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The Analysis Study of Yoga and Cognitive in Older Adults: A Systematic Review and Metaanalysis

¹ Pretika Prameswari, ² Yudhi Hajianto Nugroho, ³ Mutia Juliana

¹ Faculty of Medicine, Trisakti University, Special Region of Jakarta,
Indonesia

² Division of Geriatric, Departement of Internal Medicine, Faculty of
Medicine, Sebelas Maret University, Surakarta City, Central Java, Indonesia

³ Faculty of Health Science, General Achmad Yani University, West Java,
Indonesia

Correspondence : pretika_p@yahoo.com

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ABSTRACT

Background: Yoga practices, focusing on mindfulness and meditation, have been found to positively impact cognitive function in older adults. These practices improve physical health, balance, flexibility, and cardiovascular function, while also promoting brain plasticity, neurogenesis, and stress-induced damage. The social aspect of yoga classes may also reduce isolation, thereby reducing cognitive decline. This study aims to provide a comprehensive analysis of existing research on the effects of yoga on cognitive function in older adults. **Method:** This systematic review was conducted in accordance with the PRISMA 2020 guidelines, focusing solely on full-text articles published in English between 2014 and 2024. To ensure the inclusion of high-quality, peer-reviewed sources, editorial pieces and review articles lacking a DOI were excluded. A comprehensive literature search was carried out across several reputable databases, including ScienceDirect, SpringerLink, PubMed, and SagePub, to identify pertinent studies that met the inclusion criteria. **Result:** The initial database search yielded over 1,000 relevant publications on the topic. Following a rigorous three-stage screening process, eight studies met the predefined inclusion criteria and were selected for in-depth analysis. Each study underwent a comprehensive critical evaluation, enabling a thorough examination of the relationship between psoriasis and hypertension. This systematic approach ensured that the analysis was grounded in high-quality evidence, closely aligned with the study's objectives, and capable of providing meaningful insights into this complex association. **Conclusion:** Yoga has been found to have beneficial effects on cognitive function in older adults, although methodological limitations and inconsistencies in intervention design need further investigation. Further research is needed to determine the true efficacy of yoga in promoting cognitive health among this age group.

Keyword : cognitive function, older adults, yoga

INTRODUCTION

The aging process is associated with various physical and cognitive declines, which can significantly affect the overall well-being of older adults. Among these declines, cognitive dysfunctions such as memory loss, attention deficits, and impaired executive function are particularly concerning due to their impact on daily living and quality of life.¹ As the global population of older adults increases, finding effective strategies to mitigate these cognitive declines has become a priority in geriatric research. One such potential intervention is yoga, an ancient mind-body practice that combines physical postures, breath control, and meditation techniques.² Over the past few decades, there has been a growing interest in examining the effects of yoga on cognitive function, particularly in older adults, given its low-impact nature and ability to promote both physical and mental health.

Several studies have demonstrated the positive impact of yoga on physical health outcomes in older adults, such as improved balance, flexibility, and cardiovascular function. However, emerging evidence suggests that yoga may also play a significant role in enhancing cognitive functions in this population.^{3,4} Cognitive health is vital for older adults, as cognitive decline can lead to serious conditions such as dementia and Alzheimer's disease.⁵ Researchers have hypothesized that yoga's emphasis on mindfulness, attention control, and relaxation may help improve cognitive processes by increasing brain plasticity, enhancing neurogenesis, and reducing stress-induced damage to the brain.³⁻⁵ These findings have spurred several intervention studies exploring the benefits of yoga for cognitive function in older adults.

Yoga practices, particularly those focusing on mindfulness and meditation, may also promote psychological well-being, reduce symptoms of anxiety and depression, and improve emotional regulation, all of which are crucial for maintaining cognitive health in later life.^{6,7} The integration of mindfulness within yoga is thought to contribute to improvements in attention and memory, as it requires sustained focus and mental engagement. Additionally, the breath-focused exercises incorporated in yoga practices may help regulate the autonomic nervous

system, which is often dysregulated in older adults, thereby supporting cognitive function.^{8,9} Furthermore, the social aspect of participating in group yoga classes may foster a sense of community and reduce isolation, another factor linked to cognitive decline.¹⁰

The current literature on yoga and cognitive function in older adults is still evolving, with some studies providing promising results while others show no significant effects. The variability in findings could be attributed to differences in study design, the duration of yoga interventions, and the specific cognitive outcomes measured. To fully understand the mechanisms by which yoga may influence cognitive function in older adults, more rigorous and large-scale studies are required. This study aims to provide a comprehensive analysis of existing research on the effects of yoga on cognitive function in older adults, examining both the physiological and psychological mechanisms at play, and offering recommendations for future research directions.

METHODS

This systematic review and meta-analysis was carried out in strict accordance with the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. The research question was formulated a priori using the PICO (Population, Intervention, Comparator, Outcomes) framework. The population of interest comprised older adults, while the intervention focused on yoga-related activities. The comparator group consisted of older adults who do not regularly engage in yoga exercises. The primary outcome of the study was the assessment of cognitive functions in these populations.

Eligibility Criteria

This study seeks to explore the relationship between yoga and cognitive function in older adults through a comprehensive systematic review and synthesis of data across a variety of studies. By identifying patterns and emerging trends within the existing literature, the research aims to provide valuable insights that can enhance diagnostic approaches and inform patient care strategies. The primary

objective is to deepen the understanding of how yoga may influence cognitive function in older adults, ultimately contributing to better clinical outcomes for individuals facing cognitive challenges.

To ensure methodological rigor, the study applied strict inclusion and exclusion criteria. Only peer-reviewed articles published in English between 2014 and 2024 were considered, with each study's authenticity verified through DOI validation. Non-research materials, including reviews, editorials, and duplicate entries, were excluded to maintain a high-quality and focused dataset. This thorough selection process strengthens the reliability of the analysis, ensuring that the findings are derived from relevant and credible sources.

By employing a systematic and comprehensive methodology, the study guarantees that its conclusions are based on robust evidence. The expected findings are poised to advance the current understanding of the connection between yoga and cognitive function in older adults, providing a foundation for improved clinical management. Ultimately, this research aims to foster advancements in patient care and contribute to enhanced health outcomes for individuals affected by cognitive decline.

Data Sources and Search Strategy

A comprehensive search strategy was implemented to identify relevant studies for this systematic review, incorporating key terms such as "yoga," "cognitive functions," and "older adults." The search was conducted across four major academic databases—PubMed, SagePub, Springer Link, and ScienceDirect—to ensure an extensive and thorough examination of the topic. This methodical approach enabled the inclusion of a wide range of high-quality sources, thereby strengthening the evidence base and enhancing the reliability and validity of the review's conclusions.

Table 1. Search Strategy

<i>Database</i>	<i>Search Strategy</i>	<i>Hits</i>
Pubmed	<i>("yoga" AND "cognitive functions" AND "older adults")</i>	6
Springer Link	<i>("yoga" AND "cognitive functions" AND "older adults")</i>	305
Science Direct	<i>("yoga" AND "cognitive functions" AND "older adults")</i>	853
Sagepub	<i>("yoga" AND "cognitive functions" AND "older adults")</i>	122

Study Selection

Title and abstract screening for eligibility was performed by two independent reviewers. Studies that met the established eligibility criteria were selected, and the full-text articles were subsequently obtained and thoroughly examined. Any discrepancies in the study selection process were resolved through consensus among all authors, ensuring the accuracy and consistency of the included studies.

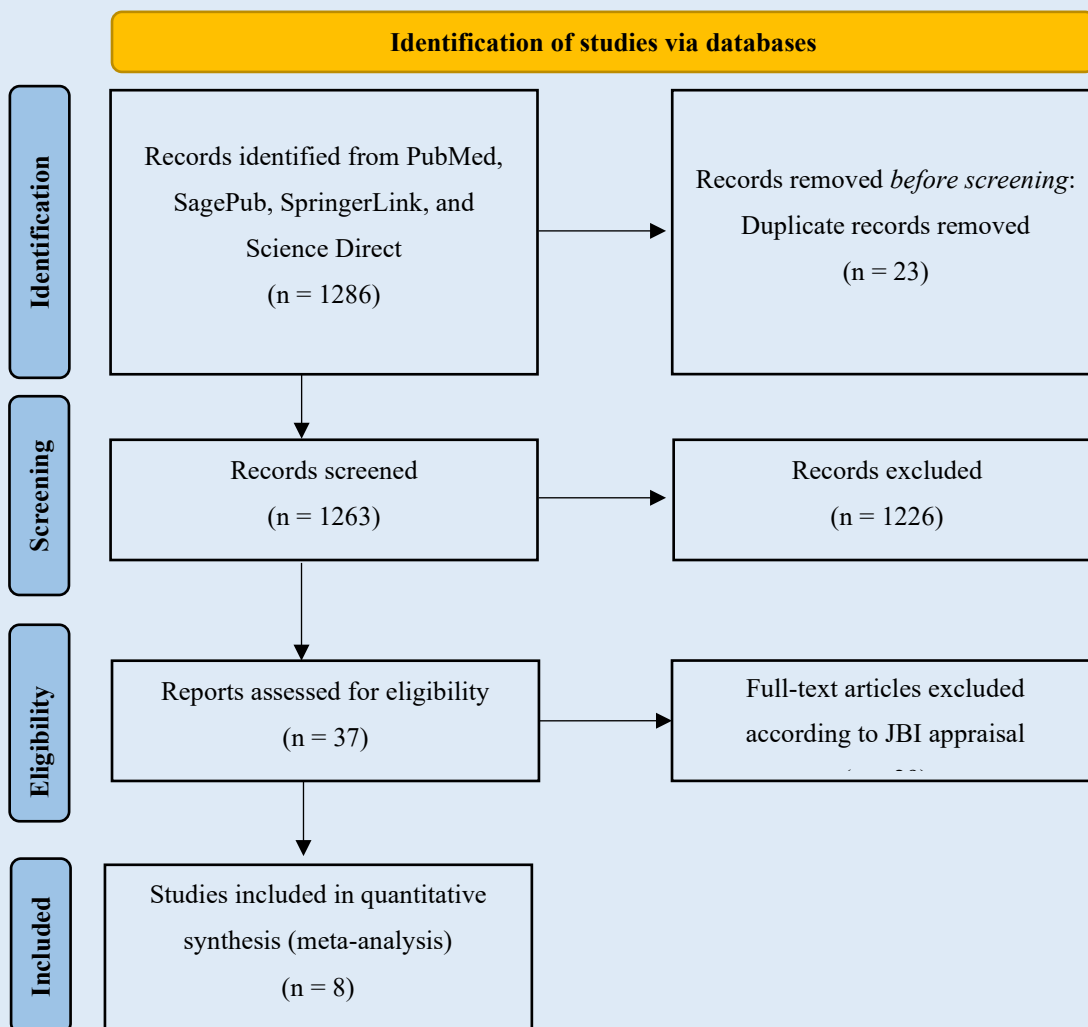


Figure 1. Search strategy and selection of studies for the meta-analysis.

Data Extraction

Data extraction was conducted independently by two authors using the full-text versions of eligible studies. The extracted data included the total number of events and controls related to the cognitive functions of older adults who engage in yoga practice. The primary source for data extraction was the information presented in tabular format within the studies.

Risk of Bias

The quality of the evidence was assessed using the GRADE system. The risk of bias was evaluated by examining the limitations inherent in each study's design. Randomized controlled trials (RCTs) were classified as high-quality

evidence, while observational studies were categorized as low-quality evidence. Each study was carefully reviewed for potential limitations, and bias was assessed across studies for each specific outcome.

Heterogeneity

Heterogeneity was assessed by examining the consistency of point estimates, the overlap of confidence intervals, and the associated statistical measures. To further investigate potential sources of heterogeneity, subgroup analyses were conducted, allowing for a deeper understanding of the factors contributing to the variability across studies.

Evaluating the Quality of Evidence

The GRADE approach was utilized to enhance the quality of evidence by considering factors such as the magnitude of pooled effects, the presence of dose-response relationships, and potential confounding variables. These elements were carefully evaluated to provide a more robust assessment of the evidence's reliability and strength.

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Table 2. Critical appraisal of Study

Parameters	(Bonura et al., 2014)	(Gothelal., et al., 2014)	(Talwadar et al., 2014)	(Eyre et al., 2017)	(Gothelal., et al., 2017)	(Cekan et al., 2020)	(Pandy et al., 2022)	(Farhang Set al., 2020)
1. Bias related to temporal precedence								
Is it clear in the study what is the “cause” and what is the “effect” (ie, there is no confusion about which variable comes first)?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2. Bias related to selection and allocation								
Was there a control group?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
3. Bias related to confounding factors								
Were participants included in any comparisons similar?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
4. Bias related to administration of intervention/exposure								
Were the participants included in any comparisons receiving similar treatment/care, other than the	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

exposure or intervention of
interest?

**5. Bias related to
assessment, detection, and
measurement of the
outcome**

Were there multiple
measurements of the
outcome, both pre and post
the intervention/exposure?

No No No No No No No No

Were the outcomes of
participants included in any
comparisons measured in the
same way?

Yes Yes Yes Yes Yes Yes Yes Yes

Were outcomes measured in a
reliable way?

Yes Yes Yes Yes Yes Yes Yes Yes

**6. Bias related to
participant retention**

Was follow-up complete and,
if not, were differences
between groups in terms of
their follow-up adequately
described and analyzed?

Yes Yes Yes Yes Yes Yes Yes Yes

**7. Statistical conclusion
validity**

Was appropriate statistical
analysis used?

Yes Yes Yes Yes Yes Yes Yes Yes

RESULT

The investigation commenced with a thorough, systematic search of well-established academic databases, including ScienceDirect, SpringerLink, PubMed, and SagePub, to identify studies relevant to the review. A rigorous three-stage screening process was implemented to ensure the selection of the most pertinent studies, ultimately narrowing down the pool to eight papers that met the predefined inclusion criteria. These studies were then subjected to a comprehensive analysis, with key themes and findings extracted for detailed examination. To improve clarity and facilitate effective presentation, the results are concisely summarized in Table 3, providing a well-organized overview of the analyzed data.

Table 3. Characteristics of studies included in the systematic review

Author	Origin	Method	Sample Size	Outcome	Result
Bonura, et al. ¹¹ (2014)	USA	A randomized controlled trial was conducted on 98 older adults aged 65-92 in two North Florida facilities.	98 participants	to assess the effect of a yoga intervention on psychological health in older adults	Yoga participants showed better improvement in anger, anxiety, depression, well-being, general self-efficacy, and self-efficacy for daily living compared to exercise and control participants. Changes in self-control moderated psychological health improvements.
Gothe, et al. ¹² (2014)	USA	Older adults living in the community were randomly assigned to either a Hatha yoga intervention group or a stretching-strengthening control group. Both groups engaged in hour-	118 participants	The study aims to investigate the impact of an 8-week Hatha yoga intervention on	Yoga showed significant improvement in executive function measures of working memory capacity, efficiency of mental set shifting, and

		long exercise sessions three times per week throughout the eight-week study duration.		executive function measures such as task switching and working memory capacity.	flexibility after 8 weeks of practice. Participants in the yoga intervention group showed shorter reaction times and higher accuracy in single trials and 2-back conditions. Further systematic trials are needed to explore yoga's effects on cognitive functioning in the aging process.
Talwadkar, et al. ¹³ (2014)	India	Elderly participants were recruited according to specified inclusion and exclusion criteria and randomly assigned to two groups: the Trataka group and the waitlist control group, utilizing a randomized block design. Trataka, a visual cleansing technique,	60 participants	This study aimed to evaluate the impact of trataka on the cognitive functions of elderly individuals.	The study showed significant improvement in digit span scores, SLCT scores, and TMT-B scores in the trataka group at the 2nd follow-up. At 1 month follow-up, the trataka group showed significantly

		was administered over a duration of 1 month (26 days).			better performance in the SLCT test and TMT-B scores. The results suggest that Trataka can enhance cognition in the elderly.
Eyre, et al. ¹⁴ (2017)	USA	Older participants with MCI were randomized to either a 12-week KY intervention or memory enhancement training, with cognitive and mood assessments conducted at baseline, 12 weeks, and 24 weeks.	81 participants	The primary outcome measures were cognitive, encompassing memory and executive functioning. Secondary outcome measures comprised mood assessments utilizing the Geriatric Depression Scale (GDS), a self-	The study showed significant improvement in memory, executive functioning, depressive symptoms, and resilience in both KY and MET groups at 12 weeks and 24 weeks, with only the KY group showing improvement in executive functioning and depressive symptoms at week 12.

				assessment tool frequently employed in trials concerning geriatric depression.	
Gothe, et al. ¹⁵ (2017)	USA	Participants were randomly assigned to either an 8-week Hatha yoga group or a stretching control group. They completed cognitive assessments, including the Attention Network Task, Trail Making Test parts A and B, and Pattern Comparison Test, at baseline and following the 8-week intervention.	118 participants	This study aims to assess the impact of an 8-week Hatha yoga intervention on attention and processing speed in older adults.	The yoga group showed improved attentional and information processing abilities, with faster reaction times and improved visuospatial and perceptual processing. The study suggests that yoga practice, including postures, breathing, and meditative exercises, may have neurobiological mechanisms.
Cekanauskaite, et al. ¹⁶ (2020)	Lithuania	Individuals aged 60–79 years were randomly assigned to a control group (n = 15) or a yoga group (n = 18) for a	33 participants	This study aims to examine the impact of yoga on cognitive	Yoga practice observed changes in cognition, balance, and learning speed-accuracy

		duration of 10 weeks. The yoga group participated in 90-minute classes twice weekly.		function, balance in both single- and dual-task scenarios, and motor learning processes.	motor tasks. Yoga practice decreased the velocity vector of the center of pressure, but no cognitive performance changes were observed. However, faster reaction and shorter movement times were observed in the yoga group. Significant moderate relationships were observed between changes in BDNF levels and functional improvements.
Pandya, S. ¹⁷ (2020)	India	Out of the initial cohort of 918 older adults randomized into intervention and waitlist control groups, 792 continued participation in the study after 5 years.	918 participants	The impact of a yoga education program (YEP) on enhancing memory and cognitive functions	The YEP, a weekly program aimed at improving mental health, was found to be effective in improving scores on the Mini-Mental State

				in a nonclinical sample of community-dwelling older adults. The study examined the personal resources that influence YEP effectiveness, either positively or negatively.	Examination and Rivermead Behavioral Memory Test–Third Edition. Participants from diverse backgrounds, including Asian cities, women, Hindus, Buddhists, middle class, and those living alone or with children, showed strong self-practice effects.
Farhang, et al. ¹⁸ (2022)	Chile	A two-arm, randomized controlled trial will be conducted at Clinical Hospital Universidad de Chile in Santiago. Older people over 60 with MCI and preserved daily living activities will be randomly assigned to either a yoga-based mindfulness intervention or an active control group	40 participants	This research evaluates the effectiveness of a yoga-based mindfulness intervention (YBM) compared to psychoeducational	YBM therapy, a relevant therapy for mental health, has been developed to improve cognitive and physical functions in Chilean elderly with MCI, highlighting the potential of evidence-based

		based on psycho-educational program.		sessions for older adults with mild cognitive impairment (MCI) at Hospital Clinic Universidad de Chile in Santiago.	programs like this for public mental health services.
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Bonura, 2014	+	?	+	+	+	+	-
Cekanauskaitė, 2020	?	?	+	+	?	?	-
Eyre, 2017	+	?	+	+	-	+	?
Farhang, 2022	?	+	+	+	?	?	-
Gothé, 2014	+	?	+	?	?	+	-
Gothé, 2017	+	?	+	?	?	+	?
Pandya, 2020	+	?	?	?	-	?	-
Talwadekar, 2014	+	?	+	?	?	?	-
	Random sequence generation (selection bias)	Allocation concealment (selection bias)	Blinding of participants and personnel (performance bias)	Blinding of outcome assessment (detection bias)	Incomplete outcome data (attrition bias)	Selective reporting (reporting bias)	Other bias

Figure 2. Risk of bias summary: review authors' judgements about each risk of bias item for each included study.

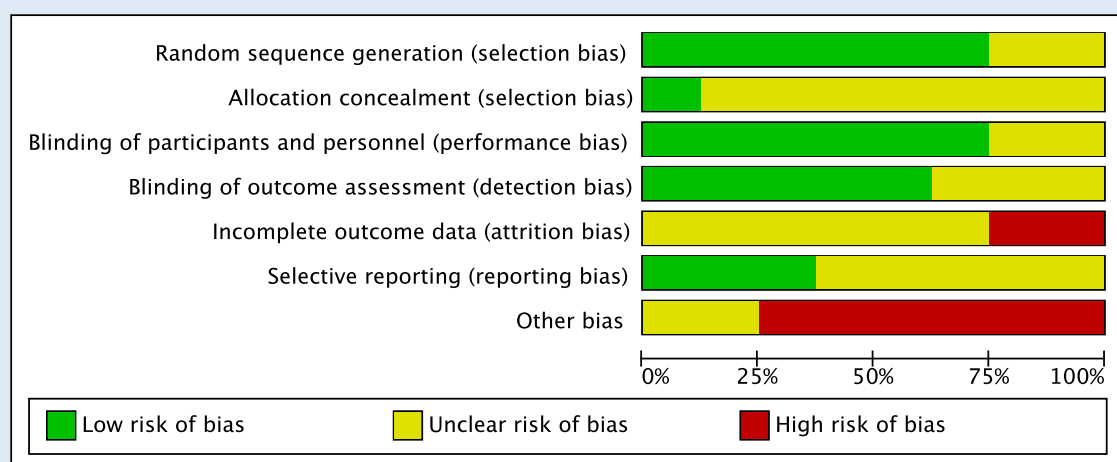


Figure 3. Risk of bias graph: review authors' judgements about each risk of bias item presented as percentages across all included studies.

The primary objective of this analysis is to evaluate the effect of yoga exercise on cognitive function in older adults. To illustrate the findings, forest plots are presented in Figure 4, depicting the mean difference in cognitive function between individuals practicing yoga and those in the control group. These plots include a log-transformed mean difference along with the associated 95%

confidence intervals (CIs). In this study, out of 684 participants who engaged in yoga exercise, a proportion demonstrated improved cognitive function. Conversely, among the 604 individuals in the control group, fewer exhibited cognitive enhancement.

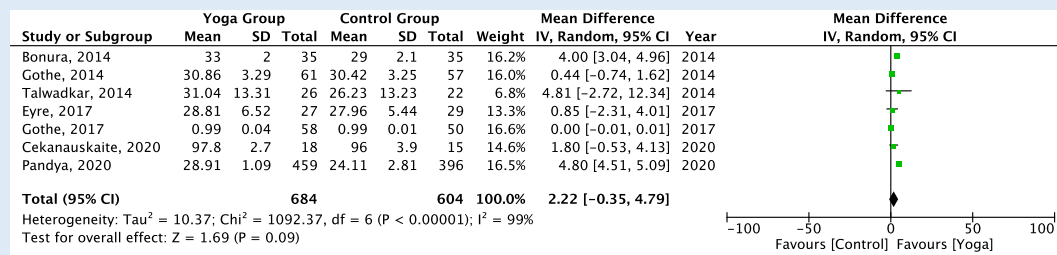


Figure 4. Forest Plot of Related Findings

The calculated mean difference (MD) comparing cognitive function between the yoga group and the control group was 2.22, with a 95% CI ranging from -0.35 to 4.79. The associated p-value for this comparison was 0.09, indicating that the difference between the two groups was not statistically significant. This suggests that while some participants practicing yoga showed cognitive improvements, the overall effect did not reach statistical significance compared to the control group.

Furthermore, a heterogeneity analysis was conducted using the I^2 statistic, which resulted in a value of 99%. This indicates that nearly all observed variability in effect sizes across the included studies was due to heterogeneity rather than random sampling error. The substantial heterogeneity, characterized by a lack of overlapping confidence intervals among individual studies, highlights significant inconsistencies in the reported effects of yoga on cognitive function.

DISCUSSION

The primary objective of this systematic review was to synthesize evidence from randomized controlled trials (RCTs) examining the effects of yoga-based interventions on cognitive function in older adults. While yoga has been widely recognized for its physical and mental health benefits, its specific impact on cognitive outcomes remains an area of growing interest. Notably, the study by Cekanauskaitė et al. reported no significant effect of a yoga-based intervention on

self-reported stress levels as measured by the Perceived Stress Scale (PSS).¹⁶ However, previous research has indicated that stress—both objectively measured through cortisol levels and subjectively assessed via self-reported anxiety and stress symptoms—plays a mediating role in the cognitive benefits of yoga.¹⁹ The ability of yoga to regulate stress responses, particularly through the downregulation of the sympathetic nervous system and the hypothalamic-pituitary-adrenal (HPA) axis, has been well-documented in the literature.^{20,21} Gothe & McAuley, in their meta-analysis, emphasized the need for future research to explore the link between yoga, stress reduction, and cognitive function.²² The lack of direct evidence addressing this relationship in the current studies represents a key limitation and highlights an important avenue for further investigation.

A secondary objective of this review was to analyze the characteristics of yoga-based interventions and examine their association with cognitive outcomes. Findings suggest that shorter-duration interventions exhibited higher adherence rates compared to longer ones. However, there were no significant differences in adherence between yoga-based interventions and exercise-based control groups, suggesting that yoga is as acceptable to older adults as other forms of physical activity. Interestingly, only one study identified adherence and self-practice as moderators of cognitive function improvement.¹⁷ This underscores the need for future research to systematically assess adherence to yoga interventions and provide clear operational definitions of adherence.²³ Additionally, where possible, objective assessments should be implemented to improve measurement accuracy. Further exploration into the differences between supervised and non-supervised programs is also warranted, as these factors may influence participant commitment and, subsequently, cognitive benefits.

Another key consideration in yoga-based interventions is the variation in practice styles, class frequency, session duration, and intervention length. None of the studies reviewed specified the proportion of time allocated to physical postures, breathing exercises, or meditation. This gap in reporting is significant because certain breathing and meditation techniques unique to yoga may contribute differently to cognitive outcomes. Furthermore, none of the included studies

documented intensity levels, despite the well-established role of exercise intensity in cognitive improvements observed in other physical activity interventions.²⁴ Given that yoga intensity does not follow the linear relationship between heart rate and oxygen consumption seen in aerobic exercise,²⁵ future studies should establish standardized methods for measuring and reporting yoga intensity.

Improved standardization in the design and reporting of yoga interventions is critical for advancing research in this field. Existing literature has called for better documentation of intervention characteristics.²⁶ One potential solution is to adopt the Template for Intervention Description and Replication (TIDieR) guidelines, which provide a structured approach for reporting intervention details.²⁷ Ensuring consistent and transparent reporting would enhance the reproducibility of findings and facilitate comparisons across studies. Additionally, a more thorough understanding of the underlying mechanisms and accurate reporting of key variables will strengthen future research in this area.²⁸

CONCLUSION

In conclusion, while evidence suggests that yoga may have beneficial effects on cognitive function in older adults, several methodological limitations hinder definitive conclusions. The role of stress reduction as a potential mediator remains underexplored, adherence patterns require further investigation, and inconsistencies in intervention design necessitate standardization. Addressing these gaps through rigorous study methodologies, objective adherence assessments, and comprehensive intervention reporting will be essential for determining the true efficacy of yoga in promoting cognitive health among older adults.

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