishi H, Naitou Y. Effects of dance on motor functions, cognitive functions, and mental symptoms of Parkinson's disease: a quasi-randomized pilot trial. *Complement Ther Med*. 2015;23(2):210-9.
  16. Kalyani HHN, Sullivan KA, Moyle G, Brauer S, Jeffrey ER, Kerr GK. Impacts of dance on cognition, psychological symptoms and quality of life in Parkinson's disease. *NeuroRehabilitation*. 2019;45(2):273-83.
  17. Bearss KA, McDonald KC, Bar RJ, DeSouza JFX. Improvements in balance and gait speed after a 12 week dance intervention for Parkinson's disease. *Advances in Integrative Medicine*. 2017;4(1):10-3.
  18. Rios Romenets S, Anang J, Fereshtehnejad SM, Pelletier A, Postuma R. Tango for treatment of motor and non-motor manifestations in Parkinson's disease: a randomized control study. *Complement Ther Med*. 2015;23(2):175-84.
  19. Solla P, Cugusi L, Bertoli M, Cereatti A, Della Croce U, Pani D, et al. Sardinian Folk Dance for Individuals with Parkinson's Disease: A Randomized Controlled Pilot Trial. *J Altern Complement Med*. 2019;25(3):305-16.
  20. Hulbert S, Ashburn A, Roberts L, Verheyden G. Dance for Parkinson's-The effects on whole body coordination during turning around. *Complement Ther Med*. 2017;32:91-7.
  21. Moratelli J, Alexandre KH, Boing L, Swarowsky A, Corrêa CL, Guimarães ACA. Binary dance rhythm or Quaternary dance rhythm which has the greatest effect on non-motor symptoms of individuals with Parkinson's disease? *Complement Ther Clin Pract*. 2021;43:101348.
  22. Kunkel D, Fitton C, Roberts L, Pickering RM, Roberts HC, Wiles R, et al. A randomized controlled feasibility trial exploring partnered ballroom dancing for people with Parkinson's disease. *Clin Rehabil*. 2017;31(10):1340-50.
  23. Lee HJ, Kim SY, Chae Y, Kim MY, Yin C, Jung WS, et al. Turo (Qi Dance) Program for Parkinson's Disease Patients: Randomized, Assessor Blind, Waiting-List Control, Partial Crossover Study. *Explore (NY)*. 2018;14(3):216-23.
  24. Shanahan J, Morris ME, Bhriain ON, Volpe D, Lynch T, Clifford AM. Dancing for Parkinson Disease: A Randomized Trial of Irish Set Dancing Compared With Usual Care. *Arch Phys Med Rehabil*. 2017;98(9):1744-51.
  25. Rabinovich DB, Garretto NS, Arakaki T, DeSouza JFX. A high dose tango intervention for people with Parkinson's disease (PwPD). *Advances in Integrative Medicine*. 2021;8(4):272-7.

26. Tunur T, DeBlois A, Yates-Horton E, Rickford K, Columna LA. Augmented reality-based dance intervention for individuals with Parkinson's disease: A pilot study. *Disabil Health J.* 2020;13(2):100848.

*This article is an Open Access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited and it is not used for commercial purposes; 2024, Usama M et al., Applied Systems and Discoveries Journals.*