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The Effects of Breathing Exercises Combined with Therapy for People with Parkinson's Disease

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Abstract

Parkinson's disease (PD) is a progressive neurodegenerative disorder characterized by motor symptoms such as tremor, bradykinesia, and rigidity, alongside non-motor symptoms like cognitive impairments, depression, and sleep disturbances, which collectively reduce patients' quality of life (QOL). This study aimed to evaluate the impact of pranayama and occupational therapy interventions on stress levels and QOL in individuals with idiopathic PD. The results demonstrated that pranayama practices (Anulom-Vilom, Kapalbhati) significantly reduced perceived stress and enhanced QOL, supported by improved autonomic and cardiopulmonary functions. Studies by Neena Sharma, Neha Singh, and others confirm the efficacy of yoga in alleviating stress, depression, and anxiety, attributed to improved cortisol regulation. While occupational therapy alone contributed to QOL improvements, its combination with pranayama proved substantially more effective in reducing stress. These findings underline the potential of integrative therapeutic approaches in the holistic management of PD symptoms and QOL improvement.

Keywords: Parkinson's disease, quality of life, stress reduction, pranayama, occupational therapy, yoga, autonomic function, idiopathic Parkinson's disease.

I. Introduction

Parkinson's disease (PD) is a progressive disorder of the extrapyramidal motor system that primarily affects movement. Its onset typically occurs in middle or late adulthood. The hallmark symptoms of PD include tremor, bradykinesia (slowness of movement), and rigidity. Additional symptoms may involve impaired posture and balance, slurred speech, reduced automatic movements, depression, fatigue, cognitive impairments, sleep disturbances, and micrographia.

The primary cause of PD is the loss of dopamine-producing neurons, which disrupts normal brain activity, leading to motor impairments and other symptoms. An age-related neurodegenerative disorder, PD affects approximately one million people in the United States alone. The pathological hallmark of PD involves the accumulation of Lewy-body-like inclusions in nigrostriatal terminals, followed by retrograde degeneration, protein aggregation in nigral cell bodies, reactive gliosis, and ultimately neuronal death. In familial forms of PD linked to mutations in the α-

synuclein gene, both loss of normal protein function and toxic effects of mutant protein forms contribute to the accumulation of cytoplasmic dopamine. This accumulation triggers oxidative stress, initiating neurodegenerative changes.

Although PD was first thoroughly described over 200 years ago, a comprehensive understanding of its functional deficits and neurobiological causes has only recently begun to emerge. Advances in biochemistry and neuroscience have expanded knowledge about the disease's pathophysiology. Despite these developments, many motor and non-motor symptoms remain resistant to existing drug therapies and surgical interventions, posing ongoing challenges for neurologists and neurosurgeons worldwide.

Exploring Alternative and Complementary Therapies

Given these challenges, many patients turn to complementary and integrative health care options. Common concerns include the high costs of current treatments and the side effects associated with medications. Integrative health approaches are generally more affordable, pose minimal physical and emotional risks, and encourage active patient participation in care. Consequently, researchers face the urgent task of developing and validating alternative therapies to complement the benefits of conventional medical and surgical treatments.

Therapeutic Approaches

Drug therapy for PD primarily relies on dopamine substitutes. However, these medications are often associated with the "on-off" phenomenon, which causes unpredictable periods of motor immobility and exacerbations of symptoms. The disabling nature of PD symptoms, coupled with the inability to halt or slow disease progression, often results in severe psychological stress and significantly impacts patients' quality of life (QoL).

Non-pharmacological interventions, such as *pranayama* (controlled breathing exercises), have shown promise in reducing stress by enhancing parasympathetic activity and reducing sympathetic activity. Occupational therapy focusing on muscle tone, posture, balance, self-care, and functional training has also been found to improve QoL for individuals with PD.

Genetic and Environmental Factors

Genetic predisposition plays a significant role in Parkinson's disease. Approximately 15–20% of individuals with PD have a close relative with similar symptoms, suggesting a hereditary component. Mutations in genes such as *parkin*, *PINK1*, *LRRK2*, *DJ-1*, and *glucocerebrosidase* have been associated with early-onset PD. To date, at least nine genetic mutations have been identified as increasing the risk of developing PD. In many cases, these genetic factors interact with environmental influences, further increasing susceptibility to the disease.

II. Rationale of the Study

Parkinson's disease (PD) is a complex neurodegenerative disorder characterized by motor and non-motor symptoms that significantly impair patients' quality of life. Despite advancements in pharmacological and surgical treatments, many symptoms remain refractory, and current therapies often carry financial burdens and adverse effects. Furthermore, the unpredictable nature of PD symptoms and the lack of disease-modifying interventions underscore the need for alternative strategies to manage the condition.

III. Aim and Objectives

Aim: To study effectiveness of pranayams combined with Occupational therapy on stress and QOL of idiopathic Parkinson's disease patients.

Objectives: To reduce perceived stress in PD patients and thus improving of QOL.

Hypothesis of study:

Null hypothesis H ($_0$)- pranayama breathing combined with conventional occupational therapy does not affect QOL and perceived stress in Parkinson's disease

Alternate hypothesis H ($_1$)- Pranayama breathing combined with conventional occupational therapy shows significant effect on QOL and perceived stress in Parkinson's disease patients

IV. Research Methodology

4.2 Study design: a prospective randomized control study

Age group: 40-70 years

4.3 sampling method - Sample size of 30 was calculated using online worthy sample size calculator.

Here's what the formula looks like: population size taken in the formula was 40, which was average number of PD patients visiting a Pacific hospital.

Parameters:

$$\frac{\frac{z^2 \times p(1-p)}{e^2}}{1+\left(\frac{z^2 \times p(1-p)}{e^2 N}\right)}$$

Population size= N

Margin of Error = e =3%

Z-Score= z=1.96 at 95 % confidence level

p= Standard Deviation= 0.5 % in calculator

4.4 Sample size: 30

4.5 Study setting – Pacific hospital, Udaipur.

Study duration : 8 weeks

4.6 Variables: Pranayama is the independent variable and stress is the dependent variable.

Inclusion criteria- 30 mild to moderate (i.e. Hoehn and Yahr stages 1-3) Idiopathic PD patients both male and female, age group 40-70 yrs, on drugs will be included in the study (random sampling). By odd even method 15-15 patients will be placed in control and experimental group respectively. Control group will be receiving conventional Occupational therapy treatment and experimental group will be receiving pranayams along with conventional OT.

Exclusion criteria- Patients with cognitive impairments, any other medical, neurological conditions and psychiatric disease were excluded.

4.7 Material and tools required

1. The WHOQOL-BREF is QOL questionnaire. It consists of 4 domains, Physical Health, Psychological, Social Relationships, and Environment. Each domain is comprised of multiple questions that are considered together in the derivation of each domain score.

Each individual item of the WHOQOL-BREF is scored from 1 to 5 on a response scale, which is stipulated as a five-point ordinal scale. The scores are then transformed linearly to a 0–100-scale. It assesses physical, social, psychological and environmental domains.

2. Perceived Stress Scale (PSS) is a classic stress assessment instrument. The questions in this scale ask about your feelings and thoughtsduring the last month. In each case, you will be asked to indicate how often you felt or thought a certain way. Although some of the questions are similar, there are differences between them and you shouldtreat each one as a separate question. For each question patient will choose from alternative 0 to 4 scale, i.e. from never to very often. Individual scores on the PSS can range from 0 to 40 with higher scores indicating higher perceivedstress.

4.8 PROCEDURE AND TREATMENT

Treatment protocol- The total treatment protocol is of 8 weeks. Pranayams like Anulom and vilom and Kapal bhati were advised for 5 mins each in the early morning on an empty stomach in 1st 2 weeks, followed by 10mins, 15 mins and 20 mins in the successive two weeks period till end of 8 weeks. [3,5]. The process of Anulom Vilom involves holding a nostril closed with a thumb and inhaling with the other, then holding the other nostril closed with your middle and ring finger and repeating the process. It is one of the easiest controlled breathing practice of yoga which is also called Yoga for everyone.

Kapal bhati pranayama is a wonderful breathing technique that involves powerful rapid exhalations followed by short & passive inhalations. The following inhale is an automatic response from the lungs being empty.

Conventional Occupational therapy treatment: tone normalization, maintaining ROM /MP, energy conservation techniques and fatigue management, coordination bed mobility, transfers, balance training, Self-care training and home modifications advices- were part of OT. O.T. sessions will be conducted for 30 mins twice a week at OT

centre and a care taker- supervised Home exercise program of all above exercises was advised to perform daily once.

V. Data Analysis

Paired t test was done for pre and post differences in Perceived stress scores as well as WHO QOL bref questionnaire.

The pre and post mean of transformed scores of the domains of WHO QOL BREF QUESTIONNAIRE in control and experimental group:

Table1: Transformed scores of Domains of WHOQOL BREF questionnaire

	Domains	Control group		Experimental group	
		Mean of transformed scores		Mean of transformed scores	
		Pre	Post	Pre	Post
1.	Physical	44.8	65.13	35.67	68.6
2.	Psychological	34.45	53.26	27.8	63.87
3.	Social	62.4	79.66	50.67	72.68
4.	Environmental	46.0	58.67	40.4	54.14

The pre and post mean of Perceived stress scale scores in control and experimental group:

Table 2: Pre and post PSS scores of both the study groups

Control group		Experimental group	
Pre	Post	Pre	Post
26.67	17.74	26.93	14

Graphical Analysis

Fig 4. Pre and Post Mean of the transformed domain scores of WHO QOL BREF questionnaire in control group. Xaxis- Domains of WHO QOL, Y- axis- Mean of transformed scores.

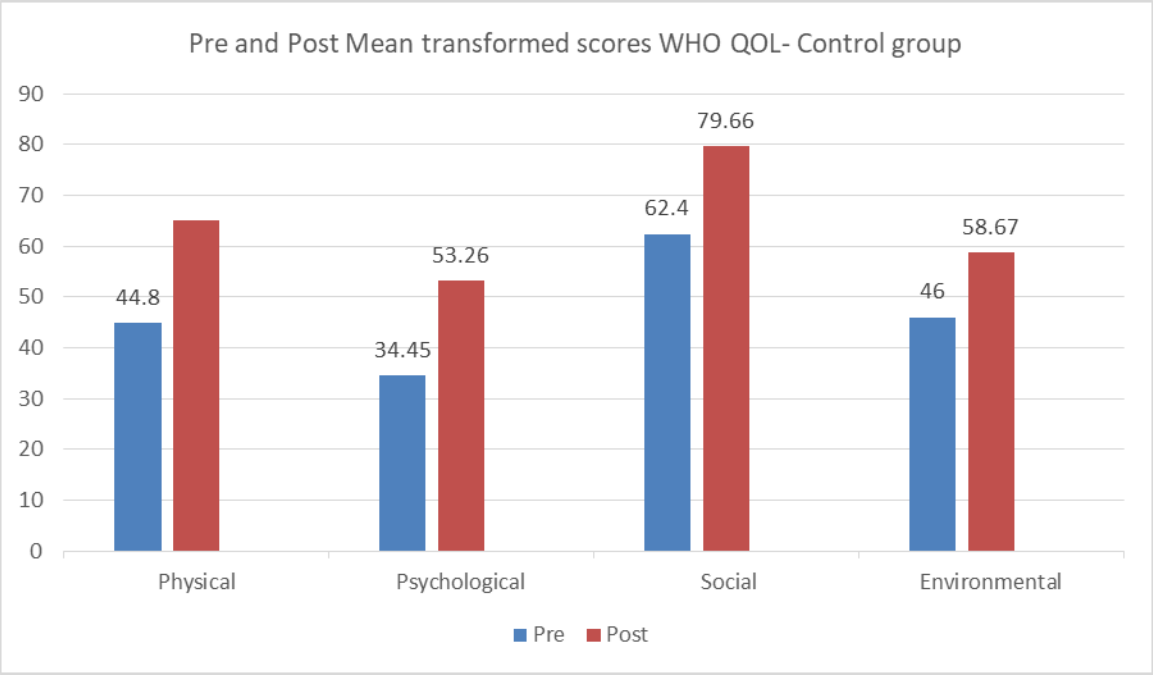
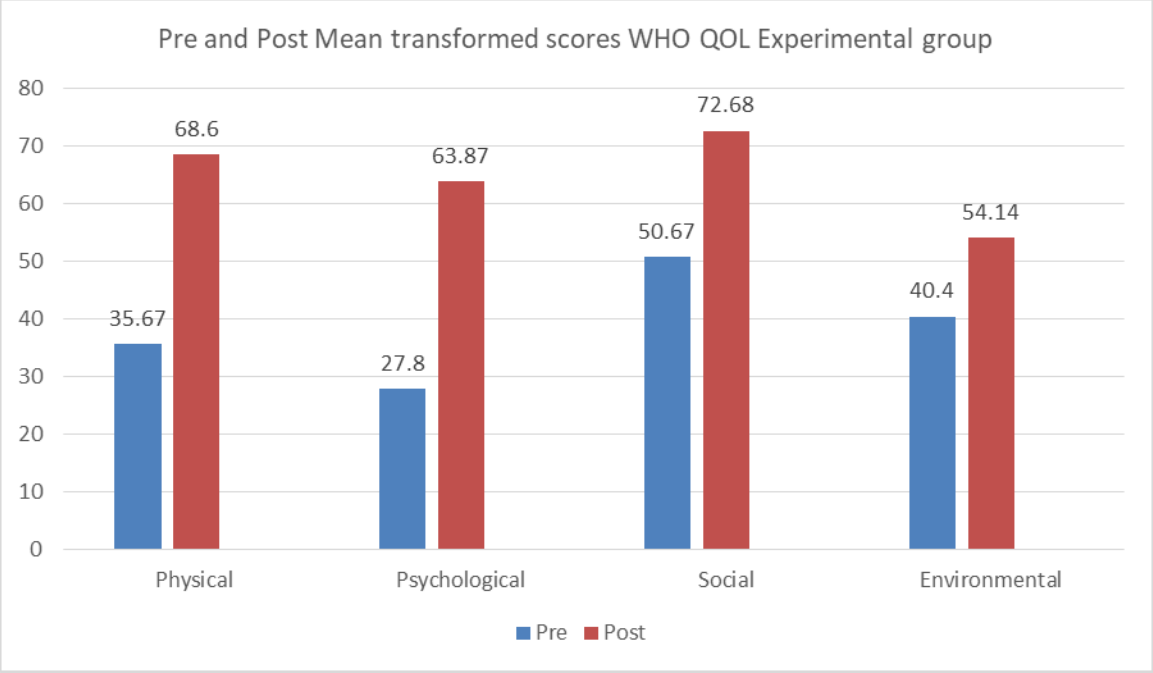


Fig 5. Pre and Post Mean of the transformed domain scores of WHO QOL BREF questionnaire in Experimental group Domains of WHO QOL, Y- axis- Mean of transformed scores.



Paired T test was used to find the significance of differences between pre and post values of PSS and WHO QOL in both control and experimental groups. T values are as follows

Paired T test values for Perceived stress scale scores in control and experimental group are as follows

Table 3: T values of PSS scale

	T values	
	Control group	Experimental group
PSS	0.97003	1.3621

Paired T test values for different domains Of WHO QOL BREF QUESTIONNAIRE in control and experimental group are as follows

Table 4: T values of Domains of WHO QOL bref questionnaire of both groups

	T values	
Domains of WHO QOL	Control group	Experimental group
Physical	47.73	8.8346
Psychological	9.06	17.9382
Social	14.6195	14.39761
environmental	12.56	15.12731

VI. Results

The analysis revealed significant improvements in the transformed domain scores of the WHOQOL-BREF questionnaire following the intervention in both the control and experimental groups. In the control group, the Physical domain mean increased from 44.8 to 65.13, the Psychological domain from 34.45 to 53.26, the Social domain from 62.4 to 79.66, and the Environmental domain from 46.0 to 58.67. Similarly, in the experimental group, the Physical domain mean increased from 35.67 to 68.6, the Psychological domain from 27.8 to 63.87, the Social domain from 50.67 to 72.68, and the Environmental domain from 40.4 to 54.14. Paired t-tests showed statistically significant differences in all domains for both groups, with t-values ranging from 8.83 to 47.73 in the control group and from 14.39 to 17.93 in the experimental group. These results highlight a greater improvement in the experimental group, particularly in the Psychological domain, which had the highest t-value (17.93).

Changes in Perceived Stress Scores

The perceived stress scale (PSS) scores also showed a reduction in both groups. In the control group, the mean PSS score decreased from 26.67 to 17.74, while in the experimental group, it dropped from 26.93 to 14. Paired t-tests indicated significant differences in the experimental group ($t = 1.36$), reflecting a more substantial reduction in perceived stress compared to the control group ($t = 0.97$). This suggests that the intervention had a more pronounced effect on stress reduction in the experimental group.

VII. Discussion

In this study demonstrate the potential of integrated therapeutic approaches, including Occupational Therapy (OT) and Pranayama, in improving the quality of life (QOL) and reducing stress among Parkinson's disease (PD) patients. The progressive nature of PD, with its accompanying physical and psychological challenges, contributes significantly to stress and diminished QOL. However, evidence from this study and supporting literature highlights the efficacy of combining OT and Pranayama in mitigating these issues.

Pranayama has shown profound effects on the autonomic nervous system, as detailed in studies like Jerath et al., which explain how slow, deep breathing can modulate neural elements in the heart, lungs, and brain, inducing a parasympathetic state. This physiological shift leads to reduced stress and improved metabolic balance. Additionally, Pranayama appears to enhance psychological well-being by promoting relaxation and reducing cortisol levels, as suggested by the studies of Neena Sharma, Neha Singh, and Bhimani. These effects align with the significant improvement observed in the psychological domain scores of the experimental group in this study.

Moreover, Pranayama's impact extends to autonomic functions, as it promotes parasympathetic dominance and reduces sympathetic drive, as supported by studies such as Bhimani et al. This rebalancing of the autonomic system underpins the reduction in stress levels, as observed in the significant decrease in Perceived Stress Scale (PSS) scores.

The physical domain results reveal a notable finding: while both groups experienced improvements, the control group showed better outcomes. This suggests that OT is particularly effective in addressing physical challenges in PD. The findings align with the study by Sturkenboom et al., which underscores OT's role in enhancing physical capabilities in PD patients.

VIII. Conclusion

In conclusion, this study underscores the potential of integrated therapeutic approaches, combining Occupational Therapy (OT) and Pranayama, to enhance the quality of life (QOL) and reduce stress in Parkinson's disease (PD) patients. The progressive and multifaceted challenges of PD, encompassing both physical and psychological domains, necessitate comprehensive interventions. Evidence from this research and supporting literature highlights the complementary benefits of OT and Pranayama in addressing these challenges.

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