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Assessment of Neurocognitive Impairment in Schizophrenia Patients Before and After Yoga Therapy- A Comparative Interventional Study

Bhagyashree Nanda[1], Rakesh Mohanty[1], Suvendu Narayan Mishra[1]*, Priyaranjan Dash[2], Ambika Pathak[2],

[1]Department of Psychiatry, Institute of Medical Sciences and SUM Hospital, Siksha O Anusandhan (Deemed to be University), Kalinga Nagar, Bhubaneswar, Odisha, India, [2]Utkal University, Department of Biostatistics, Vanivihar, Bhubaneswar, Odisha, India. *Corresponding Author's Email: suvendumishra@soa.ac.in

Abstract

In mental disorders such as depression, schizophrenia, anxiety disorders, and substance use disorders, yoga has been shown to provide short-term therapeutic effects as adjuvant therapy. Few studies revealed yoga decreases negative and positive symptoms in schizophrenia patients, improves cognitive symptoms, and increases medication adherence. The present research discusses the cognitive symptoms improvement in schizophrenia patients by applying yoga-based group therapy intervention for people with schizophrenia. We aim to assess the cognitive symptoms of schizophrenia patients before and after yoga therapy. Schizophrenia patients diagnosed by ICD 10 were recruited for the study. The sampling method was convenient sampling; 90 patients with schizophrenia were included in this study. A baseline assessment used PGIBBD (P.G.I. Brain Dysfunction) and CTT (Colour Trail Test). Then, patients were given yoga for six months. Then again, a follow-up assessment was done with the same scales after six months to see if the cognitive symptoms improved or not. It was a hospital-based prospective comparative Interventional study. Data were analysed using statistical tests like descriptive statistics and paired t-tests. Each variable had significant differences from baseline to week 24 among the two groups. PGIBBD scores significantly improved after yoga therapy with p-value <0.05. In the Color Trail test, the total time taken for the test was also enhanced after yoga therapy. Yoga Intervention can be used as an adjuvant therapy for schizophrenia patients for improvement in cognitive symptoms, leading to improvement in quality of life.

Keywords: Colour Trail Test, Neurocognitive Symptoms, PANSS, PGIBBD, Yoga Intervention.

Introduction

Schizophrenia is a persistent mental health problem that requires long-term care, and approximately 1% of the global population suffers from this disorder (1). Schizophrenia is an inherited psychotic disorder affecting both physical and mental activities, with environmental risk factors and interactions between genes and the environment (2-4). It involves impaired relationships with reality, and distortions in thoughts, behaviours, and feelings resulting in cognitive, negative, and positive symptoms. Schizophrenia spectrum disorders have a substantial impact on quality of life, well-being, and social and occupational function and thus create a considerable socio-economic burden (5). Antipsychotic drug treatments in schizophrenia reduce positive symptoms but do not significantly improve negative or cognitive symptoms, negatively impacting patients' physical and psychosocial well-being. Hence, alternative approaches should be considered (6). Several experimental and clinical articles showed that yoga reduces stress. In this study, the authors recommend several factors to consider when designing a yoga course. These include maintaining a practice frequency of at least two classes per week, incorporating additional meditation sessions, and encouraging home practice. Sustained, long-term engagement with yoga appears to be a consistently important factor in positively influencing mindfulness and self-compassion (7). Yoga, an ancient Indian art and lifestyle method, is an effective adjuvant therapy to medication for many diseases. It improves individual health and mental function through postures, breath control, and flexibility. Most of the studies used asana or pranayama for yoga intervention, avoiding meditation. Regular Yoga

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follow-up in home was also a limiting factor of this study (8). Yoga has been proven to treat various physical and mental disorders and improve global cognition, and neuropsychological domains in both cognitively and non-cognitively depressed patients. Limitation of the study was that the extent to which participants practiced Yoga Sana at home remains uncertain, as this could not be verified; only a few patients complied with the request to bring their practice log or diary to the follow-up assessment (9). Yoga can positively impact drug treatment patients' symptoms, improvement in insight, social function, treatment efficacy, quality of life, and daily routine activities (10). Studies show that yoga with a specific module decreases negative and positive symptoms in schizophrenia patients, improves cognitive symptoms, and increases medication adherence. In this study, a specific yoga-based module for schizophrenia has been designed and validated by experts. However, further research is needed to establish its efficacy and clinical utility (11). Yoga involves physical postures, breathing techniques, and meditation, providing self-regulatory strategies for mental health and wellness. Limitations of the study were small sample size, samples were only from inpatient male patients, could have been controlled on limited parameters, and limited period of yoga therapy (12). The World Health Organization states that schizophrenia patients often lack clinical insight, affecting medication adherence, relapse rates, hospitalization, and reduced cognitive and functional prognosis. The results of the study also indicated a slightly stronger relationship between Theory of Mind (ToM) and level of insight within the schizophrenia-only subgroup compared to the broader schizophrenia-spectrum disorders sample. It was a meta-analysis revealing disturbances of theory of mind in schizophrenia (13). Manjunath and Varambally's study on 88 schizophrenic patients found that 2-week yoga treatment reduced general symptoms and increased functional remission levels. Lack of a record of practice at home was a limiting factor in this study (14). Jayaram, Varambally, and Behere's study found that a 6-week yoga practice improved social functioning in 43 schizophrenia patients, enhancing well-being, happiness, life success, job satisfaction, and regulating functional remission. Blinding to treatment received in the patient group was not possible; therefore, a possible placebo effect due to an expectation of outcome from treatment, meeting a professional regularly, could be expected as limiting factor (15). Viscegliaa and Lewis found that yoga exercises, when combined with medication, significantly improved the efficiency of treatment for 18 schizophrenia patients over two weeks. This study was conducted with a sample size of 18 only (16). Yoga therapy improves facial emotion recognition deficits, potentially achieving stable autonomic balance and reducing reactivity to mental stressors, though the exact physiological basis is unknown. In this study also, they have not studied cognitive symptoms of schizophrenia (17). Another study investigates yoga's impact on schizophrenic patients' clinical insight and medication adherence, highlighting its potential to improve treatment effectiveness and patient health (18). Limited research exists on therapeutic yoga's effectiveness for individuals with mental illness, but Hampshire's study found yoga classes to reduce stress and improve mood. They worked on 13 in-patients and reported the effectiveness of yoga. But this study had a sample size that was less to generalize the findings (19). A randomized controlled study found yoga participants had greater reductions in symptoms and increased quality of life than the control group. This study also focuses on positive and negative symptoms of schizophrenia without addressing cognitive symptoms (20). Very few studies worked on cognitive symptoms of schizophrenia after yoga therapy. This study examined the selected yoga practices on cognitive symptoms in schizophrenia patients attending to hospital, highlighting the limited research on yoga therapy's effectiveness in treating schizophrenia cognitive symptoms. Along with cognitive symptoms, we have examined the positive and negative symptoms and quality of life in patients with schizophrenia

Methodology

Study Design

In the present study, schizophrenia patients treated with medications for more than one month were given yoga therapy sessions for 6 months between January and December of 2023. Each participant was given written consent, with institutional ethical approval for this study.

Inclusion Criteria

Age 18 to 60 years, both males and females who satisfied the criteria of Schizophrenia as per ICD-10, patients with a PANSS Score below 75% those who have no active symptoms for the last 4 weeks, and who gave informed consent.

Exclusion Criteria

Patients with any substance dependence accept Nicotine and caffeine, any major Neurological disorders, and mental retardation.

Sample Size

We included schizophrenia patients satisfying inclusion-exclusion criteria during the study period. As per a previous study, sample size was taken considering a dropout out of 20% was 80 (21). We have taken 100 participants for the study, but 10 participants did not follow regular yoga sessions by either not attending yoga sessions in the hospital or through video call. Hence, 10 participants were removed from the analysis. All 90 participants were assessed with scales, i.e., PANSS, PGI BBD, CTT, MoCA, and WHOQOL-BREF, applied at baseline and after 6-month Yoga intervention.

Scales Used

PANSS Scale

The Positive and Negative Syndrome Scale is known as the "gold standard" to measure the efficacy of antipsychotic treatment and has been used frequently in clinical trials for schizophrenia and other diseases. 30 items included in the PANSS, 7 constitute a Positive Scale, 7 a Negative Scale, and the remaining 16 a General Psychopathology Scale. Therefore, the potential ranges are 7 to 49 for the Positive and Negative Scales and 16 to 112 for the General Psychopathology Scale. Of the 30 items in the PANSS, 7 constitute a Positive Scale, 7 a Negative Scale, and the remaining 16 a General Psychopathology Scale (22).

PGI-BBD

The P.G.I. Brain Dysfunction is a wide range of tests used in medical centres to measure cognitive dysfunction, disability, and impairment. It measures well-known cognitive functions of the brain, including transference from one hemisphere to the other, memory, verbal and performance intelligence, and perceptual acuity. The test may be used in part depending on unique conditions, but it is meant to be used in parts based on special circumstances. Since each test has its own set of rules, it is simple to apply them easily (23).

Color Trait Test

The Color Trails Test (CTT) is a neuropsychological assessment or an instrument that measures a person's cognitive flexibility and processing speed. In this test, participant's link numbered circles in numerical sequence while switching between two colors. This test measures an individual's cognitive flexibility and processing speed. The CTT1 component measures processing speed and attention, whereas the CTT2 component tests executive function and cognitive flexibility. Compared to other CTT indices, CTT measures, including CTT1 time, CTT2 time, and the difference between CTT2 and CTT1, are thought to be better indicators of cognitive performance in people with schizophrenia (24, 25).

Montreal Cognitive Assessment (MoCA)

It is a rapid screening tool for mild cognitive dysfunction, assessing various cognitive domains. It takes 10 minutes and requires an interpretation by a health professional. The total possible score is 30 points; a score of 26 or higher is normal (26).

The World Health Organization Quality of Life (WHOQOL-BREF)

Another scale we utilized is the WHOQOL-BREF (World Health Organization Quality of Life - BREF). This scale evaluates four domains of quality of life: Physical Health, Psychological Well-Being, Social Relationships, and Environment. The questionnaire-brief version is a 5-point Likert scale which assesses the patient's current quality of life. A score below 6 indicated dissatisfaction. Quality of life significantly impacts psychiatric practice efficacy, medication effectiveness, and the prognosis of schizophrenic patients (27).

Physical Health: This domain refers to aspects of life related to physical health, including mobility, energy, and the absence of pain and discomfort. In the context of schizophrenia patients, this would likely assess how their physical well-being improves or deteriorates due to interventions like yoga.

Psychological Health: This assesses emotional well-being, self-esteem, and mental clarity. Schizophrenia patients often experience psychological symptoms like depression, anxiety, or cognitive impairments, and this domain would reflect improvements or worsening in these aspects.

Social Relationships: This domain looks at personal relationships, social support, and sexual activity. It is essential to understand how schizophrenia patients interact with others and how interventions affect their ability to maintain relationships and receive social support.

Environmental Health: Environmental health includes safety, financial resources, access to health services, and physical living conditions. It evaluates how the external environment of schizophrenia patients impacts their quality of life.

Yoga Intervention Procedure

Yoga intervention was given for a one-hour session that was conducted in our department demonstration room every day except Sunday in a week for twenty-four weeks. The yoga classes were led by instructor from our University. We hired a very skilled and experienced (PhD in yoga) yoga instructor from the University to conduct the classes. Among the Yoga, there was OM chanting for 10 minutes, Sasankasana for 10 minutes, Anulom vilom for 10 minutes, Ustrasana for 5 minutes, Tadasana for 15 minutes, sharing about Patients' experience for 5 minutes, Relaxation for 5 minutes. It was being given in the morning 8 am to 9 am inside the psychiatry demonstration room. Those patients who were not willing to come to the hospital every day were scrutinized through video call at the same 1 hour time. Participants were willing to participate in yoga sessions as family members were also supporting them for yoga adherence. If anyone missed any session at particular time (8 am to 9 am) then we insist them to do yoga on the same day as soon as possible, and we scrutinize the same through video call. Among the participants, 10 participants could not be followed up for regular yoga sessions due to non-response from their side; hence were excluded from the study. There were no negative incidents or relapse of symptoms during intervention, as medication adherence was also checked during regular follow-ups. CLARIFY (Check List standardising the Reporting of Interventions for Yoga was used to describe the yoga intervention).

This study was undertaken after approval from the Institutional Ethics Committee. Written informed consent was taken from all the participants. Participants were free to withdraw from the study at any time during the study period.

Results

For analysis, we used the flexible Python 3. X family of computer languages for the thorough data analysis, which considerably aided in our decision-making. Over a period of six months, all 90 patients underwent a comprehensive evaluation. Participants who successfully completed a thorough 6-month yoga training program were subsequently assessed through follow-up evaluations. The experiment was conducted at SUM and ISM Hospital, Bhubaneswar.

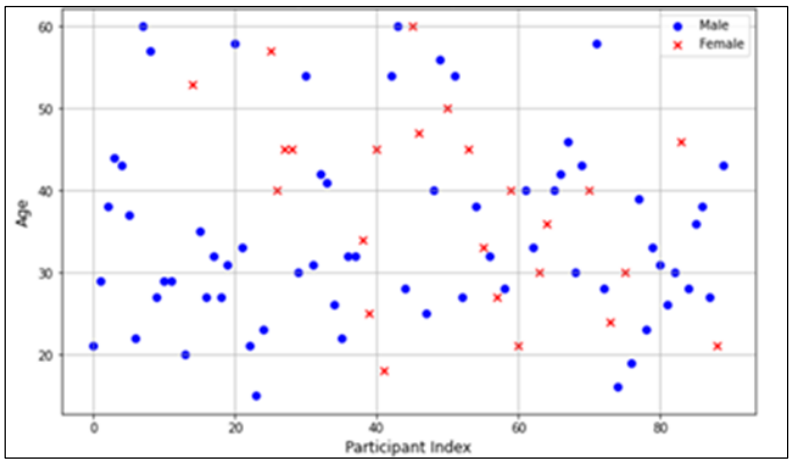

Figure 1: Age Distribution of the Schizophrenia Patients

Figure 1 is a scatter plot that shows the age distribution of participants categorized by gender. X axis represents participant index and Y axis represents age, blue dots represent male and red crosses represent female participant. The mean age of schizophrenic patients was 35.4 ± 11.6 years. As shown in Figure 1, the number of male patients is notably higher than the number of female patients.

Table 1: Socio-Demographic Characteristics of the Participants

Socio-Demographic Variables		Frequency	Percentage
Gender	Male	65	72.2
	Female	25	27.8
Religion	Hindu	83	92.2
	Muslim	06	6.7
	Christian	01	1.1
Education	Read & write	3	3.3
	Primary	5	5.6
	Middle	19	21.1
	High School	40	44.4
	Graduate& above	23	25.6
Family Income	Low	31	34.4
	Middle	53	58.9
	High	6	6.7
Habitat	Rural	35	38.9
	Urban	35	38.9
	Sub-urban	20	22.2
Family Type	Nuclear	5	5.6
	Single	37	41.1
	Joint	48	53.3
Duration of Illness	Within 1-6 months	3	3.3
	6 months & above	10	11.1
	1 to 5 years	20	22.2
	5 to 10 years	27	30.0
	10 years & above	30	33.3
Medical History	Yes	26	28.9
	No	64	71.1
Occupation	None	42	45.7
	Labourer	8	8.9
	Caste Occupation	8	8.9
	Business	10	11.1
	Independent Profession	8	8.9
	Cultivation	2	2.2
	Service	12	13.3
Age	Mean ± SD		
	35.4 ± 11.6		

Table 1 shows the details regarding the socio-demographic characteristics of the schizophrenia participants with each variable and its corresponding frequencies and percentages. Males (72.2%) outnumber females (27.8%), with Hindus accounting for most patients (92.2%). A considerable proportion (44.4%) has completed high school, while middle-income families (58.9%) make up the majority. Patients are evenly dispersed between rural and urban areas (38.9% each), with coupled families (53.3%) being the most common. The illness duration suggests chronicity, with 33.3% having schizophrenia for more than ten years. Notably, 45.7% of patients are unemployed, indicating a socioeconomic hardship.

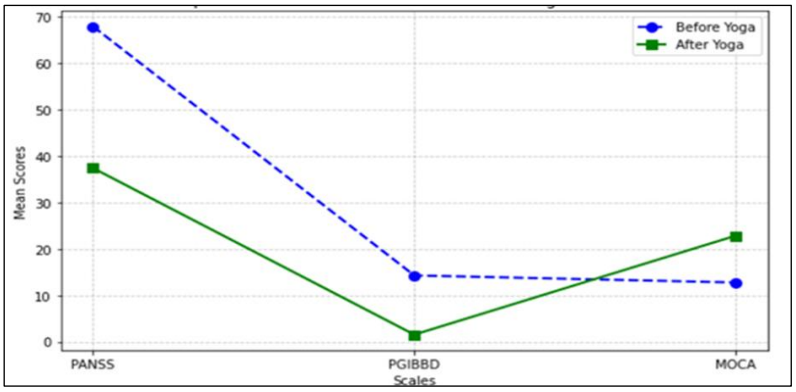

Figure 2: Before and After Yoga: A Comparative Analysis

Figure 2 is a line graph comparing mean scores before and after yoga across three assessment scales, i.e., PANSS, PGIBBD, and MOCA. The results show notable improvements post-yoga. The PANSS score, reflecting psychiatric symptoms, decreased significantly, indicating symptom reduction. The PGIBBD score showed moderate improvement, while the MOCA score, assessing cognitive function, increased substantially. These findings suggest that yoga had a positive effect on both psychiatric symptoms and cognitive abilities. The significant improvements across these scales point to the potential of yoga as a therapeutic intervention for enhancing mental health and cognitive function. Overall, the data illustrates how yoga can contribute to better psychological well-being, symptom management, and cognitive performance, as shown in Figure 2.

Table 2: Comparison of Different Scales Before & After Yoga

	Schizophrenia Patients	
	Before Yoga	**After Yoga**
PANSS SCORE		
Mean ± SD	67.9 ± 4.7	37.41 ± 6.5
Median	69	39
Inter Quartile Range	6	10.5
PGIBBD SCORE		
Mean ± SD	14.27 ± 1.7	1.5 ± 0.4
Median	14	2
Inter Quartile Range	14	1
MoCA SCALE		
Mean ± SD	12.75 ± 2.0	22.82 ± 2.5
Median	14	23
Inter Quartile Range	13.75	4

Table 2 depicts a comparison of 3 scales before and after yoga intervention. Mean, median and inter quartile range of scores obtained were compared. As shown in Table 2, before yoga, PANSS and PGIBBD scores had higher mean, standard deviation, median, and IQR values; however, following yoga, these values dropped, indicating symptom alleviation. On the other hand, lower MoCA scores before yoga indicated cognitive impairment, whereas higher scores following yoga indicated progress. PANSS scores reduced from 67.9 to 37.4 following yoga, according to the Interquartile Range (IQR) analysis, suggesting greater variability in outcomes after the intervention. The IQR for PGIBBD lowers dramatically from 14 to 1, indicating a steadier improvement, and the MoCA IQR declines from 13.75 to 4, indicating a more consistent improvement in cognitive function following yoga. This implies that yoga might assist in balancing cognitive performance and psychological problems.

Table 3: Comparative t-test Evaluation of PANSS, PGIBBD, and MoCA Pre- and Post-Yoga

Measure	T-statistic	P- value
PANSS	38.03	< 0.05
PGIBBD	63.27	< 0.05
MoCA	-85.28	< 0.05

Table 3 compares mean scores of each scale before and after yoga intervention. Data were continuous, and pre-post analysis was done; hence paired t-test was applied to find out the p-value. In Table 3, the paired t-test results show significant differences in PANSS and PGIBBD scores between schizophrenia patient's pre- and post-yoga sessions. The PANSS study indicated a high t-statistic of 38.03 and a low p-value ($p < 0.05$), indicating significant symptom reduction. PGIBBD scores showed a robust t-statistic of 63.27 and a low p-value ($p < 0.05$), indicating that regular yoga practice successfully improved cognitive symptoms. These findings show yoga's potential as a therapeutic intervention for schizophrenia symptoms. The negative t-statistic for MoCA suggests a significant increase in cognitive performance following the yoga intervention, with the mean score increasing from 12.76 to 22.82. This significant rise suggests improved cognitive functioning among patients after engaging in yoga sessions.

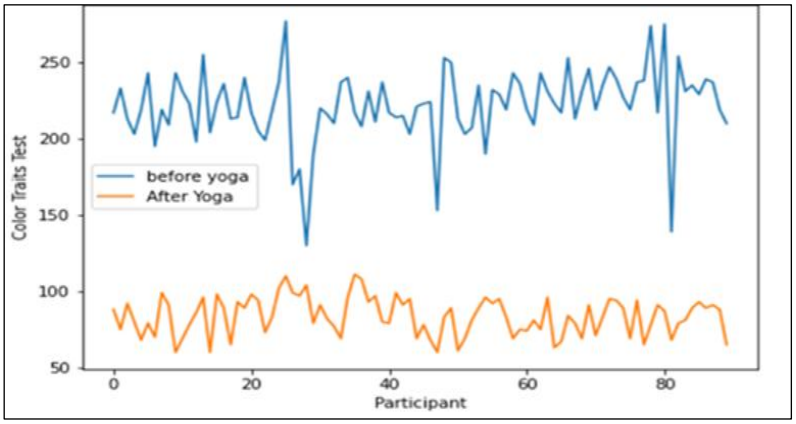

Figure 3: Comparison of Color Traits Test (CTT) Before & After Yoga

Figure 3 represents a graph with X axis as participant number, Y axis time taken in seconds to do the color trail test. Blue line represents before yoga and orange line represents after yoga performance. Figure 3 indicates a significant reduction in CTT time after yoga compared to before yoga in schizophrenia patients. The median CCT time after yoga is much shorter than before yoga, indicating faster response times and maybe improved cognitive performance post-intervention. Furthermore, the range and interquartile spread of CTT timings before yoga are bigger, with some outliers indicating increased variability in performance. In contrast, following yoga, the data is more closely clustered, indicating more consistent gains. This implies more consistent performance following the intervention, implying that yoga may aid in cognitive processing and minimize response variability across participants.

Table 4: Principal Component Analysis on Color Trail Test (CTT)

Principal Component	Explained Variance	Cumulative Variance
PC1	0.12	0.12
PC2	0.11	0.24
PC3	0.11	0.35
PC4	0.09	0.45
PC5	0.07	0.52
PC6	0.06	0.59
PC7	0.05	0.65
PC8	0.05	0.70

Table 4 summarizes the results of a Principal Component Analysis (PCA) showing the explained variance and cumulative variance for the first eight principal components (PCs). PCA is used in python and it is a dimensionally reduction technique that is used to transform a dataset with many variables into a smaller set of uncorrelated variables called principal components, but retaining most of the original data's variance (28). PC1 explains 12% of the variance in the data, followed by PC2 and PC3, each explaining 11%. The explained variance gradually decreases for the subsequent components, with PC4, PC5, PC6, and PC7 contributing 9%, 7%, 6%, and 5%, respectively. By the time we reach PC8, the cumulative explained variance reaches 70%. This indicates that the first eight components together capture 70% of the total variance, suggesting that these components provide a significant reduction in dimensionality while retaining most of the original data's information. The decreasing explained variance for higher PCs indicates that they contribute progressively less to the overall data structure.

Table 5: Clinical Performance in the Color Trail Test (CTT) in Schizophrenia Patients before and after Yoga

Variable	Schizophrenia Patients Before Yoga		Schizophrenia Patients After Yoga		t-statistic
	Mean	S. D	Mean	S. D	
Time-Based Indices					
CTT 1 time	221.85	24.19	83.63	12.38	16.08
CTT 2 time	436.56	54.08	163.20	19.11	15.07
2- 1 difference	218.67	35.56	79.66	12.22	11.69
Error Based Indices					
CTT 1 number sequence errors	3.13	0.49	0.32	0.47	13.08
CTT 1 near-misses	3.11	0.56	0.27	0.44	12.61
CTT 1 prompts	5.06	0.466	0.78	0.50	19.80
CTT 2 number sequence errors	3.41	0.55	0.76	0.66	9.7
CTT 2 color sequence errors	3.48	0.52	0.54	0. 54	12.40
CTT 2 near-misses	3.68	0.50	0.54	0.54	13.49
CTT 2 prompts	5.94	0.47	1.11	0.50	22.25

Table 5 shows time-based indices, compared to their pre-yoga performance. As means scores were compared, a paired t-test was applied. Schizophrenia patients significantly improved in response time-based indices after yoga intervention: CTT 1 time ($p < 0.001$), CTT 2 time ($p < 0.001$), and the 2-1 difference ($p < 0.001$). These improvements suggest that yoga contributed to faster response times and enhanced cognitive processing speed. Error-based indices: After the yoga intervention, schizophrenia patients required fewer cues compared to before, with a significant improvement observed in the CTT 2 prompts ($p < 0.01$). This indicates that yoga practice enhances cognitive regulation and fosters greater task independence, as shown in Table 5.

Table 6: Impact of Yoga on Quality of Life in Schizophrenia Patients

Quality of Life Variables	Schizophrenia Patients	Mean	S. D	t- test	p-value
Physical health	Pre-Yoga	46.08	6.41	-38.5	< 0.01
	Post-Yoga	74.92	5.69		
Psychological	Pre-Yoga	37.6	5.85	-53.60	< 0.01
	Post-Yoga	71.5	3.66		
Social Relationships	Pre-Yoga	41.6	6.84	-42.59	< 0.01
	Post-Yoga	72.86	3.74		
Environmental	Pre-Yoga	45.73	7.52	-32.2	<0.01
	Post-Yoga	74.71	5.32		

Table 6 examines the Quality of Life (QoL) in schizophrenia patients using four important domains: Physical Health, Psychological Health, Social Relationships, and Environmental Health.

Mean scores of all domains were compared between pre- and post-yoga therapy. These areas are critical for understanding how schizophrenia impacts different aspects of a patient's life and how interventions such as yoga can help them feel better overall.

The yoga intervention resulted in significant improvements in all aspects of quality of life for schizophrenia patients. Physical health scores improved from 46.08 to 74.92, with a lower standard deviation (S.D.) and a t-value of -38.5 ($p < 0.01$), showing better consistency and statistical significance. Psychological health improved from 37.6 to 71.5, with a t-value of -53.60 ($p < 0.01$) indicating more consistent results. The standard deviation decreased from 5.85 to 3.66. The social relationships improved from 41.6 to 72.86, with a decreased S.D. (6.84 to 3.74) and significant t-value (-42.59, $p < 0.01$). The environmental element showed considerable improvement, with mean scores increasing from 45.73 to 74.71 post-yoga, with a t-value of -32.20 and a p-value of < 0.01. Overall, the findings demonstrate yoga's significant positive influence on physical, psychological, social, and environmental well-being shown in Table 6.

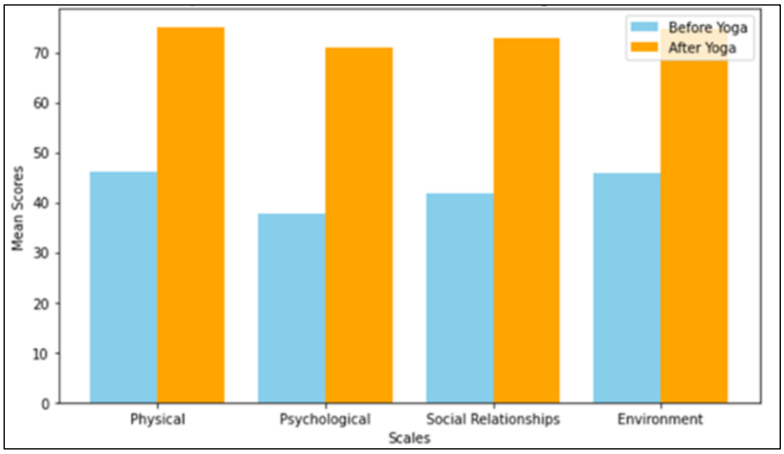

Figure 4: Comparison of Quality of Life (WHOQOL-BREF) Scores Before and After Yoga Intervention

The Figure 4 is a bar plot that compares mean scores before and after a yoga intervention across four scales: Physical, Psychological, Social Relationships, and Environment. The blue bars represent scores before the yoga intervention, while the orange bars represent scores after the intervention. Across all scales, there is a noticeable increase in scores after yoga. The Physical and Environment scales show a substantial improvement, with mean scores rising from around 45 to over 70. Similarly, the Psychological and Social Relationships scores also exhibit significant improvements. This suggests that yoga intervention positively impacts multiple dimensions of well-being, enhancing physical health, psychological state, social relationships, and environmental perceptions.

Discussion

The primary objective of our study was to examine the effects of a yoga intervention on various health outcomes, including mental, physical, and social well-being, assessed through different standardized scales. The findings revealed significant post-intervention improvements in nearly all areas, particularly physical and psychological health.

Mental Health Outcomes: The *Positive and Negative Syndrome Scale* (PANSS), which measures psychiatric symptoms, showed a significant reduction post-intervention. This decline suggests that yoga may help alleviate symptom severity, supporting its role as a complementary therapy for individuals experiencing mental health challenges. One study revealed that patients who received yoga with pharmacotherapy reported statistically significant improvement both in negative symptoms and general psychopathology sub scales of PANSS (20).

Cognitive Functioning: Cognitive performance, as measured by the *Montreal Cognitive Assessment* (MOCA), *PGI battery of Brain dysfunction* (PGI BBD) improved significantly after the yoga intervention. This indicates enhancements in cognitive flexibility and executive function, aligning with prior research highlighting the cognitive benefits of mindfulness and physical activity. Similar finding was found by one study where they

concluded yoga therapy enhances specific cognitive functions, regardless of individual differences in selected psychosocial characteristics (29).

Physical Health: Physical well-being scores showed a notable increase, likely due to improvements in flexibility, strength, and overall fitness. These findings underscore yoga's potential for enhancing physical health through regular practice.

Social and Environmental Well-being: Social interactions and environmental perception also improved significantly. Quality of life improved as per the WHOQOL BREF scale. These changes suggest that yoga may foster stronger interpersonal relationships and a more positive outlook on one's surroundings, consistent with research linking yoga to enhanced social functioning and quality of life. A recent systematic review found similar improvement in social functioning and quality of life in schizophrenia patients after yoga therapy (30).

Overall, our results emphasize the multi-dimensional benefits of yoga, extending beyond physical health to include psychological and social improvements. This supports the notion that holistic interventions, such as yoga, can address both mental and physical health needs, leading to comprehensive well-being.

Furthermore, the substantial reduction in PANSS scores highlights yoga's potential as a non-pharmacological intervention for managing mental health conditions. This is particularly valuable for individuals' seeking alternatives or supplements to conventional medical treatments.

Conclusion

Yoga as an add-on intervention along with standard pharmacotherapy was found to be effective in improving cognitive impairment. PANSS score was also found to be reduced after Yoga therapy. Quality of life was also improved in participants who underwent yoga therapy. While these findings contribute to the growing body of evidence supporting yoga as an effective health intervention, further research with larger sample sizes and diverse populations is needed to evaluate long-term effects and identify subgroups that may benefit most from such practices. This study is an interventional study with pre- and post-test involving the same group for comparison. Sampling was also purposive; hence, selection bias may be present. So randomized controlled trial can be tried in the future for robust evidence. Incorporating yoga into comprehensive care plans could play a crucial role in promoting overall health and well-being.

Abbreviations

CTT: colour Trail test, MOCA: Montreal Cognitive Assessment, NSFS: The negative symptom factor, PANSS: Positive and Negative Syndrome Scale, QoL: Quality of Life, WHOQOL-BREF: World Health Organization Quality of Life.

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Author Contributions

All authors contribute equally.

Conflict of Interest

None.

Ethics Approval

The study was approved by ethics committee and the approval no: IEC/IMS.SH/SOA/2023/524.

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