

Review Article

# Role of yoga in Parkinson's disease-A comprehensive update of the literature

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## Abstract

Parkinson's disease (PD) is a neurodegenerative disorder characterized by progressive degenerative motor symptoms (e.g., tremors, impaired balance and gait) and nonmotor symptoms (e.g., fatigue, sleep disturbances, pain) that can negatively influence health and mental wellbeing by decreasing quality of life. It affects nearly 10 million people and more and more cases are diagnosed because of the advancement seen in movement disorder clinics and diagnostic tools worldwide. Individuals with PD also complain about anxiety arising out of these symptoms of postural instability, low back pain etc., which may lead to increased risk of falls and fall related injuries of brain, bone or other organ systems. Stress is one factor which has been shown to directly correlate to neurodegenerative pathology. Ways to reduce stress at a given point of time and across one's life span is considered to be a prime necessity in today's world. Various body-mind exercises like yoga, tai chi, qi gong, tango, ballet etc., has been in research for quite some time now, which has shown benefits in PD patients. In this article evidences related to yoga and its role in PD will be reviewed in a detailed fashion.

## Introduction

Yoga has been suggested in recent past by research community as a treatment of various disorders ranging from anxiety to neurological disorders like multiple sclerosis (MS). However the scientific evidence behind it is very weak. Aerobic exercise is a physical exercise comprised of low to high intensity that uses oxygen to adequately meet energy demands during exercise. Anaerobic exercise on the other hand is considered as an intense physical activity of very short duration, fueled by the energy sources within the contracting muscles and independent of the use of inhaled oxygen as an energy source.

Anaerobic graded exercise is considered to be of great benefit in neurodegenerative diseases like PD. Yoga is believed to be a form of aerobic exercise although this is still under debate. World Health Organization (WHO) officially began promoting yoga in developing countries in 1978, it has been cited for its therapeutic potential and has been even widely recognized in Western culture. Scientific community thinks yoga as an alternative and complementary means of therapy. In this article we will focus on the role of yoga as an add on complementary therapy in PD patients who are either drug naïve or receiving anti Parkinson treatment.

## More Information

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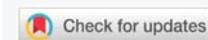
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Keywords: Stress; Yoga; Parkinson's disease

Abbreviations: BDNF: Brain-Derived Neurotrophic Factor; RCT: Randomized Clinical Trial; HRQOL: Health Related Quality Of Life; CVA: Cerebrovascular Accident; AD: Alzheimer's Disease; TBI: Traumatic Brain Injury; GBS: Guillain-Barré Syndrome; PDQ-39: Parkinson's Disease Questionnaire-39; CAT: Complementary and Alternative Therapy



Increased risk of fall in older adults is related to declining balance and power in the muscles. Brief postural instructions can affect balance control in older adults with PD[1-4]. Recent study has reported about the role of yoga, alexander technique and tai chi in strengthening embodied mindfulness as either effortful or effortless in maintaining balance in older adults [5]. Physical activity can reduce the risk and improve symptoms of PD which may include running, dancing, traditional chinese martial arts, yoga, and weight training. Physiologic mechanisms behind it are reducing the accumulation of  $\alpha$ -synuclein protein thereby decreasing neuroinflammation, and oxidative stress, while enhancing BDNF activity, nerve regeneration, and mitochondrial function [6,16].

Cortisol is a hormone released by the adrenal glands. It is believed that patterns of cortisol secretion, which are regulated by the brain is a key mediator of stress. Recent reports has suggested that engaging in stress-relieving strategies by focusing on positive characteristics, art/music therapies, mindfulness, yoga, engaging with nature and/or physical activity can promote regulation and/or restoration of



patterns of cortisol secretion which in turn can promote brain health and delay progression of symptoms and halt the disease process of many clinical disorders and neurodegenerative diseases including PD [7,8]. A recent meta-analysis further showed that mind-body exercises like yoga and tai chi can provide significant improvements in motor function, depressive symptoms, and quality of life in patients with PD [9], in line with the study of Kwok, et al., which also found that these exercises demonstrated immediate moderate to large beneficial effects on motor symptoms, postural instability, and functional mobility among individuals with mild to moderate PD [24].

Recently a case-control study reported that participants who completed a twice-weekly 12-week yoga intervention reported high levels of enjoyment. Yoga as an intervention showed improvement in balance and low back pain but no change in anxiety level in people with PD [10] in contrast to the study by Kwok, et al., where 138 study participants who had mild to moderate PD were randomly assigned to 8 weeks group sessions of 90-minute mindfulness yoga or 60-minute stretching and resistance exercise (SRTE). The yoga group had greater improvement in psychospiritual outcomes, including anxiety, depression, perceived hardship/equanimity, and health-related quality of life than did the SRTE group at 8 weeks and 20 weeks. The improvements in the yoga group were moderate to large. However both groups in the study showed similar significant improvement in motor symptoms and mobility [11]. Several other studies also found yoga as a feasible and acceptable complementary therapy in improving motor function in PD [17,18,24].

Adams, et al., wanted to identify predictive factors of functional improvement for people with PD after an 8-week yoga intervention. They found out in a stepwise multiple linear regression that a) lower cognitive functioning was predictive of improvement in perceived control over falls b) body responsiveness was predictive of improvement in PD-specific symptoms c) and gait velocity was predictive of improvement in balance and activity constraints. However they concluded that extensive researches in future are required among PD patients who are best fit for yoga therapy rather than a generalized add on therapy for all patients and for evaluating the need to include cognitive self-management training concurrent with yoga therapy [12]. A randomized, wait-list controlled pilot study examined the influence of an 8-week yoga intervention for people with PD and found out reduction of freezing gait in individuals with PD [19].

Maddela, et al., explored cognitive behavior and psychosomatic associations of disease in PD patients in a cross-sectional sample survey. They found out stress associated with thinking about death accelerates PD progression and is consistent with yoga philosophy and with neurophysiological mechanisms associated with the psychosomatic connections [13]. Walter, et al., examined changes in nonmotor symptoms

among individuals with PD following an 8-week yoga intervention. They found out yoga to be an efficacious intervention for improving nonmotor symptoms as well as HRQOL [14,18,22]. A recent systematic review by Green and colleagues on benefits of yoga at risk for falls because of neuromuscular problems found out that, there is a moderate positive evidence to support yoga to decrease the risk for falls for community-dwelling older adults and people with CVA, AD-type dementia, and MS. However, no clear benefit has been found in TBI and PD patients [15]. Wahbeh and colleagues, also reported that mind-body therapies can be effective in preventing migraine headache whereas its usefulness in other neurological conditions is unclear [36].

A single-blind, randomized, waitlist-controlled, phase II exploratory pilot study using an after-trial embedded mixed methods design reported an effect of an 8-week Hatha yoga intervention on individuals with PD. Their results endorsed the use of Hatha yoga as a community-based rehabilitation intervention for individuals with PD by improving many types of activities and participation outcomes like social relationships, self-care and recreation [20]. Justice, et al., developed and tested a bi-weekly, 12-week yoga program to determine its safety and feasibility for people with PD. The sequences used by them were yoga postures (asana), breathing techniques (pranayama), and mindfulness meditation principles specifically chosen to address concerns unique to the PD population. The intervention was safely tolerated by participants with no adverse outcome with complete satisfaction [21].

Kakde, et al., developed and validated an integrated yoga module (IYM) for PD after a thorough review of classical yoga texts and previous findings [23]. Shin, et al., used a self-administered, cross-sectional survey and found out 2/3<sup>rd</sup> of participants used complementary health approaches like yoga, massage etc. either for general health measures or controlling quality of life in patients with PD [25].

Meng, et al., evaluated the effects of a specially designed power yoga program (YOGA) on bradykinesia, rigidity, muscular performance and quality of life in older patients with PD in a RCT. The YOGA group produced significant improvement in both upper and lower limbs bradykinesia scores, rigidity score, and improvements were seen in the PDQ-39 overall score, mobility and activities of daily living. The 3-month YOGA program significantly reduced bradykinesia and rigidity, and increased muscle strength and power in older patients with PD. They concluded power training as an effective training modality to improve physical function and quality of life for patients with PD [26]. They also compared effects of power training (PWT) and a high-speed yoga program on physical performances in older patients with PD to find out if these interventions can ameliorate PD symptoms and improve physical performance. They found out specially designed yoga program and PWT programs can significantly improve physical performance in older persons with PD [27].



De Caro and Brown in a pilot study explored outcomes of laughter yoga (LY) in adults with PD and their caregivers. Significant improvements were seen in both PD patients and caregivers after LY sessions [28]. General exercise, yoga and other neuro feedback-based techniques can benefit PD patients psychologically and improve quality of life and solve balance issues [29]. Boulgarides, et al., in a pilot study identified the outcome measures responsive to change in individuals with PD after an 8-week adaptive yoga program and found out depression subscale of the Hospital Anxiety and Depression Scale (HADS), 30-Second Chair Stand (TSCS), Single-Leg Balance test (SLB), and the right and left Sit-and-Reach Test (SRT) changed as outcome measures. They concluded that adaptive yoga can be very helpful in patients with PD [30]. Sharma, et al., in a randomized controlled pilot study found out yoga may improve aspects of QOL and physiological functions in stages 1-2 of PD patients [31].

Moriello, et al., in their case study reported about an intense exercise program of 1½-hour integrating yoga twice weekly for 12 weeks with a dedicated physical therapy exercise for another 12 weeks in a male with PD. They reported improvement in the PDQ, High Level Mobility Assessment Scores, muscle length of several lower extremity muscles, strength in upper and lower extremity muscle, quality of life making him to participate in community, work and leisure activities [32] in contrast to the case report of a 69 year old female with 8 year history of PD where no change of PDQ was noted [33]. Hubert, et al. suggested proper education of complementary and alternative therapies should be provided to patients and caregivers to get the maximum benefit [34].

In a study by Pecci, et al., which interviewed 300 patients to determine the prevalence of CATs use and their association with demographic, social, or disease-specific characteristics among patients with PD, found out 25.7% of the PD patients interviewed had used CATs to improve their PD symptoms whereas 38.0% used some CATs without any relation to PD, at least once in life. The use of CATs was much more frequent among women and more common in the 50- to 69-year age group. They also reported that no major association between CATs use and the duration of the disease, side of initial involvement, PD phenotype, or the Hoehn and Yahr, staging was found [35].

## Discussion and conclusions

Stress leads to illness and is considered to be harbinger of many diseases. Currently in a fast paced society, engagement in strategies to be stress free is vital for good health and improvement quality of life across one's lifetime. These mind-body exercises has shown to have benefit in decreasing stress and enhancement of wellbeing of individuals if practiced meticulously. It is being thought now that these practices can regulate and/or restore patterns of cortisol secretion in our body and minimize stress and thereby improving the health of neurons and central nervous system. Many researchers believe now that stress can cause several physiological changes in our body and brain which might directly relate to neurodegenerative conditions like AD, PD etc.

Yoga might be considered as an effective adjuvant for patients with various neurological disorders like MS, stroke, epilepsy, PD, dementia, AD, neuropathy, GBS, myelopathy as evident from recently published literatures [37]. Mind body practices or exercises can communicate with areas of the brain involved in reward processing, learning, memory consolidation, attention, sensory integration and awareness, emotional control by deactivating amygdala. It may improve brain network connectivity which generally degenerates with neurodegenerative diseases [38].

These mind body exercises can be of great help in terms of controlling motor, nonmotor, depressive symptoms and can enhance quality of life in PD patients. However more studies in the form of prospective and RCTs are required to prove the usage of CATs in PD while taking several factors like age, gender, severity of the disease itself and drug usage into consideration.

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