Exploring the Impact of an 8-Week Structured Dance Program on Quality of Life and Depressive Symptoms in Early-to-Mid-Stage Parkinson's Disease: Gender Differences and Therapeutic Potential

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Abstract

Parkinson's disease (PD) is a progressive neurodegenerative disorder characterized by motor and non-motor symptoms that significantly reduce quality of life (QoL). Non-motor symptoms, including depressive symptoms, are often overlooked but contribute heavily to disease burden. This study evaluates the effects of an 8-week structured Dance for Parkinson's Disease® (DfPD®) program on QoL and depressive symptoms in early-to-mid-stage PD patients, with a focus on gender differences. Data from 16 participants, assessed before and after the intervention using the Parkinson's Disease Questionnaire-8 (PDQ-8) and Beck Depression Inventory-II (BDI-II), revealed significant improvements in QoL and depressive symptoms. Paired t-tests showed reductions in PDQ-8 and BDI-II scores, indicating enhanced well-being and reduced depression. However, linear mixed-effects models revealed that men exhibited consistently higher depressive symptoms than women, both before and after the intervention, with no significant gender differences in the rate of change over time. While both genders benefited from the program, men showed a greater improvement in QoL. These findings underscore the therapeutic potential of dance interventions in PD, particularly for enhancing social engagement and emotional well-being, and highlight the importance of tailoring interventions to gender-specific needs. Further research is warranted to explore long-term outcomes and refine gender-based therapeutic strategies.

Introduction

Parkinson's Disease (PD) is a progressive neurodegenerative disorder that affects movement and a range of other cognitive and behavioral functions due to the gradual loss of dopamine-producing neurons in the brain, specifically in the substantia nigra. Affecting approximately 1% of people over the age of 60, PD is one of the most common neurodegenerative diseases worldwide (*Parkinson's Disease*, 2022). PD's hallmark motor symptoms include tremors, rigidity, bradykinesia (slowed movement), and postural instability, which progressively impair a patient's physical abilities and independence. Alongside these motor symptoms, patients often experience cognitive decline, mood disorders, and various other non-motor symptoms, which together diminish their quality of life and increase dependency on caregivers (*Parkinson's Disease*, 2022). Understanding and addressing the full range of PD symptoms, especially those beyond motor impairments, is critical to improving the daily lives of people with PD and enhancing treatment outcomes (Shehata et al., 2024)

Traditional treatments and surgical interventions for PD, such as medications that replenish or mimic dopamine and deep brain stimulation, primarily target motor symptoms. These treatments aim to manage tremors, rigidity, and other movement-related issues to help patients maintain some level of physical functionality. However, while these interventions provide some relief for physical symptoms, they do not adequately address non-motor symptoms like mood disturbances, cognitive decline, and fatigue (Chaudhuri & Odin, 2010). These non-motor symptoms often go unrecognized or are overlooked by healthcare providers, in part due to the mistaken belief that they are difficult to treat or less impactful (Cerri et al., 2019) In reality, non-motor symptoms significantly contribute to the overall burden of the disease, affecting clinical progression, quality of life, and even life expectancy. For these reasons, addressing non-motor symptoms alongside motor symptoms is essential to provide a

comprehensive treatment approach that can genuinely improve patient well-being (Laar & Jain, 2004).

The Importance of Addressing Non-Motor Behavioral Symptoms in PD

Depressive symptoms are particularly common in PD patients and can further reduce quality of life, impact treatment adherence, and increase the burden on caregivers. It is critical for accurate diagnosis and treatment of depression and other mood-based symptoms, especially for patients with more advanced cognitive impairment who are at higher risk of depression (Shehata et al., 2024). Despite this, depressive and other non-motor symptoms often remain untreated or inadequately managed, underscoring a need for interventions that can address these challenges in a more holistic manner (Chaudhuri & Odin, 2010).

Gender Differences in Parkinson's Disease

Growing evidence suggests that gender differences in PD may play an important role in how patients experience and respond to the disease. Studies indicate that men generally develop PD at a younger age and experience a more severe form of the disease, characterized by higher rates of motor complications and depression than women (Laar & Jain, 2004). Women, in contrast, tend to develop PD later and may have higher striatal dopamine levels, which could potentially influence estrogen. This may contribute to their delayed onset and milder motor symptoms (Haaxma et al., 2007). However, long-term treatment in women is often associated with a higher prevalence of dyskinesias, or involuntary movements, which can complicate treatment outcomes. These distinctions highlight the importance of tailoring treatments to gender-specific patterns, which may offer new avenues for improving quality of life and mental health outcomes in PD patients.

Dance as a Therapeutic Approach

In the context of PD, rehabilitation typically focuses on restoring motor function. However, addressing non-motor symptoms is equally crucial for enhancing quality of life (QoL). Dance therapy has emerged as an enjoyable, motivating, and engaging form of rehabilitation that simultaneously targets motor function, cognitive abilities, and emotional well-being. Studies have shown that dance promotes motor function through activities like muscle stretching, executing steps, and maintaining balance, which can improve coordination and stability in PD patients (Kalyani et al., 2019). Additionally, dance challenges cognitive function, requiring patients to plan movements, follow rhythmic cues, remember sequences, and maintain spatial awareness (Earhart, 2009). As a social activity, dance also fosters emotional expression and social connectedness, which can alleviate depressive symptoms and enhance mood (Gyrling et al., 2021)

Study Purpose

Despite growing support for the benefits of dance therapy in PD, there remains a gap in understanding its effects on long-term quality of life and depressive symptoms, particularly in relation to gender differences. The aim of this literature review and analysis is to evaluate the effectiveness of an 8-week structured dance program on emotional well-being in

early-to-mid-stage PD patients, with a specific focus on depressive symptoms and quality of life. This study also seeks to explore potential differences in response to dance therapy between men and women, providing insight that could inform more personalized, gender-specific approaches to rehabilitation in PD.

Methods

Data Source

The data set used was collected by Elpidoforou and colleagues and was made publicly available as an open-source data set (Elpidoforou et al., 2022). This study was non-randomized, uncontrolled, open-label pilot design to assess the efficacy, safety, and feasibility of a culturally adapted Dance for Parkinson's Disease® (DfPD®) program for Greek patients with early-to-mid-stage PD. Sixteen participants were recruited from the Eginition's Hospital Neurological Outpatient PD Clinic. Participants were required to be aged 18 or older, diagnosed with idiopathic PD (Hoehn and Yahr stages 0 to 2.5), Greek-speaking, and capable of providing written consent.

Exclusion criteria included advanced PD (Hoehn and Yahr stage ≥3), significant health issues that precluded exercise, and unrelated mental disorders. The intervention consisted of sixteen weekly 60-minute DfPD® classes, integrating various dance genres, with sessions held twice per week for 8 weeks. Participants were divided into groups of 8 to facilitate monitoring. Baseline assessments were conducted one week prior to the intervention, and follow-up evaluations occurred one week after its completion.

The study measured a variety of outcomes. For this project, we focused on the measurements of quality of life using the Parkinson's Disease Questionnaire-8 (PDQ-8), depressive symptoms with the Beck Depression Inventory-II (BDI-II), and cognitive functions using the Montreal Cognitive Assessment (MoCA). These measurements were taken both before and after the intervention to assess change over time. The full details of the methods can be found in the original study by (Elpidoforou et al., 2022).

Data Preparation

The data was made available through the open-source dataset provided by Elpidoforou and colleagues, 2022. The data was downloaded and cleaned to only include the relevant variables for our research questions.

Statistical Methods

All statistical analysis was performed using *R statistics*, a statistical software environment (R Core Team, 2024). Only participants that included both pre- and post-data assessments were included in the analysis. The following statistical tests were performed to answer the research questions.

To compare mean scores for both the PDQ-8 and BDI-II before and after the intervention, paired t-tests were conducted. This statistical test helps determine if there is a significant

difference in scores (quality of life and depressive symptoms) from before to after the intervention.

Next, linear regression models were used to examine the relationship between changes in quality of life or depressive symptoms and gender. These models help determine if there were differences in the effectiveness of the dance program between men and women. Linear mixed-effects models were also employed to account for repeated measures (pre- and post-intervention) from the same participants. This type of model considers both fixed effects (such as time and gender) and random effects (such as individual differences between participants). These models analyzed how the dance intervention affected quality of life and depressive symptoms, while accounting for individual variations.

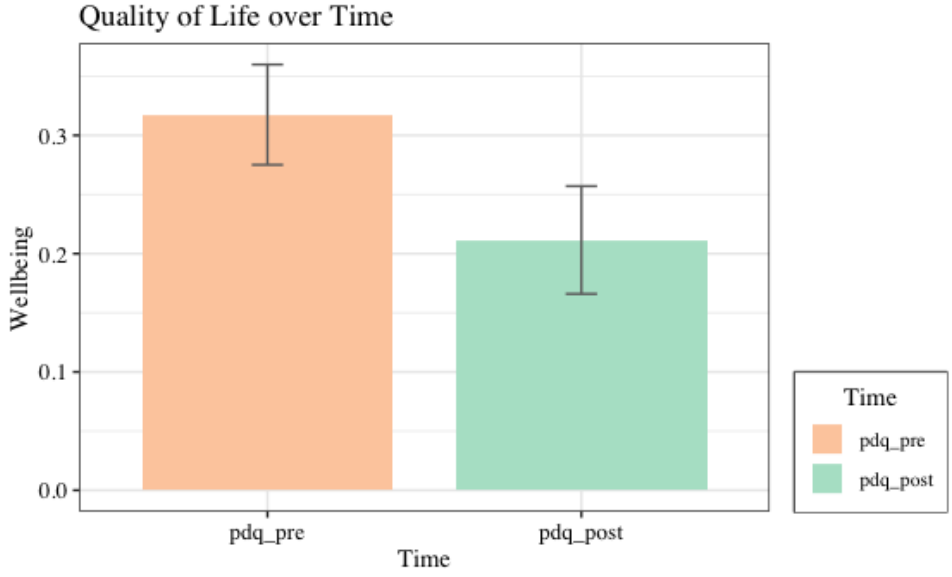
Results

Quality of Life Change

There was a significant difference in quality of life when comparing before and after the intervention values: ($t(12) = 2.47$, $p = 0.03$, $d = 12$). Lower PDQ scores indicate improved well-being. Participants have lower scores after the dance intervention suggesting improvement in well-being and quality of life (see Figure 1).

Figure 1

Quality of Life Change over time (before to after dance intervention)



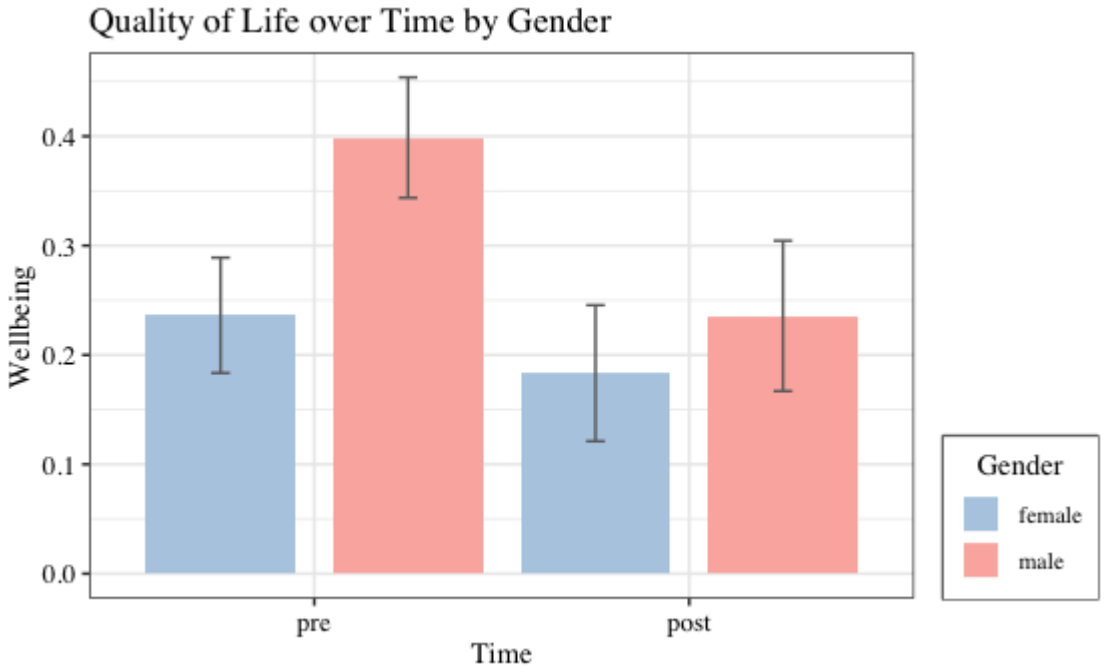
Change in well-being, accounting for gender differences

A linear mixed-effects model was conducted to examine the effects of time, gender, and cognitive function on wellbeing, with random effects of the participant.The model included time (pre, post), gender (male, female), their interaction, and MoCA as a covariate.

The model shows no significant main effects of time, gender, or MoCA score ($p > 0.05$) on wellbeing. The interaction between time and gender is trending towards significance, ($b = 0.125$, $t(11.02) = 1.98$, $p = 0.07$). This suggests a trend that the effect of time on well-being is different in males than in females (see Figure 2).

Figure 2

Quality of Life Change over time by Gender (before to after dance intervention)

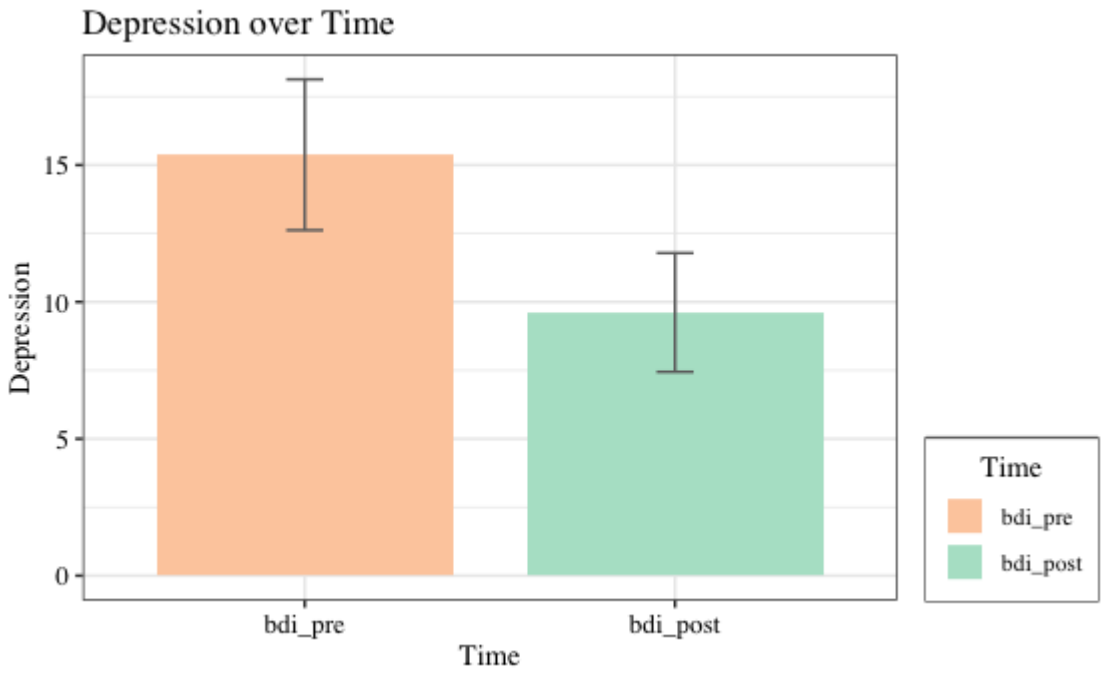


Depression Change

There was a significant difference in depression before to after the intervention: t(12) = 2.22, p = 0.05, d = 12. Lower depression scores indicate improved depression. Participants have lower scores after the dance intervention suggesting improvement in depressive symptoms (see Figure 3).

Figure 3

Depression change over time (before to after dance intervention)

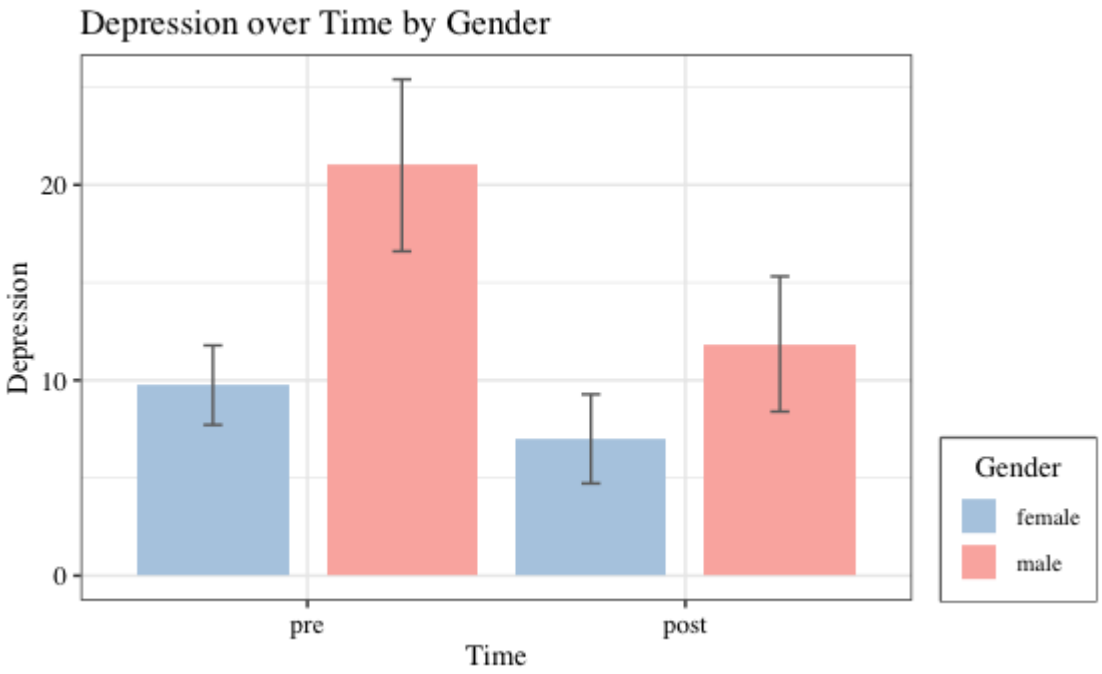


Changes in depressive symptoms, accounting for gender differences

A linear mixed-effects model was conducted to examine the effects of time, gender, and cognitive function on depressive symptoms, with random effects of participant.The model included time (pre, post), gender (male, female), their interaction, and MoCA as a covariate.

There was a significant main effect of gender, indicating that men had higher depression scores compared to women overall, both before and after the intervention. The interaction between time and gender was not statistically significant, suggesting that the change in depression over time did not differ significantly between men and women. Results indicated no significant main effect of time on depression scores, (b = -5.61, t(11.30) = -1.26, p = 0.23), suggesting that depressive symptoms did not significantly change from before to after the intervention across participants. These results suggest that while there is no evidence of an overall reduction in depressive symptoms after the intervention, men exhibited significantly higher depression levels than women, regardless of time (see Figure 4).

Figure 4
Depression over time by Gender (before to after dance intervention)



Discussion

The evidence shows the impact of an 8-week structured dance intervention on both quality of life and depressive symptoms in individuals with Parkinson's disease (PD). The findings suggest significant improvements in well-being and depressive symptoms following the intervention. Specifically, quality of life improved over time for both men and women, but men showed a stronger improvement in their well-being and quality of life. While simple tests show improvement in depression, this may be due to men having overall higher depression scores than women both before and after the intervention took place.

In reviewing the effects of the dance intervention on depressive symptoms, we find some interesting contradictions between the t-test and the more complex mixed-effects model. The t-test initially suggested an overall decrease in depression scores after the intervention, which could easily lead us to assume that the dance program had a positive impact on participants' mental health. However, the mixed-effects model reveals something different: it suggests that this apparent drop in depression scores might actually reflect gender differences, rather than a true reduction due to the intervention itself. Specifically, men had consistently higher depression scores than women, both before and after the program. This finding is important because it shows that the improvement in depressive symptoms suggested by the t-test wasn't necessarily driven by a change over time. Instead, it may be that men's higher depression levels created an impression of improvement when comparing groups. Recognizing this gender difference in depression levels is valuable, as it indicates that men with Parkinson's may face unique mental health challenges that could require additional support.

In short, while simpler tests like the t-test showed a reduction in depressive symptoms, the mixed-effects model clarified that this result was more about pre-existing gender differences

than actual improvement over time. This finding underscores the importance of considering gender in future studies and exploring whether tailored interventions might better address these differences.

Changes in Quality of Life

The paired t-test results showed a significant improvement in quality of life before to after the intervention, as measured by the Parkinson's Disease Questionnaire. This finding aligns with previous research that highlights the beneficial effects of dance and movement-based therapies for PD patients, particularly in addressing motor and non-motor symptoms and improving social engagement, mood, and functional independence (Colombo et al., 2022). While few studies have specifically examined the emotional benefits of dance for Parkinson's disease patients, existing literature shows that combining dance with music can lower levels of depression, anxiety, and stress. It may also improve emotional understanding, empathy, emotional perception and expression, emotional interaction, and prosocial behaviors (Colombo et al., 2022). The longest longitudinal study to date is McRae et al. (2018), which spanned two years and assessed quality of life, self-efficacy, the influence of Dance for PD® (DfPD) classes on daily activities outside of class, and functional mobility in Parkinson's disease participants. The study concluded that DfPD classes had a positive impact on both social and emotional well-being outside of class, and that motor function influences quality of life through self-efficacy. As the results of the paired t-test here show a similar significant improvement, it is evident that dance interventions may positively influence quality of life in PD patients, potentially through several mechanisms. Factors such as rhythmic music, which has been shown to stimulate dopamine production and regulate mood, and coordinated body movements, which reinforce motor skills and balance, likely contribute to this effect (McRae et al., 2018). Together, these elements may evoke feelings of joy, empowerment, and social connection, further supporting the therapeutic potential of dance in enhancing the holistic well-being of individuals with Parkinson’s disease.

Gender Differences in Change of Quality of Life

The linear mixed-effects model examining gender differences in quality of life revealed more nuanced patterns. Although the interaction between time and gender for quality of life was not statistically significant, there was a trend towards a gender difference in well-being improvement over time: the men indicated a greater improvement level compared to women. A study by Davila et al. (2022) showed that men reported lower overall QoL than women, particularly in domains like social activities and emotional support. Interviews revealed that men were less satisfied with activities, had fewer friendships, and struggled more with family support (Davila et al., 2022). Men’s greater improvement in QoL following a dance intervention could be attributed to the fact that dance programs often enhance social interaction and emotional support, areas where men have reported lower satisfaction. By increasing social engagement and providing emotional benefits, dance interventions may address some of the specific challenges men face, thus contributing to more significant improvements in their overall QoL.

Changes in Depressive Symptoms

The results regarding change in depressive symptoms are more difficult to interpret. If understanding is solely based on t-test results, the intervention resulted in significant improvements in depressive symptoms. Given that depression is a common non-motor symptom of PD, this finding is particularly relevant, as it suggests that dance-based interventions may offer an effective, non-pharmacological approach to alleviate depressive symptoms in this population. A study by Gyrling, Ljunggren, and Karlsson (2021) investigated the impact of a dance program on individuals with Parkinson's disease. The research found that dance improved physical, social, and emotional well-being, with participants reporting better sleep, increased mobility, and a heightened sense of community and self-esteem. These benefits likely contribute to the reduction in depressive symptoms observed in dance interventions. The social interaction and increased self-esteem associated with dance can alleviate feelings of isolation and boost emotional resilience, leading to improved mood and reduced depression (Gyrling et al., 2021).

Gender Differences in Change of Depressive Symptoms

Although the t-tests showed significant improvements in depression, the linear mixed-effects model examining gender differences revealed more nuanced patterns. When adding these covariates, the main effect of time on depressive symptoms goes away. Instead the model showed that men had significantly higher depressive symptoms both before and after the intervention compared to women. The interaction between time and gender was not statistically significant, suggesting that the rate of change in depressive symptoms did not differ between men and women, even though men had consistently higher scores. Estrogen levels may influence the progression of Parkinson's disease could help explain why men might experience higher depressive symptoms compared to women (Haaxma et al., 2007). Estrogen is known to have neuroprotective effects (Brann et al., 2007) and is linked to mood regulation. Haaxma et al. (2007) suggest that women’s slower onset of Parkinson’s disease and slower motor deterioration, possibly due to higher estrogen levels, may provide some emotional and cognitive protection. In contrast, men, who have lower estrogen levels, might be more vulnerable to both the physical progression of the disease and associated mental health challenges, like increased depressive symptoms. The absence of estrogen's protective effects in men could contribute to their higher risk of mood changes in Parkinson’s disease.

Limitations

It is essential to acknowledge that this study did not include a comparison or control group. Consequently, although the findings suggest improvements in quality of life and depressive symptoms, it is unclear whether these benefits stem specifically from the dance intervention or from the general positive effects of group interaction and social engagement. Moreover, the study’s small sample size limits the statistical power of the findings and may not fully represent the broader population of individuals with Parkinson's disease. With a larger sample, the study could achieve more generalizable results, allowing for more reliable conclusions regarding the effectiveness of dance interventions in this population. The limited sample size may also increase the risk of sampling bias, as individual variations among participants can have a greater influence on the overall findings.

The short duration of the intervention - only eight weeks - also presents a limitation, as it restricts the ability to assess the long-term sustainability of the improvements observed. Parkinson's disease is a chronic, progressive condition, and an intervention of longer duration might provide more insight into whether dance can produce enduring benefits in quality of life, mood, and symptom management. Future research should address these limitations by employing a larger sample and extending the intervention duration. Incorporating a comparison or control group would also help to better isolate the specific impact of the dance program from other influencing factors.

Conclusion

The improvement in well-being and potential reduction in depressive symptoms are promising, as they suggest a benefit of the program that may extend beyond physical functions. The potential gender differences in outcomes also raise important questions about how men and women with PD may respond differently to such interventions, which could inform more tailored approaches in future therapies.

This research provides evidence that an 8-week dance intervention can significantly improve quality of life and depressive symptoms in individuals with PD, with some indication of gender differences in well being levels. These results highlight the potential of movement programs as useful in managing both the physical and emotional aspects of Parkinson's disease.

References

Brann, D. W., Dhandapani, K., Wakade, C., Mahesh, V. B., & Khan, M. M. (2007). Neurotrophic and neuroprotective actions of estrogen: Basic mechanisms and clinical implications. *Steroids*, *72*(5), 381–405. https://doi.org/10.1016/j.steroids.2007.02.003

Cerri, S., Mus, L., & Blandini, F. (2019). Parkinson's Disease in Women and Men: What's the Difference? *Journal of Parkinson's Disease*, *9*(3), Article 3. https://doi.org/10.3233/JPD-191683

Chaudhuri, K. R., & Odin, P. (2010). The challenge of non-motor symptoms in Parkinson's disease. *Progress in Brain Research*, *184*, 325–341. https://doi.org/10.1016/S0079-6123(10)84017-8

Colombo, B., Rigby, A., Gnerre, M., & Biassoni, F. (2022). The Effects of a Dance and Music-Based Intervention on Parkinson's Patients' Well-Being: An Interview Study. *International Journal of Environmental Research and Public Health*, *19*(12), 7519. https://doi.org/10.3390/ijerph19127519

Davila, H., Ng, W., Akosionu, O., Thao, M. S., Skarphol, T., Virnig, B. A., Thorpe, R. J., & Shippee, T. P. (2022). Why Men Fare Worse: A Mixed-Methods Study Examining Gender Differences in Nursing Home Resident Quality of Life. *The Gerontologist*, *62*(9), 1347–1358. https://doi.org/10.1093/geront/gnac003

Earhart, G. M. (2009). Dance as Therapy for Individuals with Parkinson Disease. *European Journal of Physical and Rehabilitation Medicine*, *45*(2), 231–238.

Elpidoforou, M., Bakalidou, D., Drakopoulou, M., Kavga, A., Chrysovitsanou, C., & Stefanis, L. (2022). Effects of a structured dance program in Parkinson's disease. A Greek pilot study.

Complementary Therapies in Clinical Practice, *46*, 101528. https://doi.org/10.1016/j.ctcp.2021.101528

Gyrling, T., Ljunggren, M., & Karlsson, S. (2021). The impact of dance activities on the health of persons with Parkinson's disease in Sweden. *International Journal of Qualitative Studies on Health and Well-Being*, *16*(1), 1992842. https://doi.org/10.1080/17482631.2021.1992842

Haaxma, C. A., Bloem, B. R., Borm, G. F., Oyen, W. J. G., Leenders, K. L., Eshuis, S., Booij, J., Dluzen, D. E., & Horstink, M. W. I. M. (2007). Gender differences in Parkinson's disease. *Journal of Neurology, Neurosurgery, and Psychiatry*, *78*(8), 819–824. https://doi.org/10.1136/jnnp.2006.103788

Kalyani, H. H. N., Sullivan, K. A., Moyle, G., Brauer, S., Jeffrey, E. R., & Kerr, G. K. (2019). Impacts of dance on cognition, psychological symptoms and quality of life in Parkinson's disease. *NeuroRehabilitation*, *45*(2), 273–283. https://doi.org/10.3233/NRE-192788

Laar, A. D. V., & Jain, S. (2004). Non-motor Symptoms of Parkinson Disease: Update on the Diagnosis and Treatment. *The Neurologist*, *10*(4), Article 4. https://doi.org/10.1097/01.nrl.0000131146.08278.a5

McRae, C., Leventhal, D., Westheimer, O., Mastin, T., Utley, J., & Russell, D. (2018). Long-term effects of Dance for PD® on self-efficacy among persons with Parkinson's disease. *Arts & Health*, *10*(1), 85–96. https://doi.org/10.1080/17533015.2017.1326390

Parkinson's Disease: What It Is, Causes, Symptoms & Treatment. (2022, April 15). Cleveland Clinic. https://my.clevelandclinic.org/health/diseases/8525-parkinsons-disease-an-overview

R Core Team. (2024). *R: A Language and Environment for Statistical Computing*.

Shehata, G. A., Farweez, H. M., Ali, A. M., Hassan, H. S., Tohamy, A. M., Mostafa, M., Ibrahim, M. A., Tarek, K., Elrashedy, A. A., Abdelnaby, R., Elsayed, M., & Gaber, D. E. (2024). Impact of Parkinsonism comorbid depression on cognitive functions. *The Egyptian Journal of Neurology, Psychiatry and Neurosurgery*, *60*(1), 37. https://doi.org/10.1186/s41983-024-00813-z