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A THREE MONTHS YOGA PROGRAM ON COGNITIVE VARIABLES OF DEMENTIA RISK PARTICIPANTS: A PILOT STUDY

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Abstract

Background: *Dementia refers to symptoms that affect memory, thinking, orientation, judgment, speech, and social abilities significantly enough to interfere with daily activities. Dementia is the second most prevalent disease worldwide.* ***Materials & Methods:*** *A total of thirty individuals, with an average age of 52.4 years (± 7.68 years), were enrolled and then assigned at random to either the yoga group (average age 50.9 years ± 7.23 years) or the control group (average age 52.2 years ± 7.73 years). For a duration of three months, the control group participated in brisk walking sessions lasting thirty minutes five days a week, whereas the yoga group endured sixty-minute yoga sessions five days a week. Before and after the three-month intervention period for both groups, working memory was evaluated using the N back task, and executive function was examined using the Trail Making Test (TMT).* ***Results:*** *A significant difference was observed in all four parameters of N back test in yoga group as compared to the control group ($P < 0.05$) after 12 weeks [H1($P = 0.01$), E1($P = 0.009$), H2 ($P = 0.0007$), E2 ($P = 0.006$]. There was improvement in the Trail Making Test, but did not observe the significant difference in the yoga group as compared to the control group ($P > 0.05$), [A ($P = 0.096$), B ($P = 0.569$)].* ***Conclusion:*** *The result of this pilot study suggests that yoga practices for dementia risk participants improves the Hit score of the N back test and reduces errors, similarly this improves the executive functions of the brain. Larger studies are needed to confirm these findings.*

Keywords: *Dementia, Cognition, Yoga*

BACKGROUND

Dementia is a term used to describe symptoms that interfere with daily activities by affecting memory, thinking, orientation, judgment, speaking, and social abilities. It is a progressive condition in which cognitive function deteriorates beyond one's biological age (WHO, 2021). Dementia is the greatest cause of impairment among the elderly; it affects more than 50 million people globally, and this figure is expected to double every 20 years (Avila et al., 2001; Imtiaz et al., 2014). The average worldwide societal cost of dementia in 2019 was US$ 1.3 trillion, and this is anticipated to rise to US$ 2.8 trillion by 2030. (WHO, 2021).

Dementia, characterized by symptoms like memory loss, impaired thinking, judgment, and social skills, is a progressive condition that affects cognitive function beyond one's age (WHO, 2021). It poses a significant challenge globally, impacting over 50 million people, a number projected to double every 20 years (Avila et al., 2001; Imtiaz et al., 2014). The economic burden is substantial, with the societal cost reaching US$ 1.3 trillion in 2019 and expected to rise to US$ 2.8 trillion by 2030 (WHO, 2021).

India's population is rapidly aging, with estimates suggesting that by 2050, 20% of its population will be over 60 (Dominguez et al., 2021). However, aging often brings about cognitive decline, increasing the risk of dementia and related conditions (Livingston et al., 2020). Alarmingly, over 60% of older adults with dementia will reside in low- and middle-income countries (LMICs) like India (Stites, 2022). The 2017 Lancet Commission identifies 12 modifiable factors, including education levels, lifestyle habits, and environmental factors, that can reduce dementia risk (Livingston et al., 2020).

Early detection of individuals at high risk is crucial for preventive measures. Lifestyle modifications, such as regular exercise, maintaining a healthy diet, and managing health parameters like blood pressure and cholesterol, are effective strategies in dementia prevention (WHO, 2021; Stephen et al., 2021).

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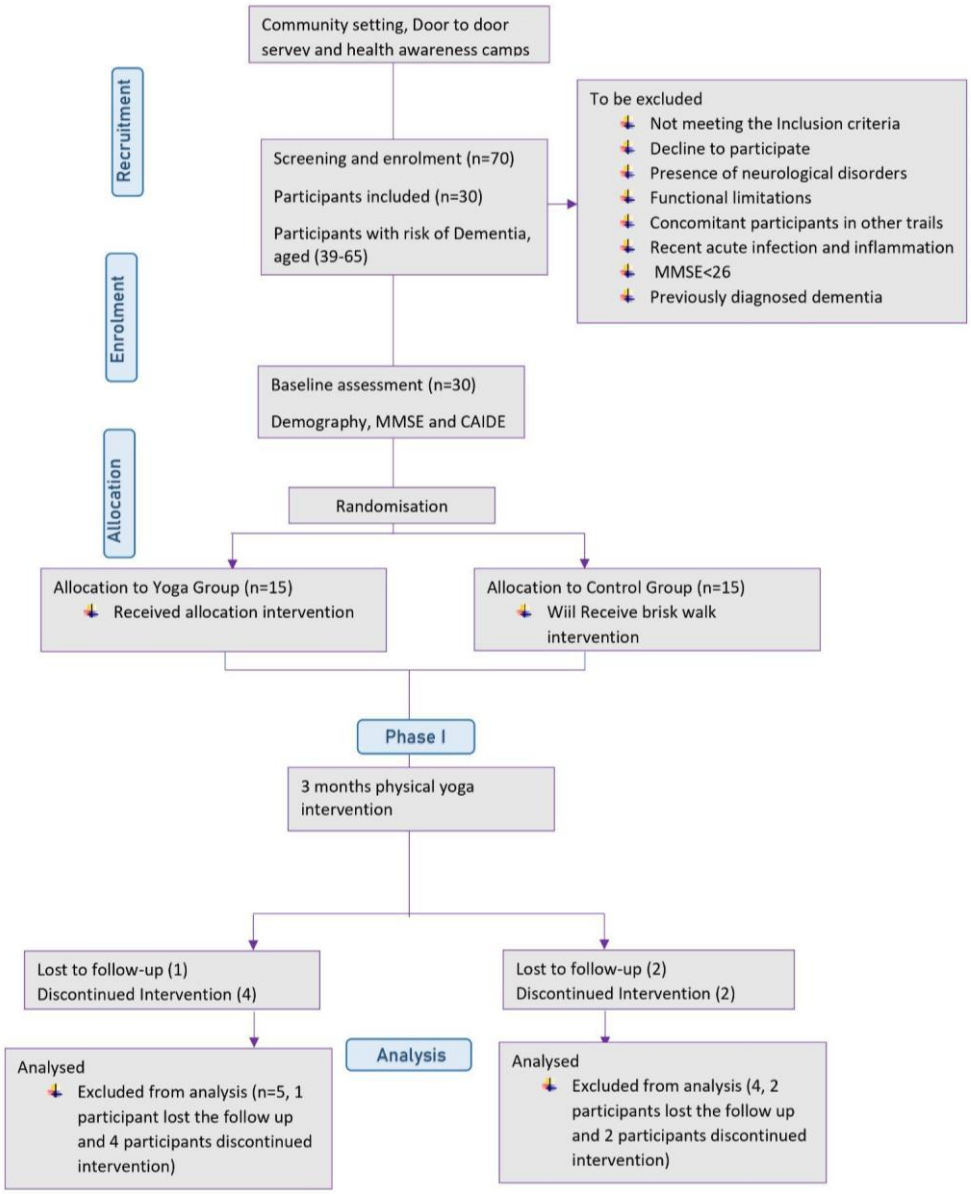
In our study, we aimed to assess dementia risk in middle-aged individuals, dividing them into groups practicing yoga and brisk walking. Utilizing the CAIDE risk score, we identified those at risk and conducted cognitive function tests. Understanding the potential of yoga in mitigating dementia risk, through its emphasis on mindfulness, physical activity, and stress reduction, could provide valuable insights into dementia prevention (Hariprasad, V. R., et al., 2013).

METHODS

Study design

We conducted a mixed methods feasibility open-trial study, with a pre-post design, that explored delivering a 3 month yoga program and brisk walk for control groups with dementia at-risk. The study was approved by the SVYASA University Research Ethics Board.



The demographic data for the 30 participants, split evenly between a yoga group and a control group, includes their average age and assignment to either the yoga or control group. The average age of participants in the yoga group was 50.9 years, while in the control group it was 52.28 years. The numbers in the "Yoga" column indicate whether participants

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were assigned to the yoga group (0.2) or not (0), and similarly for the "Control" column for the control group (0.82 for assigned, 0 for not assigned). Gender distribution is not provided in the given data (Table 1).

Table 1: Sociodemographic details

	Age	Gender
Yoga	50.9±7.23	0.2±0.42
Control	52.28±7.73	0.82±0.404

30 Participants with dementia risk were enrolled using convenience sampling from March 2023 to April 2023. Individuals were screened using a Mini-Mental State Exam (MMSE) ≥26 to exclude gross dementia and a CAIDE Risk Score (Cardiovascular Risk Factors, Aging, and Dementia) of ≥6 points (Stephen et al., 2021). Middle-aged individuals, aged 39 to 65 years were eligible if they have not regularly practiced any form of yoga in the previous 6 months and do not have a history of dementia. The details of inclusion and exclusion are listed in Table no 2.

Patients will be followed for 3 months or until they withdraw from the study.

TABLE 2: Inclusion and Exclusion criteria of study

Inclusion	**Exclusion**
Individuals between 39 to 65 years of age (Fayosse, et al)	Presence of neurological disorders
Both genders included	Functional limitations
People diagnosed with a high risk of dementia based on the CAIDE.	Persistent cognitive impairment due to psychoactive substance use
No prior exposure to yoga in last 6 months	Concomitant participation in other trials
Able to perform yogic practice	Not willing to participate
Active smoking or Drinking	Recent acute infection or any other inflammation
Dyslipidemia, defined by any of the following: Diagnosis by specialist or GP* Currently on lipid-lowering drugs Total cholesterol >=6.5 mmol/l (Richard, E., 2019)	MMSE score >25
Lack of physical exercise defined WHO norm of 30 minutes of intermediate exercise, 5 times a week	Previously diagnosed dementia
History of cardiovascular disease: stroke/transient ischemic attack, myocardial infarction, angina pectoris and/or peripheral arterial disease. (diagnosis by specialist)	
Diabetes mellitus (diagnosis by specialist or GP) (Richard, E., 2019)	

Outcome measures:
Primary Outcome: 1. MMSE, 2. TMT, and 3. N Back
1. **Mini-Mental State Evaluation Score (MMSE):** MMSE is a cognitive screening tool used in clinical and research settings. It assesses various cognitive functions, and scores between 10-20 indicate a risk of dementia (Guerrero-Berroa, 2009; Creavin, 2016).

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2. **Executive Function: Trail Making Test:** This neuropsychological test measures visual attention and task switching. Part A primarily assesses visual scanning and psychomotor speed, while Part B requires mental flexibility and working memory. It is effective in identifying cognitive disorders, including dementia (Trail Making Test | Psychology Wiki | Fandom, n.d.).
3. **Working Memory: N-Back Test:** The N-Back Test evaluates working memory. Participants listen to a series of consonants and respond when a consonant is repeated consecutively or after an intervening consonant. Scores are based on successful responses, with negative scores assigned for errors (Varsha & Shashikala, 2017).

Intervention:
Participants in the yoga group will undergo a 3-month intervention, five days a week, led by qualified yoga professionals. Sessions include gentle loosening movements, postures, breathing practices, and meditation. The intervention will be divided into three phases: Phase 1 consisting of 60 supervised sessions, The intervention aims to bring harmony to the mind and body, with modifications made according to individual medical limitations (Varsha & Shashikala, 2017).

Table 2. Schedule of Yoga Sessions

Yoga sessions	
	Supervised by yoga instructor
Number of sessions	60
Duration/ session	60 mins
	Welcome and Philosophical perspective (2 min) Preparatory loosening exercises (10 min) + IRT (1 min) Postural yoga (Asanas-20 min) + relaxation (3 min) Breathing exercises: Pranayama (20 min) Guided meditation (5 min) relaxation (3 min) Closing prayer (2 min) Query and discussion (10 mint)

RESULT
In N Back, The participants in the yoga group exhibited a marked enhancement in their performance, showing a statistically significant improvement from the initial assessment (7.6) to the post-test (8.4) on the H1 task ($p = 0.01$), as well as on the E1 task. Conversely, individuals in the control group demonstrated no notable changes in performance from baseline to post-test in either the H1 or E1 tasks ($p = 0.34$). These results suggest that the implementation of yoga intervention positively influenced cognitive function associated with the N-back task compared to those who did not undergo yoga sessions.
For TMT A, both the yoga and control groups showed a decrease in completion time from baseline to post-test, but this change was not statistically significant for either group ($p = 0.096$ and $p = 0.51$, respectively). Similarly, for TMT B, there were no significant changes in completion time from baseline to post-test in either the yoga group ($p = 0.569$) or the control group ($p = 0.97$). Overall, neither yoga intervention nor brisk walking had significant effects on performance in the Trail Making Test tasks. However, yoga intervention had a significant positive effect on cognitive function tasks related to N-back, while no significant effects were observed for the Trail Making Test tasks in this pilot study (Table 3).

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Table 3. Within group comparison

Parameter		Baseline	Post Test	P Value within group	
				Yoga	Control
N back	H1	7.6±1.51	8.4±097	0.01	0.34
	E1	1.5±1.72	0.6±0.97	0.009	0.34
	H2	5.1±1.92	6.4±1.84	0.0007	0.22
	E2	4±1.89	2.7±1.34	0.006	0.02
TMT	A	72.1±53.58	57.3±52.85	0.096	0.51
	B	136.3±73.04	132.1±68.25	0.569	0.97

H* Hit, E* Error, TMT* Trail Making Test

Based on between-group comparisons:

In the N-back tasks (H1 and E1), there were no statistically significant differences between the yoga and control groups at baseline ($p > 0.05$). However, after the intervention, the yoga group showed significantly greater improvement compared to the control group in both H1 and E1 tasks ($p < 0.05$). For H2 and E2 tasks, there were no significant differences between the groups at baseline ($p > 0.05$). After the intervention, while the difference in the H2 task remained non-significant ($p > 0.05$), the E2 task showed a significant difference ($p < 0.05$), indicating greater improvement in the yoga group compared to the control group in the E2 task.

In the Trail Making Test (TMT) tasks (TMT A and TMT B), there were no statistically significant differences between the yoga and control groups at baseline ($p > 0.05$). After the intervention, there were still no significant differences between the groups in either TMT A or TMT B tasks ($p > 0.05$), indicating that neither yoga intervention nor brisk walking had a significant differential effect on performance in these tasks compared to the control group.

Overall, the between-group comparisons suggest that yoga intervention had a significant positive impact on cognitive function tasks related to N-back (specifically H1 and E1), while no significant effects were observed in the Trail Making Test tasks (TMT A and TMT B) when compared to the control group Table 3.

Table 3: Comparison between toga and control group

Between group comparison			
N back	H1	Pre	0.107
		Post	0.94
	E1	Pre	0.103
		Post	0.94
	H2	Pre	0.509
		Post	0.108
	E2	Pre	0.519
		Post	0.033
TMT	A	Pre	0.792

		Post	0.929
	B	Pre	0.948
		Post	0.946

DISCUSSION

The pilot study aimed to investigate the effects of a three-month yoga program on cognitive variables associated with dementia risk among participants. The findings revealed significant improvements in working memory, as assessed by the N-back task, in the yoga group compared to the control group. However, there were no significant differences observed between the two groups in executive function, as measured by the Trail Making Test (TMT).

The observed improvements in working memory among participants in the yoga group suggest that yoga interventions may have a beneficial impact on cognitive function, particularly in domains associated with memory processing and attention. These findings are consistent with previous research demonstrating the cognitive benefits of yoga in various populations, including older adults and individuals with neurological disorders (Siu et al., 2015; Hariprasad et al., 2013). Yoga practices, which include physical postures, breathing exercises, and meditation, have been shown to enhance cognitive function through mechanisms such as stress reduction, neuroplasticity, and increased cerebral blood flow (Raveendran et al., 2018; Kuppili et al., 2018).

The lack of significant improvements in executive function between the yoga and control groups, as measured by the TMT, is somewhat unexpected. Executive function encompasses higher-order cognitive processes, including cognitive flexibility, problem-solving, and inhibition, which are crucial for daily functioning (Livingston et al., 2020). While previous studies have reported positive effects of yoga on executive function (Bernstein et al., 2014), the results of the current study suggest that the specific yoga intervention utilized may not have targeted these cognitive domains effectively. It is possible that a longer duration or different types of yoga practices may be needed to elicit changes in executive function.

The study's limitations should be considered when interpreting the findings. The small sample size and short duration of the intervention limit the generalizability of the results. Additionally, the absence of a long-term follow-up assessment precludes understanding the sustained effects of the yoga program on cognitive function. Future research should employ larger sample sizes, longer intervention durations, and incorporate diverse yoga practices to comprehensively evaluate the effects of yoga on dementia risk and cognitive function.

CONCLUSION

In conclusion, the findings of this pilot study suggest that a three-month yoga program may lead to improvements in working memory among individuals at risk for dementia. However, no significant effects were observed on executive function. These results highlight the potential of yoga interventions as a non-pharmacological approach to mitigating cognitive decline and reducing dementia risk. Larger-scale studies with longer follow-up periods are warranted to confirm these findings and elucidate the mechanisms underlying the cognitive benefits of yoga. Nonetheless, the current findings underscore the importance of incorporating lifestyle interventions, such as yoga, into dementia prevention strategies, particularly in aging populations where the burden of cognitive impairment is significant.

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