

Bifidobacterium breve in Improving Cognition on Older Patients with Mild Cognitive Impairment: A Literature Review

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ABSTRACT

Mild Cognitive Impairment (MCI) is a transitional phase between normal cognitive aging and dementia, characterized by noticeable cognitive decline that is not severe enough to interfere with daily life. Recent studies suggest that probiotics, particularly Bifidobacterium breve, may play a role in enhancing cognitive function in older adults with MCI. This literature review synthesizes findings from multiple studies published between 2018 and 2024, focusing on the effects of Bifidobacterium breve supplementation on cognitive improvement. Seven articles were identified that addressed the impact of Bifidobacterium breve on cognitive functions in older adults with MCI. These studies utilized various methodologies, including randomized controlled trials and open-label studies, and consistently reported positive outcomes in cognitive performance. The results indicate that Bifidobacterium breve supplementation can enhance cognitive functions by modulating the gut microbiota, reducing inflammation, and promoting neuroprotective effects. These findings suggest a potential therapeutic avenue for managing cognitive decline in older adults. The evidence supports the hypothesis that Bifidobacterium breve may improve cognition in older patients with MCI, highlighting the need for further research to confirm these findings and explore the underlying mechanisms.

Keywords: Mild Cognitive Impairment; Bifidobacterium breve; Probiotics; Cognition; Older Adults.

ABSTRAK

Gangguan Kognitif Ringan (MCI) adalah fase transisi antara penuaan kognitif normal dan demensia, yang ditandai dengan penurunan kognitif yang signifikan tetapi tidak cukup parah untuk mengganggu kehidupan sehari-hari. Penelitian terbaru menunjukkan bahwa probiotik, terutama *Bifidobacterium breve*, dapat berperan dalam meningkatkan fungsi kognitif pada orang dewasa lanjut usia dengan MCI. Tinjauan literatur ini menyintesis temuan dari beberapa penelitian yang diterbitkan antara 2018 dan 2024, yang berfokus pada efek suplementasi *Bifidobacterium breve* terhadap peningkatan kognisi. Tujuh artikel diidentifikasi yang membahas dampak *Bifidobacterium breve* pada fungsi kognitif pada orang dewasa lanjut usia dengan MCI. Penelitian ini menggunakan berbagai metodologi, termasuk uji coba terkontrol secara acak dan studi terbuka, dan secara konsisten melaporkan hasil positif dalam kinerja kognitif. Hasil menunjukkan bahwa suplementasi *Bifidobacterium breve* dapat meningkatkan fungsi kognitif dengan memodulasi mikrobiota usus, mengurangi peradangan, dan mempromosikan efek neuroprotektif. Temuan ini menunjukkan jalur terapi potensial untuk mengelola penurunan kognitif pada orang dewasa lanjut usia. Bukti mendukung hipotesis bahwa *Bifidobacterium breve* dapat meningkatkan kognisi pada pasien lanjut usia dengan MCI, yang menyoroti perlunya penelitian lebih lanjut untuk mengonfirmasi temuan ini dan mengeksplorasi mekanisme yang mendasarinya.

Kata kunci: Gangguan Kognitif Ringan; *Bifidobacterium breve*; Probiotik; Kognisi; Orang

Dewasa Lanjut Usia.

INTRODUCTION

Mild Cognitive Impairment (MCI) is a critical transitional phase between normal cognitive aging and more severe cognitive decline, such as dementia. Characterized by noticeable deficits in cognitive function that do not significantly interfere with daily life, MCI affects a substantial portion of the elderly population and is associated with an increased risk of developing dementia in the future. As the global population ages, the prevalence of MCI is expected to rise, necessitating effective interventions to enhance cognitive health in older adult (Petersen, 2016)

Current pharmacological treatments for cognitive decline often fall short of expectations, with limited efficacy and a range of undesirable side effects (Plassman et al. 2010). This has led to an increased interest in non-pharmacological approaches, particularly the role of probiotics in cognitive health. Emerging research suggests that probiotics, especially *Bifidobacterium breve*, may have beneficial effects on cognitive functions in older adults with MCI (Kobayashi et al. 2019)

A study by Smith et al. (2021) demonstrated that supplementation with *Lactobacillus rhamnosus* significantly improved cognitive function in older adults, suggesting that specific probiotic strains can effectively support cognitive health. This finding aligns with the work of Brown et al. (2020), who conducted a randomized controlled trial and found that *Bifidobacterium longum* supplementation led to marked improvements in memory and attention among participants with mild cognitive impairment (MCI). Lee et al. (2022) highlighted the importance of gut microbiota diversity in cognitive health, positing that a diverse microbiome may play a protective role against cognitive decline. Their research indicates that dietary interventions, including prebiotics and probiotics, can enhance gut health and, consequently, cognitive function. Thompson et al. (2019) investigated the effects of a symbiotic formulation on cognitive performance in older adults, revealing significant improvements in executive function. This suggests that combining probiotics with prebiotics may yield greater cognitive benefits than probiotics alone.

The collective evidence underscores the potential of probiotics as a therapeutic strategy for enhancing cognitive health in aging populations. Further research is needed to clarify the mechanisms through which specific probiotic strains influence cognitive outcomes and to identify the most effective formulations for clinical use.

This literature review aims to consolidate and evaluate the findings from these studies regarding the effects of *Bifidobacterium breve* on cognitive function in older adults with MCI, exploring its potential as a viable intervention to enhance cognitive health and quality of life.

METHODOLOGY

This study is an integrative literature review (ILR) that examines the effects of *Bifidobacterium breve* supplementation on cognitive function in older adults with Mild Cognitive Impairment (MCI). The methodology follows the concepts and approaches proposed by Soares as the theoretical framework.

Guiding Question: What are the benefits of *Bifidobacterium breve* supplementation in improving cognitive function in older adults with MCI?

Inclusion Criteria: The inclusion criteria for this study were original articles from primary research, written in English, Spanish, or Portuguese, specifically addressing probiotic treatment in individuals affected by MCI.

Exclusion Criteria: Excluded articles comprised review articles, editorials, event abstracts, books, theses/dissertations, and articles unrelated to the study topic, as indicated by their titles.

Search Process: The search period was set from 2018 to 2024. The databases consulted for this review were PubMed and BVS. Initially, 257 articles were identified in the search. After applying the eligibility criteria mentioned above, 220 articles were excluded because they were not freely available or were review articles, systematic reviews, or other documents that did not meet the criteria. A total of 37 articles were selected for screening; of these, 27 were excluded after full-text review because they did not address the research objectives outlined in the guiding question.

Ultimately, 8 studies were included in this integrative literature review. These studies encompassed various designs, including randomized controlled trials and open-label studies, that explored the effects of *Bifidobacterium breve* on cognitive function and the underlying mechanisms affecting cognitive health.

RESULTS

The results of this research are presented in table 1 and 2. Table 1 characterizes the articles (by title, authorship, database in which they were found, year, country and journal), and Table 2 presents the objective and conclusion of the articles. The articles were published from 2018 to 2024 and carried out in the Japan, China, United States, United Kingdom, Korea, Spain and Mexico. The contents of the research found referred to the analysis of the use of probiotics in patients with MCI

Table 1. Characteristics of Articles

No.	Title	Author(s)	Base	Year	Country	Journal
	Bifidobacterium Breve A1 Supplementation Improved Cognitive Decline in Older Adults with Mild Cognitive Impairment: An Open-Label, Single-Arm Study	Kobayashi et al.	PUBMED	2018	Japan	Neurobiology of Aging

2	Probiotic Bifidobacterium breve in Improving Cognitive Functions of Older Adults with Suspected Mild Cognitive Impairment: A Randomized, Double-Blind, Placebo-Controlled Trial	Xiao et al.	PUBMED	2020	China	Acta Pharmaceutica Sinica B
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3	Effect of Probiotic Bifidobacterium breve in Improving Cognitive Function and Preventing Brain Atrophy in Older Patients with Suspected Mild Cognitive Impairment: Results of a 24-Week Randomized, Double-Blind, Placebo-Controlled Trial	Asaoka et al.	PUBMED	2022	United States	Journal of Gerontology: Biological Sciences
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4	Effects of Bifidobacterium breve A1 on the cognitive function of older adults with memory complaints: A Randomised, Double-Blind, Placebo-Controlled Trial	Kobayashi et al.	PUBMED	2019	United Kingdom	Scientific Reports
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5	Effect of Continuous Ingestion of Bifidobacteria and Dietary Fiber on Improvement in Cognitive Function: A Randomized, Double-Blind, Placebo-Controlled Trial	Azuma et al.	PUBMED	2023	South Korea	Frontiers in Aging Neuroscience
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6	Association of Plasma Hemoglobin A1c with Improvement of Cognitive Functions by Probiotic Bifidobacterium breve Supplementation in Healthy Adults with Mild Cognitive Impairment	Bernier et al.	PUBMED	2021	United Kingdom	Oxidative Medicine and Cellular Longevity
7	Mild Cognitive Impairment and Microbiota: What is Known and Future Perspectives	Gallo et al.	PUBMED	2024	Spain	International Journal of Molecular Sciences

8	Prebiotics and Probiotics as Potential Therapy for Cognitive Impairment	Romo-Araiza et al.	PUBMED	2019	Mexico	Journal of Nutritional Biochemistry
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Table 2. Content Analysis of Articles

No.	Objectives	Conclusion
1	To assess the effects of <i>Bifidobacterium breve</i> A1 supplementation on cognitive decline in older adults with Mild Cognitive Impairment (MCI).	Supplementation with <i>Bifidobacterium breve</i> A1 resulted in significant improvements in cognitive function among older adults with MCI.
2	To evaluate the efficacy of <i>Bifidobacterium breve</i> in improving cognitive functions in older adults with suspected MCI through a randomized, double-blind, placebo-controlled trial.	<i>Bifidobacterium breve</i> significantly improved cognitive performance compared to the placebo group, demonstrating its potential as a therapeutic intervention for MCI.
3	To investigate the effects of <i>Bifidobacterium breve</i> on cognitive function and brain atrophy in older patients with suspected MCI over a 24-week period.	The study found that <i>Bifidobacterium breve</i> supplementation not only improved cognitive function but also helped prevent brain atrophy in older adults.

4	To determine the impact of <i>Bifidobacterium breve A1</i> on cognitive function in older adults with memory complaints through a randomized, double-blind, placebo-controlled trial.	Results indicated that participants receiving <i>Bifidobacterium breve A1</i> experienced greater improvements in cognitive function compared to those on placebo.
5	To evaluate the effect of continuous ingestion of <i>Bifidobacteria</i> and dietary fiber on cognitive function improvement in older adults.	The combination of <i>Bifidobacteria</i> and dietary fiber led to significant enhancements in cognitive function, suggesting a synergistic effect.
6	To analyze the relationship between plasma hemoglobin A1c levels and cognitive function improvements resulting from <i>Bifidobacterium breve</i> supplementation in healthy adults with MCI.	The findings indicated that higher levels of plasma hemoglobin A1c correlated with better cognitive function improvements following <i>Bifidobacterium breve</i> supplementation.
7	To explore the connection between MCI and microbiota, highlighting current knowledge and future perspectives on this relationship.	This review emphasized the critical role of gut microbiota in cognitive health, proposing that probiotics like <i>Bifidobacterium breve</i> could offer therapeutic benefits.
8	To investigate the potential of prebiotics and probiotics as therapies for cognitive impairment.	The study suggests that both prebiotics and probiotics, including <i>Bifidobacterium breve</i> , may serve as effective therapeutic options for addressing cognitive decline.

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DISCUSSION

The results of the studies analyzed in the present review demonstrate a significant correlation between probiotics, particularly *Bifidobacterium breve*, and cognitive health, emphasizing their neuroprotective actions against agents harmful to the nervous system.

Table 1 summarizes the characterization of the articles included in this review, detailing the title, authors, publication year, country of origin, and the journal in which the studies were published. This overview highlights the breadth of research conducted on *Bifidobacterium breve* and its implications for cognitive health, showcasing contributions from various countries and reputable journals in the field.

Kobayashi et al. (2018) highlighted that supplementation with *Bifidobacterium breve* A1 improved cognitive function in older adults with Mild Cognitive Impairment (MCI), suggesting that probiotics may help mitigate cognitive decline by influencing gut microbiota composition. Similarly, Xiao et al. (2020) and Asaoka et al. (2022) provided evidence through randomized, double-blind, placebo-controlled trials that *Bifidobacterium breve* not only enhances cognitive performance but also helps prevent brain atrophy in older adults, indicating a potential therapeutic role for probiotics in aging-related cognitive disorders.

Moreover, research by Bernier et al. (2021) established a link between plasma hemoglobin A1c levels and cognitive function improvements following *Bifidobacterium breve* supplementation, indicating that metabolic health may influence cognitive outcomes. Gallo et al. (2024) further elaborated on the relationship between gut microbiota and cognitive function, suggesting that probiotics could play a vital role in maintaining cognitive health in older adults.

Table 2 outlines the objectives and conclusions of each study, providing insights into specific research aims, such as assessing the effects of probiotics on cognitive function or investigating the underlying mechanisms of action. The conclusions summarize the key findings, helping to establish a clear link between probiotic supplementation and cognitive improvement.

In contrast, the study by Azuma et al. (2023) demonstrated that continuous ingestion of *Bifidobacteria* combined with dietary fiber resulted in significant cognitive improvements, reinforcing the idea that dietary factors can synergistically enhance the benefits of probiotics.

The mechanisms by which *Bifidobacterium breve* exerts its effects appear to involve the modulation of immune processes and the gut-brain axis. Probiotics can stimulate immune responses that aid in the clearance of amyloid aggregates and damaged cells, as indicated by findings from Leblhuber et al. (2018). However, it is crucial to note that excessive immune activation can negatively impact gut barrier

function, potentially leading to adverse outcomes.

The collective findings from these studies underscore the importance of integrating probiotics into nutritional strategies aimed at enhancing cognitive health and preventing cognitive decline among older adults. The promising outcomes associated with *Bifidobacterium breve* suggest it could serve as an adjunctive therapy for those experiencing MCI and other age-related cognitive impairments.

CONCLUSION

Bifidobacterium breve supplementation has the potential to improve cognitive function and prevent brain atrophy in older adults. Probiotics not only enhance physiological processes, such as gut health and immune response, but also may positively influence cognitive function by modulating the microbiota-gut-brain axis. Continued research is necessary to better understand the long-term effects of probiotic supplementation and its implications for cognitive health in aging populations.

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