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Effect of yoga practice on cognitive functions among the patients of depression

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ABSTRACT

Background: Decline in the cognitive functions is commonly observed in patients suffering with depression. Practicing yoga was reported to improve cognitive functions as well as manages depression. **Aims and Objectives:** The present study was undertaken to observe the effect of yoga practice on cognitive functions among the patients of depression. **Materials and Methods:** A total of 64 patients suffering with depression were recruited after obtaining written informed consent. Participants were randomly assigned to the interventional and control groups with 32 participants in each group. Digit span test (DST) was used to assess the cognitive functions of the participants at the baseline, after 1 month, and after 3 months of intervention. Yoga practice was administered as an adjunctive therapy to the interventional group for 3 months of period. No intervention was administered to the control group. Unpaired Student's "t"-test and repeated measure ANOVA test were applied and $P<0.05$ was considered as statistically significant. **Results:** The forward, backward, and total DST scores were not significantly different between the interventional and control groups at the baseline as well as after 1 month. Whereas, a statistically significant improvement after 3 months of yoga intervention in the forward ($P<0.001$), backward ($P<0.05$), and total ($P<0.001$) DST scores was observed when the interventional group was compared with the control group. A statistically significant improvement was observed in the interventional group even after 1 month of yoga practice in forward ($P<0.001$) and total ($P<0.05$) DST scores, while in backward DST scores, statistically significant improvement was observed after 3 months. **Conclusion:** The study results support improvement in the cognitive functions followed by yoga practice in patients suffering from depression within a short period of time. The study recommends the implication of yoga practice as an adjunctive therapy in the management of depression.

Key words: Adjunctive therapy; Cognition; Depression; Digit span test; Yoga

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INTRODUCTION

Depression is a major type of mental disorder in the population, and cognitive impairment is a primary symptom of clinical depression.[1,2] The Diagnostic and Statistical Manual of Mental Disorders, fourth edition, lists "diminished capacity to focus or concentrate or indecisiveness" as an additional condition for depression.[3,4] Neuropsychological studies have discovered that depressed people have impaired short-term memory processing, executive functioning, a deficit in sustained attention, and impairment of cognitive functions.[5] Depression also has an impact on spatial working memory (WM), visual memory, and psychomotor speed, as well as a lack of energy during both initial sensory processing and the planning and execution of psychomotor tasks.[5] Depression-related cognitive dysfunction affects other domains such as executive functions, short-term memory, attention, and problem-solving abilities, which rely on prefrontal function.[4] Depression also increased vulnerability to

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cognitive decline and neurodegenerative dementia and has an impact on activities of daily living and patient quality of life.[6]

Regular mindfulness practice increases both awareness and intense focus by drawing attention to the present moment without prejudice. The forward and backward digit span test (DST) on the Wechsler Adult Intelligence Scale is the most often used for assessing verbal WM. A prior study among healthy persons found that yogic meditation techniques dramatically improved WM task results.[7]

Although there is increasing evidence that long-term practicing yoga has a positive influence on physical and psychological health in healthy persons, there is currently a lack of evidence that practicing yoga helps to improve cognitive processes in patients suffering from depression.

Aims and objectives

The present study was conducted to establish the effect of 3 months of practicing yoga on cognitive functions in patients suffering from depression and to compare them to patients suffering from depression that did not practice yoga for the same time period.

MATERIALS AND METHODS

Study settings

The present study was conducted at the Department of Physiology in collaboration with the Department of Psychiatry, S.M.S. Medical College and Attached Hospitals, Jaipur, Rajasthan, from October 2018 to December 2020.

Study design

This was an interventional type of study.

Study participants

After obtaining written, informed permission, a total of 64 depressed individuals were enrolled. To recruit the participants, the following criteria were used:

- Patients suffering from depression, both male and female, aged 18–45 years, with mild-to-moderate degrees of depression, and on stable dosages of medicine for the previous month, were eligible
- Patients with any acute or chronic disease, any mental or medical comorbidities, prior yoga practicing, a history of smoking, alcohol, or any other drug consumption, and who were receiving cognitive behavioral therapy, psychotherapy, counseling, or any other alternative therapies were excluded from the study.

After recruiting, the 64 participants were grouped into two groups with 32 participants in each group.

- Interventional group (n=32); yoga practice for 3 months
- Control group (n=32); no intervention.

Yoga practice

For 3 months, one group received yoga intervention while continuing to take the same medical treatment (interventional group), whereas the other group continued to take the same conventional antidepressant medication (control group). Under the guidance of a certified yoga teacher, the interventional group was asked to perform a series of yogic postures (asana), pranayama, and dhyana for 60 min daily, in the early hours, for at least 5 days a week. DST scores in both study groups were assessed at the start, 1 month, and 3 months.

Outcome measures: DST[8,9]

A standard neurocognitive test that consists of two sets of test was used to assess WM. Forward DST has eight rounds, whereas backward DST has seven rounds. There are two successful trials in each round. With a monotone voice, the assessor pronounces the list of digits at a pace of about one digit per second. Participants were instructed to immediately repeat the list of digits in the same order for forward DST and in the reverse order for backward DST. Passing either of the two trials is the eligibility criteria to enter the next round. If the participant fails in both trials, the test was stopped at that corresponding round. The maximum score of the forward DST and backward DST is 16 and 14, respectively.

Statistical analysis

The data were entered into a spreadsheet (MS Excel 2007), out of which quantitative data were expressed in mean and SD, while qualitative data were expressed in percentage and proportion. Quantitative data were further analyzed by unpaired Student's "t"-test and for multiple variables, repeated measure ANOVA was applied. The tests were conducted in SPSS version 20 with a confidence interval of 95% and an alpha error of 0.05. $P<0.05$ was considered statistically significant.

Ethical considerations

The present study protocol was approved by University Research Board (No. F7 Research/RUHS/2018/16480) and Institutional Human Ethical Committee (No. 3951 MC/EC/2018).

RESULTS

The present study included 64 depressed patients, 72% of whom suffered from major depression and 28% had mild

depression. The majority of the participants were male (62.5%), younger (64%), and belong to the middle class (80%) and urban areas (73%), as shown in Table 1.

A statistically significant difference was observed between the interventional and control groups in the forward (P<0.001), backward (P<0.05), and total (P<0.001) DST scores after 3 months of follow-up, whereas no significant difference was observed at baseline and after 1 month between the interventional and the control groups (Table 2).

The time frame comparison at baseline, 1 and 3 months is represented by F statistics, which exhibit a highly significant difference (P<0.001) among the interventional group participants in all sets of tests, but the significant difference (P<0.05) was found only in forward and total DST scores for the control group subjects, as shown in Table 2.

The present study found that the interventional group's forward (P<0.001) and total (P<0.05) DST scores increased even after 1 month in individuals suffering from depression, however, the backward DST scores showed a statistically significant rise after 3 months (P<0.001) (Table 3).

The present research reveals a statistically significant difference in the forward (P<0.05) and total (P<0.05) DST scores after 3 months in the control group in patients suffering from depression, whereas no significant difference was observed in the backward DST scores at any of the time scales (Table 4).

A statistically significant (P<0.001) difference was observed in the forward, backward, and total DST scores in terms of mean change (baseline–3 months) between the interventional group and the control group, indicating that yoga practices improve cognitive functions (Figure 1).

Table 1: Sociodemographic profile of the study participants

Variables	Interventional group (n=32), n(%)	Control group (n=32), n(%)	Total (n=64), n(%)
Gender			
Female	13 (40.62)	11 (34.38)	24 (37.50)
Male	19 (59.38)	21 (65.62)	40 (62.50)
Setting			
Rural	6 (18.75)	11 (34.38)	17 (26.56)
Urban	26 (81.25)	21 (65.62)	47 (73.44)
Age groups			
18–30 years	25 (78.13)	16 (50.00)	41 (64.06)
31–45 years	7 (21.87)	16 (50.00)	23 (35.94)
Family type			
Joint	14 (43.75)	18 (56.25)	32 (50.00)
Nuclear	18 (56.25)	14 (43.75)	32 (50.00)
Employment			
Employed	16 (50.00)	17 (53.12)	33 (51.56)
Unemployed	16 (50.00)	15 (46.88)	31 (48.44)
Socioeconomic status of family			
Lower class	1 (3.12)	3 (9.38)	4 (6.25)
Middle class	28 (87.50)	23 (71.88)	51 (79.69)
Upper class	3 (9.38)	6 (18.75)	9 (14.06)
Depression			
Mild	5 (15.62)	13 (40.62)	18 (28.13)
Moderate	27 (84.38)	19 (59.38)	46 (71.87)

DISCUSSION

The present study included 64 individuals who had mild-to-moderate depression. The interventional group's forward and total DST scores increased significantly after 1 month of yoga practice only, while backward DST scores improved significantly after 3 months. However, after 3 months, statistically significant increases in forward and total DST scores were reported in the control group, but no significant improvements in backward DST scores were observed.

Table 2: Comparison of mean digit span test scores among the interventional and the control groups

Digit span test	Time duration	Interventional group (Mean±SD)	Control group (Mean±SD)	t	P-value
Forward	Baseline	8.03±1.49	8.16±1.82	0.301	0.764
	1 month	8.47±1.54	7.94±1.74	1.292	0.201
	3 months	10.19±1.62	8.34±1.86	4.234	0.000**
	F	237.468	3.841		
	p-value	0.000**	0.029*		
Backward	Baseline	4.66±1.12	4.63±1.50	0.094	0.925
	1 month	4.72±1.28	4.63±1.39	0.282	0.779
	3 months	5.69±1.12	4.81±1.12	3.125	0.003*
	F	39.946	1.251		
	p-value	0.000**	0.293		
Total	Baseline	12.69±2.33	12.78±2.99	0.140	0.889
	1 month	13.19±2.56	12.56±2.90	0.915	0.364
	3 months	15.88±2.52	13.16±2.70	4.160	0.000**
	F	190.646	4.763		
	p-value	0.000**	0.012*		

*Level of significance: *P<0.05(significant), **P<0.001(highly significant)

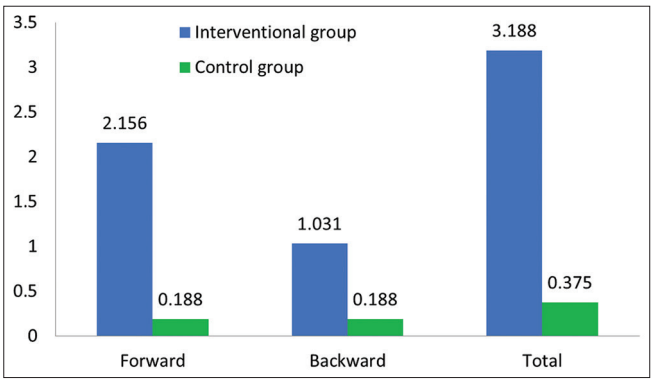

Figure 1: Mean difference of digit span test scores between baseline and after 3 months among the interventional and control groups

Yogic practice is an old Indian therapy that has cognitive advantages. These practices on a regular basis improve the mind-body connection which is a beneficial activity for improving pupils' cognitive performance.[10,11] Several researchers across diverse populations observed that interventions such as yoga asanas, pranayama, relaxation methods, and cleaning techniques harmonized mood states[11] and also improve depression as well as the quality of life in patients of depression.[12,13] Structured yogic practices include a variety of meditations that appear to have the ability to improve cognitive function.[7,11] The following table displays the various study outcomes of yoga practice.

S. No.	Author's name and year	Place of study	Participants	Intervention given	Conclusion
1.	Pandya, 2018[14]	India	n=792, older adults	Hatha yoga, 1time per week, 40 min a session(along with home practice), 260 weeks	Significant improvements in the MMSE test and RBMT-3 test following yoga
2.	Kondam *et al.*, 2017[15]	India	n=80, 1st year medical students	Pranayama and Surya Namaskar, 5 days a week, 30 min, 6 months	A significant improvement was observed in all the parameters including attention and orientation, memory, fluency, and visuospatial
3.	Gothe *et al.*, 2017[16]	USA	n=108, 55–79years	Hatha yoga, 3 times a week, 60 min per session, 8 weeks	Yoga practice improved attentional and information processing abilities
4.	Lin *et al.*, 2015[17]	China	n=124, females	Yoga therapy, 3 times a week, 60 min, 12 weeks	Yoga group showed a significant improvement in working memory, verbal acquisition, and attention
5.	Present study	India	n=64, having depression, 18–45years	Yoga practice, 5 times a week, 60 min, 3 months	Yoga group showed a significant improvement in cognitive functions in terms of digit span test scores

Table 3: Pairwise comparison of digit span test scores among the interventional group

Digit span test	Duration		Mean difference	95% confidence interval for difference		P-value
				Lower bound	Upper bound	
Forward	Baseline	1 month	0.438	−0.690	−0.185	0.000**
	Baseline	3 months	2.156	−2.480	−1.833	0.000**
	1 month	3 months	1.719	−1.923	−1.514	0.000**
Backward	Baseline	1 month	0.063	−0.402	0.277	1.000
	Baseline	3 months	1.031	−1.362	−0.700	0.000**
	1 month	3 months	0.969	−1.280	−0.658	0.000**
Total	Baseline	1 month	0.500	−0.940	−0.060	0.022*
	Baseline	3 months	3.188	−3.689	−2.686	0.000**
	1 month	3 months	2.688	−3.072	−2.303	0.000**

*Level of significance: *P<0.05(significant), **P<0.001(highly significant)

Table 4: Pairwise comparison of digit span test scores among the control group

Digit span test	Duration		Mean difference	95% confidence interval for difference		P-value
				Lower bound	Upper bound	
Forward	Baseline	1 month	0.219	−0.171	0.608	0.495
	Baseline	3 months	0.188	−0.518	0.143	0.482
	1 month	3 months	0.406	−0.798	−0.015	0.040*
Backward	Baseline	1 month	0.000	−0.359	0.359	1.000
	Baseline	3 months	0.188	−0.555	0.180	0.617
	1 month	3 months	0.188	−0.497	0.122	0.408
Total	Baseline	1 month	0.219	−0.286	0.724	0.844
	Baseline	3 months	0.375	−0.880	0.130	0.209
	1 month	3 months	0.594	−1.060	−0.127	0.009*

*Level of significance: *P<0.05(significant)

Yogic practices are reported to cause a shift in autonomic balance toward parasympathetic dominance, the students following pranayama took significantly less time in solving problems compared to the time taken for solving the problems before the training.[18] Yoga and mindfulness may provide physical and cognitive benefits through mechanisms such as pranayama and parasympathetic nervous system activation.[7,10] Other mechanisms for cognitive benefits consist of meditative or contemplative practices, increased body perception, stronger functional connectivity within the basal ganglia, or increased activation of gray matter volume and amygdala with regional enlargement.[7,19-21]

Limitations of the study

The study results may not be generalized due to its small sample size. Other tests used to analyze WM can also be used to confirm cognitive functions.

CONCLUSION

The interventional group's cognitive functions improved significantly after 1 months for the forward and total DST scores, but the control group's scores improved after 3 months. The other cognitive test (backward digit span) significantly improved only for the interventional group. The present research provides evidence that yoga practice improves cognitive function in a short period of time and in all types of cognitive skills. Thus, the present study recommends yoga practice as an adjunctive therapy in the management of depression.

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NK and AY- Concept and design of the study, results interpretation, review of the literature, and preparing the first draft of the manuscript.
IDG, DJ, and KY- Results interpretation, review of the literature, and preparing the first draft of the manuscript. **SSKG, NG, and AC-** Statistical analysis and interpretation, revision of the manuscript.

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