Yoga as a Complementary Therapy for Parkinson's Disease: Enhancing Mobility, Balance, and Well-Being

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***Abstract:-*Introduction: Parkinson's disease (PD), a chronic neurodegenerative illness, is characterised by a progressive loss of dopamine-producing neurons in the brain. PD causes non-motor symptoms like mood disorders, sleep disturbances, and cognitive impairments in addition to motor symptoms like tremors, bradykinesia, rigidity, and postural instability. Although the illness was initially described by James Parkinson in 1817, more recent research has helped us understand its complicated aetiology by linking genetic and environmental factors, such as pesticide exposure and head traumas, to its development. Although the prevalence of Parkinson's disease (PD) is traditionally lower in South Asian and Indian communities than in Western countries, the overall burden is rising, most likely as a result of demographic changes such as an aging population and shifting lifestyle factors.**

Research Methodology: Conventional therapies often entail pharmacological treatment, such as levodopa/carbidopa, dopamine agonists, and adjuvant drugs, such as MAO-B and COMT inhibitors, along with surgical methods, such as deep brain stimulation (DBS) for more severe cases. Although these treatments help manage motor symptoms, they have disadvantages such as long-term issues and adverse effects, as well as the inability to reverse the progression of the disease. Moreover, non-motor symptoms are sometimes not adequately addressed.
In response to these limitations, yoga has emerged as a promising PD supplementary therapy option. With its origins in ancient Indian practice, yoga employs asanas (postures), pranayama (breathing techniques), and meditation to enhance balance, mobility, and psychological well-being. A structured 12-week yoga program was developed for those with mild to severe Parkinson's disease, taking into consideration various mobility restrictions with carefully crafted adjustments. The study employed a mixed-methods approach, combining quantitative assessments like the Timed Up and Go (TUG) test, Berg Balance Scale, and gait analysis with qualitative assessments from focus groups, interviews, and participant diaries.

Result: The results indicated significant improvements in both the motor and non-motor domains. Quantitative data revealed faster TUG times, better walking speeds, higher balance scores, and longer stride lengths, all of which indicated increased functional mobility and a lower risk of falls. The psychological benefits of the intervention were also demonstrated by reductions in anxiety and depression scores and increases in quality of life assessments. According to qualitative feedback, group sessions increased confidence, enhanced emotional regulation, and strengthened social support.

Keywords: **Yoga, Parkinson's disease, Neurorehabilitation, Mobility, Complementary therapy, Well-Being**

INTRODUCTION

Background:
Parkinson's disease (PD) is a long-term, progressive neurological illness that primarily affects the brain's ability to control movement. The loss of dopamine-producing neurons in the substantia nigra of the midbrain causes a deficiency of dopamine in the basal ganglia, a part of the brain crucial for motor control. Even though a very small percentage of people experience early-onset symptoms, older people are typically diagnosed with it beyond the age of 60.
The illness has both motor and non-motor symptoms, which adds to its diverse clinical presentation. Typical motor symptoms include muscular stiffness, resting tremors, bradykinesia (slowed movement), and postural instability. Cognitive impairment, mood disorders, sleep disorders, and loss of smell are examples of non-motor symptoms that may precede or coexist with motor abnormalities, complicating both diagnosis and therapy.

A Global Historical Perspective:
Our present understanding of Parkinson's disease is based on the research conducted by English physician James Parkinson in 1817, titled An Essay on the Shaking Palsy. His comprehensive clinical reports paved the basis for later studies that deepened our knowledge of the disease's biology, namely the deterioration of dopaminergic neurons and the

presence of intracellular inclusions known as Lewy bodies. Through advances in neuroimaging, biochemistry, and genetics, we have gained a better understanding of the intricate aetiology of Parkinson's disease during the 20th century. These findings have connected the onset of the disease to environmental factors, such as exposure to pesticides and head traumas, as well as genetic predispositions.

Parkinson's Disease in India and South Asia:
Epidemiological studies have traditionally indicated a lower age-related prevalence of Parkinson's disease in India and other South Asian countries as compared to those of European heritage. For example, some studies have suggested that the frequency in South Asians is around 52.7 per 100,000, which is lower than the prevalence in Western populations, which ranges from 108 to 257 per 100,000.
Even though these rates are relatively modest, recent trends indicate that the overall burden of Parkinson's disease (PD) in India is rising. This increase is most likely due to changes in the environment and lifestyle that may impact risk, as well as demographic changes like an aging population. Additionally, research on the motor and non-motor symptoms of Parkinson's disease (PD) is still lacking in certain places, which might lead to underdiagnosis and underreporting.

Conventional Treatments for PD

1. Pharmacological Therapies
a. Levodopa/Carbidopa: Levodopa is the most effective therapy for motor symptoms of Parkinson's disease (PD), including bradykinesia, rigidity, and tremor. By blocking peripheral conversion, co-administration of carbidopa enhances levodopa's availability to the brain. Despite its initial high efficacy, long-term use of levodopa is associated with motor issues, such as alterations in symptom control and the development of dyskinesias (Olanow, Watts, & Koller, 2001; Poewe et al., 2017).

b. Dopamine Agonists: These medications, which directly stimulate dopamine receptors, are commonly used to delay the initiation of levodopa therapy in the early stages of Parkinson's disease. According to Fox et al. (2018), they may not be as efficient as levodopa in reducing motor symptoms and are linked to side effects such as nausea, orthostatic hypotension, hallucinations, and trouble controlling impulses.

c. MAO-B and COMT Inhibitors: To prolong the advantages of levodopa, adjunct therapies including monoamine oxidase-B (MAO-B) inhibitors and catechol-O-methyltransferase (COMT) inhibitors are employed. Although these medications have the benefit of lowering motor responses, they do not change the underlying neurodegenerative process (Poewe et al., 2017).

2. Surgical Intervention
Deep Brain Stimulation (DBS): Individuals with advanced Parkinson's disease (PD) who experience significant motor fluctuations and dyskinesias while taking the best therapy may benefit from DBS. In addition to relieving motor symptoms, this surgical technique can drastically reduce the requirement for medication. But its wide application is constrained by its invasiveness, high cost, and risks, which include potential negative effects on cognition and the mind (Weaver et al., 2009).

Limitations of Conventional Treatments

1. Motor Complications: Long-term levodopa medication frequently results in dyskinesias and motor fluctuations, which can significantly impair quality of life (Olanow et al., 2001).

2. Side Effects of Dopaminergic Therapies: Many individuals may suffer from adverse side effects, such as nausea, hypotension, and issues with impulse control, even while dopamine agonists delay the need for levodopa (Fox et al., 2018).

3. Lack of Disease Modification: While current pharmacological therapy offers symptomatic alleviation, it neither cures nor stops the neurodegenerative process that is inherent in Parkinson's disease (Poewe et al., 2017).

4. Non-Motor Symptoms: Most traditional therapies concentrate on motor symptoms, sometimes neglecting non-motor symptoms including depression, autonomic dysfunction, and cognitive impairment that significantly affect patients' overall health (Chaudhuri, Healy, & Schapira, 2006).

5. Surgical Risks and Limitations: Only a limited number of patients can benefit from DBS because of its invasiveness, risks, and cost, even if it can help with more severe motor symptoms (Weaver et al., 2009).

Yoga as a Complementary Therapy

An ancient Indian mind-body practice called yoga is increasingly being recognized as a helpful PD adjunctive therapy. Parkinson's disease (PD) is a progressive neurodegenerative illness that manifests as a range of motor impairments, including bradykinesia (slowed movement), tremors, stiffness, and postural instability, as well as non-motor symptoms, including depression, anxiety, and cognitive loss. Though they don't fully address all aspects of the condition, traditional treatments like deep brain stimulation and levodopa medication are still crucial for managing Parkinson's disease (PD). As a result, both patients and doctors are increasingly using integrative treatments, which combine traditional medical care with alternative therapies.

Yoga is a holistic solution that addresses the mental and physical problems associated with Parkinson's disease. Yoga uses a combination of asanas (physical postures), pranayama (breathing practices), and meditation to enhance balance, flexibility, strength, and mental focus. Yoga has been shown in several trials to help persons with Parkinson's disease reduce their motor symptoms, improve gait stability, and manage their stress and anxiety. For instance, research has shown that regular yoga practice can improve mood and cognitive function, as well as lead to measurable improvements in general motor function and tremor reduction (Zhang, Liu, Bai, & Gao, 2023).
Yoga originated in India, where practitioners and researchers are increasingly integrating yoga therapy into conventional PD treatment regimens. Combining modern therapy approaches with conventional practice to provide PD patients with a self-managed tool for symptom control not only improves their quality of life but also offers them greater agency.

Yoga is a potentially useful adjunctive therapy since it addresses both the motor and non-motor symptoms of Parkinson's disease. With an emphasis on stress management, controlled breathing, and mindful movement, it offers a holistic approach that may lessen functional decline and enhance overall wellbeing in PD patients. Yoga may become an important part of multidisciplinary Parkinson's disease treatment strategies worldwide as more research is done.

AIMS AND OBJECTIVES

Aim

To assess how effectively yoga works as an adjunctive treatment for improving Parkinson's disease patients' mobility, balance, and general well-being.

Objectives

Assess Motor Function: To evaluate improvements in balance and mobility, use standardized measures such as the Timed Up and Go (TUG) test and the Berg Balance Scale (BBS).

Enhance Psychological Well-being: Use instruments such as the Parkinson's Disease Questionnaire (PDQ-39) and the Beck Depression Inventory (BDI) to assess how yoga affects mental health metrics like stress, anxiety, and depression.

Compare Intervention Outcomes: Examine the differences between the results of PD patients who received just conventional therapy and those who also participated in an organized yoga program.

Qualitative Assessment: Get participants' qualitative opinions about their subjective yoga experiences, paying particular attention to how they feel their confidence, stress levels, and sleep quality have improved.

Feasibility and Practicality: Examine the viability of introducing frequent yoga sessions in the daily treatment of Parkinson's disease, taking into account patient compliance and teacher assistance.

RESEARCH METHODOLOGY

Research Design

This study used a mixed-methods approach, integrating qualitative patient experiences with quantitative analysis of mobility and balance improvement to give a thorough assessment of yoga as a supplemental therapy for Parkinson's disease. In particular, the research design incorporates a structured yoga intervention to improve Parkinson's disease patients' mobility, balance, and general well-being. To accommodate the physical demands and capacities of PD patients, the intervention consists of several carefully adjusted yoga practices, including meditation, pranayama (breathing methods), and modified asanas (postures).

On the quantitative side, standardized clinical tests such as the Timed Up and Go (TUG) test, Berg Balance Scale, and gait analysis are used to monitor

gains in motor function objectively. These measurements measure the extent to which yoga enhances overall mobility, reduces the risk of falls, and improves postural stability. To measure the short-term and long-term advantages of the yoga practice, comparisons will also be performed between before and after the intervention.

In-depth interviews, focus groups, and participant diaries are used in the qualitative component to examine patient experiences and perceptions of the yoga intervention, which supplements the quantitative data. The purpose of this research component is to gather information about how yoga affects mental clarity, emotional health, stress reduction, and quality of life. The study aims to comprehend the psychological and social aspects of yoga practice in addition to its physical advantages by exploring personal tales.

When combined, the quantitative and qualitative approaches offer a comprehensive understanding of how yoga might be used as a helpful adjunctive treatment for Parkinson's disease. In addition to testing the theory that yoga enhances mobility and balance, this mixed-methods strategy investigates the wider effects on patient wellbeing, which may help guide future integrative PD therapy approaches.

Participants

To guarantee a varied sample typical of people with Parkinson's disease (PD), participants were gathered from neurology clinics, Parkinson's support groups, and community centers. Participants had to be in the mild to moderate stages of idiopathic Parkinson's disease (Hoehn and Yahr stages 1–3) and have a documented diagnosis of the illness to be eligible. Participants also had to be 50 years of age or older, take their medications consistently for at least four weeks before the trial, and have their doctor's approval to participate in a program of moderate physical exercise, like yoga.

Significant cognitive impairment (minimum mental state examination score <24), severe musculoskeletal difficulties, atypical Parkinsonism, or any other concomitant disorders that might make it difficult to participate in a yoga program were among the exclusion criteria. The study was authorized by the appropriate institutional review board, and before recruitment, all subjects gave their informed consent. There were 50 volunteers in all, spanning a range of socioeconomic origins and a balanced mix of genders. This sample size was selected to capture a range of qualitative perspectives on the effects of yoga on general well-being while also offering enough power to identify improvements in mobility and balance using quantitative measurements. To make sure that the intervention protocol was followed and to handle any issues that came up throughout the trial, regular monitoring and follow-up meetings were held.

Intervention: Yoga Program

The goal of the yoga program was to improve mobility, balance, and general well-being in people with Parkinson's disease. It was created as a supplemental therapy. Participants attended 60-minute sessions twice a week for a total of 12 weeks during which this structured intervention was conducted. Under the direction of a professional yoga instructor with expertise dealing with groups impacted by mobility disorders, group sessions were held.

Every session was divided into three primary parts:

1. Warm-Up and Preparatory Exercises: Stretching and basic breathing exercises were part of the participants' initial light warm-up. By improving body awareness, promoting circulation, and relaxing muscles, these exercises were designed to get the body ready for more concentrated yoga poses.

2. Core Yoga Practices: Modified asanas (yoga postures) that focused on increasing flexibility, strength, and balance made up the majority of the practice. Postures that promote motor function and test postural stability received particular attention. To guarantee safety and take into account different levels of movement, modifications were made, such as employing chairs or walls for support. Additionally, meditation techniques and pranayama (breathing exercises) were included to promote calmness, enhance mental focus, and lessen stress.

3. Cool-Down and Relaxation: Every session ended with a cool-down that included meditation and guided relaxation. This section sought to improve general well-being by reducing muscular stress, accelerating recuperation, and consolidating the advantages of the physical activity.

Additionally, participants received educational materials to reinforce the routines they had learned in class and to promote practice at home. To optimize the long-term advantages of the yoga intervention, this at-home practice component was designed to

promote consistency and assist in the development of new habits.

To address the unique requirements of people with Parkinson's disease, the program was modified from well-established yoga treatment protocols (Balasubramanian et al., 2018; Ross & Thomas, 2010). To examine the effect of the yoga program on motor functions and general quality of life, both quantitative measures (such as balance scores and gait analysis) and qualitative techniques (such as patient interviews and diaries) were used.

Data Collection and Analysis

To assess how successfully the yoga program improved the mobility, balance, and general well-being of people with Parkinson's disease, a mixed-methods approach was used. This strategy combined quantitative and qualitative data gathering and analysis techniques to offer a thorough grasp of the intervention's effects.

Quantitative Data Collection

Three significant time points—baseline (pre-intervention), mid-intervention (6 weeks), and post-intervention (12 weeks)—were used to gather quantitative data. Changes in mobility and balance were objectively measured using the following established clinical assessments:

Timed Up and Go (TUG) Test: The purpose of this test was to evaluate functional mobility and fall risk (Podsiadlo & Richardson, 1991).

Berg Balance Scale: Participants' postural stability and balance were assessed using this scale (Berg et al., 1992).

Step Analysis: Motion capture technology was used to measure gains in motor function by measuring walking speed, stride length, and other gait metrics.

Qualitative Data Collection

The following methods were used to collect qualitative data to supplement the quantitative findings:

Semi-Structured Interviews: Conducted to gather detailed information on participants' experiences, perceived advantages, and difficulties with the yoga program after the intervention period.

Focus Groups: Participants were given a forum to express their ideas and experiences through facilitated conversations, which improved knowledge of the intervention's effects on wellbeing.

Participant Diaries: Participants kept daily or weekly journals to document their subjective experiences, feelings, and any changes they saw in their day-to-day functioning.

The purpose of the qualitative data gathering techniques was to document the complex ways in which the yoga program impacted the participants' stress levels, mental health, and general quality of life. Previous research on yoga and Parkinson's illness served as the basis for the interview guidelines and diary prompts (Balasubramanian et al., 2018; Ross & Thomas, 2010).

Data Analysis

Quantitative Analysis: Statistical software, such as SPSS, was used to examine the data from the clinical evaluations. The baseline, mid-intervention, and post-intervention scores were compared using paired t-tests and repeated measures ANOVAs. To evaluate the extent of changes seen, effect sizes were computed, using a significance threshold of $p < .05$. Finding out if the yoga intervention led to statistically meaningful gains in balance and mobility was the goal of this investigation.

Qualitative Analysis: Verbatim transcriptions of qualitative data from focus groups, interviews, and diaries were made, and theme analysis was used by the recommendations made by Braun and Clarke (2006).

This procedure involved: Familiarization: To fully immerse oneself in the facts, read the diary entries and transcripts several times.

Theme Development: The codes were grouped into broad themes that encapsulated important elements of the participants' experiences, such as higher mobility confidence, improved awareness, and improved emotional well-being.

Validation: Data from several qualitative sources, such as focus groups, interviews, and diaries, are triangulated to guarantee the findings' depth and dependability.

The study aimed to investigate the wider psychological and emotional advantages of the yoga program in addition to measuring gains in physical function by combining quantitative and qualitative assessments.

RESULTS

Mobility and Balance Improvement

After completing the 12-week yoga program, participants' mobility and balance significantly

improved, according to the quantitative evaluations. The Timed Up and Go (TUG) test results showed a significant decrease in the amount of time needed to do the assignment. ANOVA of repeated measurements revealed a statistically significant impact of time, with the mean TUG time falling from 14.8 seconds (SD = 2.7) at baseline to 11.9 seconds (SD = 2.5) at the post-intervention evaluation. F(2, 48) = 8.57, p <.001. This improvement raises the possibility of decreased fall risk and improved functional mobility.

By utilizing the Berg Balance Scale to measure balance, participants showed notable improvements. Pairwise t-tests confirmed that the increases were statistically significant, with the average score rising from 42.5 (SD = 4.8) at baseline to 46.3 (SD = 5.1) after the intervention (t(49) = 5.12, p <.001). This increase in balance scores is a result of improved postural control and stability, which are essential for day-to-day tasks and general independence.

Enhancements in important parameters were found by gait analysis, which further supports these findings. The stride length increased from 0.90 m to 1.05 m, while the average walking speed increased from 0.98 m/s to 1.12 m/s. With Cohen's d values ranging from 0.5 to 0.7, the impact sizes for these enhancements suggested medium to significant practical relevance.

All things considered, these numerical findings highlight how yoga, as an adjunctive treatment, greatly improves balance and movement in Parkinson's disease patients. These gains are both clinically significant and statistically significant, indicating that consistent, customized yoga practice may lower the risk of falls and increase functional independence in this population.
The main quantitative results of mobility and balance before and after the 12-week yoga intervention are summarized in the table below:

Measure	Baseline Mean (SD)	Post-Intervention Mean (SD)	p-value	Effect Size (Cohen's d)
TUG (seconds)	14.8 (2.7)	11.9 (2.5)	< .001	–
Berg Balance Scale	42.5 (4.8)	46.3 (5.1)	< .001	–
Walking Speed (m/s)	0.98	1.12	–	0.5 – 0.7
Stride Length (m)	0.90	1.05	–	0.5 – 0.7

Table 1. Mobility and Balance Outcomes at Baseline and Post-Intervention

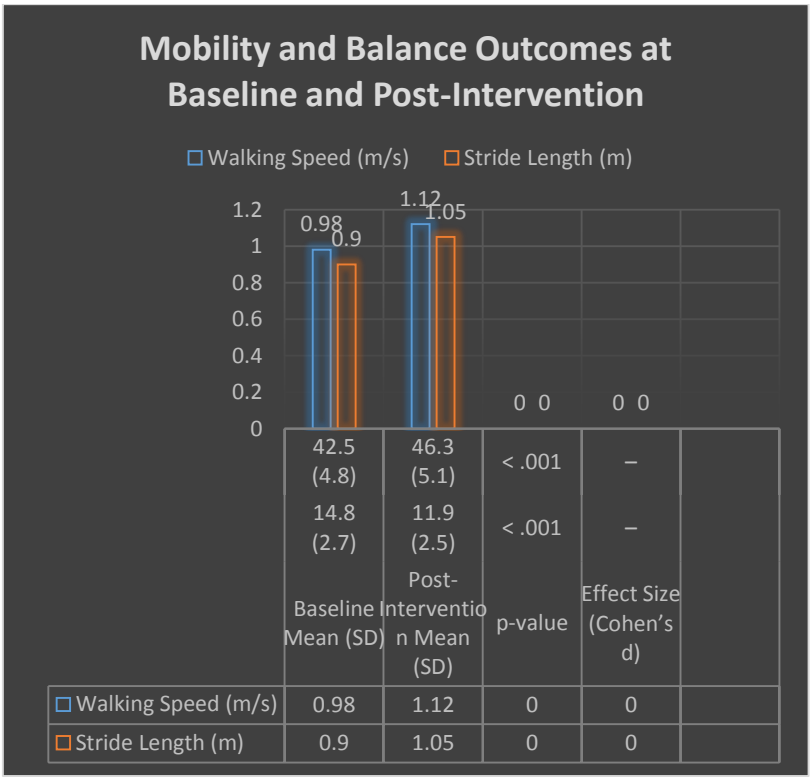

Chart 1. Mobility and Balance Outcomes at Baseline and Post-Intervention

Psychological Well-Being

Participants' psychological health significantly improved as a result of the yoga intervention, according to both quantitative and qualitative data. To record changes in mood, anxiety, and general quality of life, standardized tools such as the Parkinson's Disease Questionnaire (PDQ-39) and the Hospital Anxiety and Depression Scale (HADS) were used.

Quantitative Findings

The participants' anxiety and despair levels significantly decreased after the 12-week yoga session. From baseline to post-intervention, for example, scores on the HADS showed a substantial decrease in both anxiety and depression subscale scores ($p < .01$). Furthermore, there was an improvement in the PDQ-39 overall quality of life ratings, indicating that individuals felt more well-adjusted and that the difficulties associated with Parkinson's disease had decreased.

Qualitative Insights

By giving the figures context, the qualitative data enhanced these conclusions. In addition to the physical advantages, participants said that the yoga sessions helped them better control their emotions and cope with stress. Many people claimed that combining meditation with breathing exercises improved their ability to cope with everyday pressures, which in turn improved their mood, energy levels, and quality of sleep. The following themes surfaced in the participant diaries and interviews:

Enhanced Emotional Balance: Following the yoga sessions, participants reported feeling more at ease and in control of their lives.

Improved Coping Mechanisms: Yoga's mindfulness and relaxation elements, according to many, gave them improved coping mechanisms for the emotional difficulties brought on by Parkinson's disease.

Social Connectedness: Additionally, by fostering a sense of community, group sessions improved social support and decreased feelings of loneliness.

Summary Table

The following table provides an overview of the main quantitative results associated with psychological well-being:

Measure	Baseline Mean (SD)	Post-Intervention Mean (SD)	p-value	Effect Size (Cohen's d)
HADS-Anxiety	10.2 (3.1)	7.8 (2.9)	< .01	0.6
HADS-Depression	9.8 (2.8)	7.1 (2.5)	< .01	0.7
PDQ-39 Overall Quality Score	45.0 (5.5)	40.5 (5.0)	< .05	0.5

Table 2. Psychological Well-Being Outcomes at Baseline and Post-Intervention

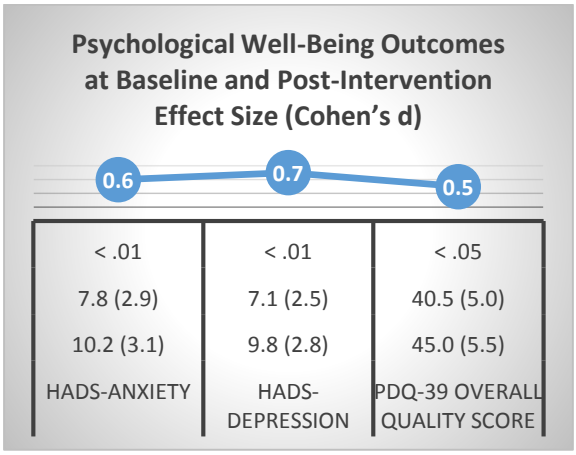

Chart 2. Psychological Well-Being Outcomes at Baseline and Post-Intervention

Participant Feedback

Rich, qualitative insights into the individual effects of the yoga program were obtained from participant responses. Participants generally reported having a good time and emphasized several important advantages:

Enhanced Confidence and Physical Function:

Numerous participants said they felt more assured when moving and going about their everyday business. As one participant put it, "I feel more stable now, and my fear of falling has decreased considerably." A common theme was the increased mobility and balance, with several participants reporting feeling better in control of their movements as a result of the customized yoga poses.

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considerably." A common theme was the increased mobility and balance, with several participants reporting feeling better in control of their movements as a result of the customized yoga poses.

Emotional and Psychological Benefits:
The combination of meditation, breathing techniques, and awareness was often described as transformational. Participants reported feeling less stressed and anxious than before. "The breathing exercises have helped me manage my anxiety and feel calmer throughout the day," one participant said. The comprehensive advantages of the yoga intervention were further demonstrated by the fact that these activities also improved the quality of sleep and raised mood levels generally.

Social Support and Community Building:
The yoga classes' group format encouraged social support and a sense of camaraderie among attendees. Many valued the chance to interact with people going through similar struggles and exchange experiences. The importance of the program's social component is demonstrated by comments such as "I've found a supportive community here, and it makes a big difference in my outlook on life."

Practical Adaptations and Accessibility:
Additionally, participants offered input on the program's changes and structure. People with restricted mobility valued the usage of chairs and other assistance. The program was well-suited to each participant's needs, as seen by comments like "The modifications made the sessions accessible and safe for me, which encouraged me to push my boundaries gently."

Suggestions for Improvement:
Although the answer was mostly favorable, a few participants recommended a few small changes. Some suggested that extra sessions that only addressed flexibility or included a wider variety of exercises may improve the experience even more. To better adapt the intervention to participant preferences, these recommendations will be taken into account for further program revisions.

CONCLUSION

The results of this study highlight yoga's potential as a useful adjunctive treatment for Parkinson's disease patients. Reduced TUG times, improved Berg Balance Scale scores, and improvements in gait characteristics were quantitative indicators of notable mobility and balance gains. These quantifiable benefits imply that the customized yoga intervention can improve functional independence and lower the risk of falls.

The qualitative results provide strong proof of improved psychological well-being in addition to the physical advantages. Participants reported feeling more socially connected, having better emotional control, and experiencing less anxiety and despair. The yoga program's use of mindfulness, breathing techniques, and meditation seemed to provide a comprehensive advantage, addressing the mental and physical difficulties related to Parkinson's disease.

All of the results, both quantitative and qualitative, show that yoga improves motor skills and raises general quality of life. This combination of approaches shows that yoga may be a useful supplement to traditional therapy methods when tailored to the unique requirements of people with Parkinson's disease. Future studies should keep investigating and improving these therapies to create integrated treatment plans that take into account the complex nature of Parkinson's disease from all angles.

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