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Diet and Memory Loss in Older Adults: A Neuroscience Perspective

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Abstract **Introduction:** There is a solid theoretical foundation for the understanding that the intake of certain nutrients may have an impact on the established processes for neurodegeneration, proven by plausible biological mechanisms. This study focuses on compiling important studies giving insight into dietary patterns that can prevent cognitive deterioration. **Methods:** The selected keywords facilitated a thorough and methodical search for relevant published articles, utilizing indexing sources including Scopus, Web of Science and PubMed. Evaluating the connection between nutrition and neuroscience efficiently. Only studies conducted with older adults and elderly individuals, for which complete articles were available, were included. The search strategy yielded 65 studies, reviews and meta-analyses concerning diet and cognition, supplemented by an additional 33 studies identified through reference lists of the reviews and meta-analyses. A total of 98 studies were identified, with 36 selected based on comprehensive abstracts and texts. A total of 26 studies were identified regarding the Mediterranean diet's impact on cognitive function or dementia, alongside 15 studies examining other dietary patterns related to cognitive function. Five studies conducted analyses on the Mediterranean diet in comparison to other dietary patterns. Two reviewers (OVDR and AAMB) independently conducted study selection, data extraction and quality assessment. **Discussions:** This review shows how diet affects memory loss, stressing the complex relationship between nutrition and neurobiology. The Mediterranean and DASH diets have high in antioxidants, anti-inflammatories and brain-healthy nutrients. These nutrients may reduce neuroinflammation, increase neuroplasticity and boost neurotrophic factor production. The gut-brain axis and microbiome modulation in cognitive function are also explored in this review. This shows that conservative diets can prevent memory decline and improve cognitive performance in older persons without drugs. This analysis lays the groundwork for future study and dietary recommendations to improve aging adults' quality of life and cognitive health. **Conclusions:** Effective nutritional strategies significantly reduce the overall rate of cognitive decline, particularly among the elderly population. The dietary pattern has demonstrated the potential to enhance cognitive functions within a few weeks of consistent adherence; individuals with diabetes mellitus experience advantages from the ketogenic diet; and those with obesity gain benefits from the MIND diet.

Key Words Cognitive Health, Geriatric Population, Cognitive Deterioration, Mediterranean Diet, MIND Diet

INTRODUCTION

Background

Memory loss is one of the common causes of morbidity and mortality in the elderly population, Dementia is found to be the 7th common cause of death according to the World Health Organization (WHO) affecting around fifty-five million people globally and its prevalence is significantly on the rise [1-4]. Research is being done to focus on preventative techniques and non-pharmacological therapies for dementia [5-7]. Normal cognition in healthy people is benefitted from Non-pharmacological therapy [8-11]. Non-pharmacological therapy has also been found to help reduce worsening parameters in the elderly such as depression, hearing loss

and cardiovascular disease (CVD) [12-14]. Nutritional approaches for the deference of memory loss are gaining attention. The most common cause of memory loss is Alzheimer's Disease (AD) [2,3]. It has been established that many dietary patterns (Table 1) and current pharmacological therapies for dementia and AD are gaining importance as the ketogenic diet and MUFA-rich diets in drug resistance to epilepsy and cognitive declines are found to be helpful and beneficial [4-7].

Ketogenic Diet and Brain Health

The Ketogenic Diet (KD) has emerged as a potential therapeutic approach for Alzheimer's Disease (AD), because of the following proposed hypotheses. The ketogenic diet shifts the body's energy source from glucose to ketone bodies, which can provide an alternative fuel for the brain, particularly in conditions where glucose metabolism is impaired in AD patients [1].

Table 1: An overview of 15 different diets for their potential benefits in dementia and Alzheimer's disease, along with their key components

S.No	Name of diet	Composition	Benefits	References
1.	MIND Diet	A combination of the Mediterranean and DASH diets. Emphasizes leafy greens, berries, nuts, whole grains, fish, poultry, olive oil, and limited red meat, sweets, and fried foods	Associated with reduced risk of Alzheimer's and slower cognitive decline	[17,38-40]
2.	Mediterranean Diet	Rich in fruits, vegetables, whole grains, legumes, nuts, olive oil, and moderate consumption of fish and poultry. Low in red meat and dairy	Linked to improved cognitive function and reduced dementia risk	[4,9,11]
3	DASH Diet	Focuses on fruits, vegetables, whole grains, lean proteins, and low-fat dairy, with reduced saturated fats, sugars, and sodium	Promotes heart health, which may indirectly benefit brain health	[17-21]
4	Ketogenic Diet	High in fats, moderate in proteins, and very low in carbohydrates. Includes foods like fatty fish, avocados, nuts, and oils	Provides an alternative fuel source for the brain and may improve cognitive function in some individuals	[12-15]
5	Plant-Based Diet	Emphasizes whole, unprocessed plant foods such as fruits, vegetables, legumes, nuts, seeds, and whole grains. Excludes or minimizes animal products	Associated with lower risk of cognitive decline and improved brain health	[20-23]
6	Whole30 Diet	A short-term elimination diet focused on whole, unprocessed foods. Excludes sugar, grains, dairy, and legumes for 30 days	Aims to reset eating habits and improve overall health, which may support brain function	[22,23,29,33]
7	Paleo Diet	Focuses on whole foods similar to those eaten by early humans, including lean meats, fish, fruits, vegetables, nuts, and seeds. Excludes grains, legumes, and processed foods	May improve metabolic health, which can positively affect brain health	[26,28,38,39,41]
8.	Intermittent Fasting	Involves cycling between periods of eating and fasting. Variants include 16/8 (16 hours fasting, 8 hours eating) or alternate-day fasting	May enhance brain function and reduce inflammation	[21-23]
9	Flexitarian Diet	Primarily vegetarian but includes occasional meat or fish. Emphasizes fruits, vegetables, whole grains, nuts, and legumes	Promotes overall health and can help manage weight, which is beneficial for cognitive function	[21-23]
10.	Nordic Diet	Similar to the Mediterranean diet but focuses on foods native to the Nordic countries. Includes whole grains, fatty fish, root vegetables, and berries	May reduce the risk of cognitive decline and support overall brain health	[37,42]
11	Anti-Inflammatory Diet	Focuses on foods that reduce inflammation, such as fatty fish, leafy greens, nuts, fruits, and whole grains, while limiting processed foods and sugars	Reduces inflammation, which is linked to cognitive decline	[43-45]
12	Low Glycemic Index Diet	Emphasizes foods that have a low glycemic index (GI), including whole grains, legumes, vegetables, and certain fruits. Avoids high-GI foods like white bread and sugary snacks	Stabilizes blood sugar levels, which can positively impact cognitive function	[37,42,45]
13	Cognitive Enhancing Diet	Incorporates foods rich in antioxidants, omega-3 fatty acids, vitamins, and minerals, such as berries, fish, nuts, and green leafy vegetables	Aims to support brain health and cognitive function	[46,47]
14	Low-Carbohydrate Diet	Reduces carbohydrate intake while emphasizing proteins and healthy fats. Includes meats, fish, eggs, non-starchy vegetables, and healthy fats	May improve cognitive function and metabolic health	[48,49]
15	Mediterranean Diet	A variation of the Mediterranean diet, focusing on seasonal and locally sourced foods, with an emphasis on plant-based ingredients and healthy fats	Supports brain health through nutrient-dense foods and anti-inflammatory properties	[50-52]

Also, ketone bodies have been shown to exert neuroprotective effects by reducing oxidative stress and inflammation, which are significant contributors to the pathology of Alzheimer's disease [2]. In addition, the diet may enhance mitochondrial function, which is often compromised in Alzheimer's patients, leading to improved energy production in neurons [3].

Clinical Studies Furthermore, A notable study found that a 12-week modified ketogenic diet improved daily function and quality of life, as measured by the Activities of Daily Living (ADCS-ADL) and Quality of Life in Alzheimer's Disease (QOL-AD) scales [3].

Animal studies have indicated that ketogenic diets can reduce amyloid plaque accumulation and improve cognitive function in models of Alzheimer's disease, suggesting a potential mechanism for the diet's benefits [1]. These finding were supported by other epidemiological studies which had linked dietary patterns, including high-glycemic diets, to increased risk of AD, highlighting the potential role of dietary interventions like the ketogenic diet in mitigating this risk [2].

The ketogenic diet shows promise as a potential intervention for Alzheimer's disease, with evidence suggesting improvements in daily functioning and quality of life. However, further research is needed to establish its long-term efficacy and safety in this population. Viewpoints regarding the role of the ketogenic diet role in dementia and Alzheimer's disease that have been suggested to be considered as individual variability as Responses to the ketogenic diet can vary significantly among individuals, necessitating personalized approaches and medical supervision [2]. Also, Adhering to a strict ketogenic diet can be challenging and long-term effects are still under investigation [3].

Decreased insulin receptors in the brain causing insulin resistance is seen in AD patients [3]. Drug-resistant epilepsy is successfully treated with the Ketogenic Diet (KD), a low-carb, high-fat diet [5]. Nutritional ketosis may take place to a certain extent with different forms of KD [6]. The brain can use ketones as a substitute energy source when glucose is unavailable [7-9].

The Mediterranean diet and brain health

The Mediterranean diet (MeDi) has been shown to lower the advancement of dementia (Table 2). The MeDi dietary pattern consists of an increased intake of plant-based foods and has been linked with a more gradual course of memory decline in AD [10-14] and neurodegenerative diseases [15,16]. The benefits of the Mediterranean diet (Table 3) supports brain health through nutrient-dense foods and anti-inflammatory properties. Several scoring systems have been established to measure MeDi adherence [17,18], even though the MeDi has no precise definition [19]. Each of these scoring methods is vital in determining MeDi compliance and associated health benefits. Meta-analyses of articles have linked MeDi adherence with improved results in cognitive function with its main focus being on glucose metabolism [20,21], which is compromised in dementia patients [22,23]. The "MEDI scores," or Mediterranean Diet Adherence Screener, is a tool used to assess adherence to the Mediterranean diet (Table 4). The scoring system evaluates the consumption of various food groups traditionally associated with the Mediterranean dietary pattern.

Components of MEDI

Scoring System

The total MEDI score is typically calculated on a scale, with higher scores indicating greater adherence to the Mediterranean diet. Interpretation: Scores can be categorized to reflect low, moderate, or high adherence levels.

The MEDI scores provide a useful framework for assessing adherence to the Mediterranean diet, which is linked to various health benefits, including improved cognitive function and reduced risk of Alzheimer's disease. By focusing on specific food groups, the scoring system helps guide individuals toward healthier dietary patterns.

Aging and memory loss are known to be significantly impaired by oxidative stress and inflammation [24]. The therapeutic dietary components of MEDI, have been shown to reduce neuroinflammatory reactions because of their antioxidant qualities [25,26].

Table 2: Studies showing association of MIND diet on cognitive decline and memory loss

S. No.	Study title	Objective	Methods	Key Findings	Conclusion	References
1	MIND Diet Associated with Reduced Incidence of Alzheimer's Disease	To investigate the relationship between MIND diet adherence and the incidence of Alzheimer's disease (AD)	A prospective study with 923 participants aged 58-98, followed for an average of 4.5 years; dietary assessment via food frequency questionnaire	Higher adherence to the MIND diet was associated with lower rates of AD (HR = 0.65 for second tertile, HR = 0.47 for highest tertile)	High adherence to the MIND diet may reduce AD risk; moderate adherence is also beneficial	[1,3]
2	MIND Diet Slows Cognitive Decline with Aging	To assess the impact of the MIND diet on cognitive decline over time	Longitudinal study with 960 participants from the Memory and Aging Project, average follow-up of 4.7 years; cognitive assessments and dietary scoring	MIND diet score positively associated with slower cognitive decline ($\beta = 0.0092$; $p<.0001$); top tertile equivalent to being 7.5 years younger	MIND diet substantially slows cognitive decline; further intervention trials needed	[2,7]
3.	Diet Review: MIND Diet	To summarize the MIND diet and its implications for cognitive health	Review of existing literature and studies on MIND diet and cognitive function	Participants with higher MIND diet scores had a 53% lower rate of AD; moderate adherence showed a 35% lower rate	The MIND diet is associated with the preservation of cognitive function and may benefit overall health	[3,6]

Table 3: Studies showing the benefits of adherence to the MIND diet

S. No.	Study title	Sample size	Key findings	References
1	MIND diet, common brain pathologies, and cognition in community-dwelling older adults	569	Higher MIND diet score linked to better cognitive functioning, independent of brain pathology	[4,5]
2	MIND diet slows cognitive decline with aging	960	MIND diet score associated with slower cognitive decline; top tertile equivalent to being 7.5 years younger	[2,7]
3	MIND diet and the risk of dementia: a population-based study	5375	Higher MIND diet score linked to lower risk of dementia over time	[5,9]

Table 4: "MEDI scores," or mediterranean diet score

S. No.	Components	Score	Recommendation
1	Fruits	Points are awarded for daily consumptio	Encourages high consumption of fresh fruit
2	Vegetables	Points are awarded for daily consumption	Emphasizes a variety of vegetables, preferably fresh
3	Legumes	Points are awarded for weekly consumption	Recommendation Includes beans, lentils, and chickpeas
4	Nuts	Points awarded for weekly consumption	Focus on unsalted nuts and seeds
5	Whole Grains	Points are awarded for daily consumption of whole-grain products	Encourages the use of whole grains over refined grains
6	Fish	Points are awarded for weekly consumption	Emphasizes fatty fish rich in omega-3 fatty acids
7	Poultry	Points are awarded for moderate consumption	Suggests lower consumption compared to red meat
8	Red Meat	Points are deducted for high consumption	Limits red meat intake
9	Dairy	Points awarded for moderate consumption of dairy products	Encourages low-fat dairy options
10	Olive Oil	Points are awarded for daily use as the primary cooking fat	Promotes the use of extra virgin olive oil
11	Sweet Foods and Beverages	Points are deducted for high consumption	Limits added sugars and sweets

Monounsaturated fatty acids (MUFAs) are a type of unsaturated fat characterized by having one double bond in their fatty acid chain. They are generally considered heart-healthy fats and are found in various food sources [27,28]. Characteristics of MUFAs are as follows:

- Chemical Structure: MUFAs have a single double bond between carbon atoms in their fatty acid chain, which creates a kink that prevents the molecules from packing tightly together. This structure contributes to their liquid state at room temperature
- Health Benefits: MUFAs are associated with several health benefits, including:
- Heart Health: They can help lower bad cholesterol (LDL) levels while increasing good cholesterol (HDL) levels, reducing the risk of heart disease
- Anti-Inflammatory Properties: MUFAs may have anti-inflammatory effects, contributing to overall health and potentially lowering the risk of chronic diseases
- MUFAs are found in a variety of foods, including [26,30]: Olive Oil: One of the richest sources, particularly extra virgin olive oil., Avocados: High in MUFAs and other beneficial nutrients, Nuts and Seeds: Almonds, cashews, hazelnuts and sesame seeds are good sources and fatty Fish: Some fish, like salmon, contain MUFAs along with omega-3 fatty acids
- Peanut Oil and Canola Oil: Used in cooking, these oils are also high in MUFAs
- Incorporating MUFAs into the diet is recommended for promoting heart health and overall well-being. They are a key component of healthy dietary patterns, such as the Mediterranean diet

MCT (medium chain triglyceride) undergoes acetyl CoA metabolism, which increases beta-hydroxybutyrate (βHB) levels and causes ketogenesis and thus improves cognition in AD patients [31,32]. MCT supplementation, which has demonstrated beneficial cognitive effects, has been proposed as an alternative to the problems associated with adhering to a rigorous diet to induce ketogenesis [33]. On the other hand, MCT consumption would require consuming more saturated fatty acids, which are associated with an increased risk of inflammation and heart disease [34]. Another diet that shows promise for preventing dementia is the Mediterranean-DASH (Dietary Approaches to Stop Hypertension) & Intervention for Neurodegenerative Delay (MIND) diet, which combines the DASH and MeDi diets [35]. Neuroprotective foods like olive oil and fatty salmon are part of the MIND diet [36]. Through the use of antioxidant and anti-inflammatory components, the MIND diet attempts to boost neuroprotection and prevent dementia by modifying cardiac factors [37]. Figure 1 and 2 shows the association of nutritional patterns with a decreased risk of memory decline.

Rationale and Knowledge Gap

Cognitive decline represents an increasing public health issue, especially within aging demographics; however, the

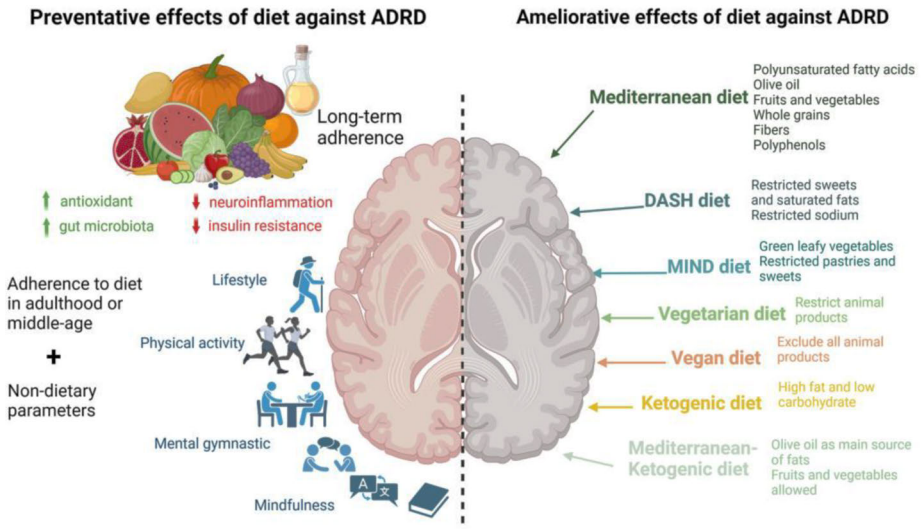

Figure 1: Impact of Dietary Habits on Cognitive Health: Enhancing Cognitive Function through Dietary Interventions: A Focus on Antioxidant, Anti-Inflammatory, and Microbiome Modulation Mechanisms (By preventing memory loss through antioxidant/anti-inflammatory mechanisms and positive microbiome modulation, long-term adherence to prudent dietary patterns (left-side panel) combined with a healthy lifestyle may improve cognitive function and overall quality of life. These factors are linked to a decreased propensity for aging-associated neuroinflammation and insulin resistance. ([12,29]; ↑ higher; ↓ lower)

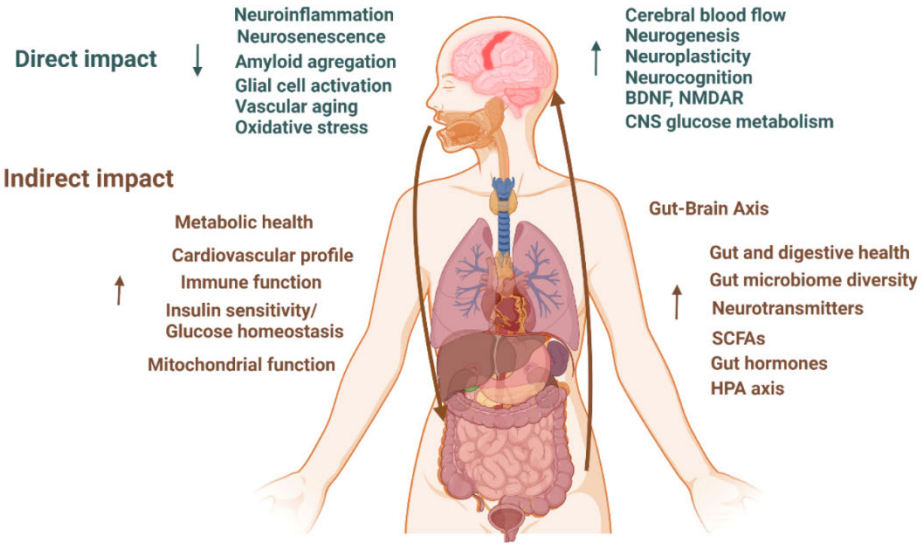

Figure 2: Dietary Patterns and Their Impact on Cognitive Function: Exploring the Direct and Indirect Effects of Dietary Patterns on Cognitive Function: Mechanisms and Implications (Dietary patterns' suspected direct and indirect effects on cognition function: neurotrophic factor derived from the brain; CNS: central nervous system; HPA: hypothalamic-pituitary-adrenal; SCFAs: short-chain fatty acids; NMDR: N-methyl-D-aspartate receptor (References: [29,37]; ↑ higher; ↓ lower)

availability of effective preventive measures is still constrained. Previous research indicates a potential connection between nutrition and brain health; however, the evidence remains fragmented across diverse dietary patterns and population groups, lacking a cohesive synthesis. This study systematically reviews and consolidates existing evidence regarding the effects of dietary patterns-namely the Mediterranean, DASH, ketogenic and MIND diets-on cognitive function in older adults, thereby addressing a significant knowledge gap. This study evaluates established and emerging dietary strategies, offering a comprehensive understanding of how nutrition can mitigate neurodegeneration. This study examines under-researched mechanisms, including the gut-brain axis and microbiome modulation, providing new insights into non-pharmacological strategies for maintaining cognitive health.

Objective

This study aims to explore how dietary patterns influence memory loss and cognitive decline in older adults. By reviewing high-quality studies, including research on the Mediterranean, DASH, MIND and ketogenic diets, the review highlights the biological mechanisms-such as reduced neuroinflammation, enhanced neuroplasticity and gut-brain axis modulation-through which nutrition supports brain health. The findings underscore the potential of diet-based strategies to improve cognitive function and prevent memory deterioration in aging populations, providing a foundation for future research and dietary guidelines.

METHODS

This review's thorough literature search ensured a complete and insightful examination of geriatric eating habits and cognitive performance. Although this is a narrative review and not a meta-analysis, the reporting process was guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) checklist to ensure transparency, structure and reliability. The study question and topical themes, terms and concepts were defined first. To improve search efficiency, a list of relevant terms and phrases, including synonyms and variations, was created. Searches were refined using AND, OR, NOT. To ensure comprehensive peer-reviewed study coverage, PubMed, Scopus, Web of Science and Google Scholar were searched. After a comprehensive keyword search to assess the literature, abstracts were reviewed to find relevant papers to the research issue. Key keywords were "geriatric population," "dietary patterns," "memory loss," "cognitive decline," "nutrition and neuroscience," "neuroinflammation," & "antioxidants."

Advanced search options including filters and classification improved precision. Inclusion and exclusion criteria determined study selection. Peer-reviewed literature over the last 10 years, investigations on dietary patterns and cognitive health in older persons and research relating nutrition to biological mechanisms controlling cognition were included. Non-English papers and non-geriatric studies were excluded.

To collect relevant data from chosen research, a structured data extraction form was created. Author(s), year of publication, study design (observational, intervention), sample size and demographics, food patterns, cognitive outcomes and main findings and conclusions were extracted. Grouping studies by antioxidant effects, anti-inflammatory characteristics and microbiota regulation enabled a thematic analysis and structured synthesis.

For observational research, the Newcastle-Ottawa Scale (NOS) assessed quality, whereas for randomized controlled trials, the Cochrane Risk of Bias Tool assessed methodological rigor and dependability. A narrative synthesis approach was used to integrate findings from multiple research to provide a thorough review of dietary habits and cognitive performance in older persons. Research gaps were also found, notably for specific dietary components and their cognitive health mechanisms. Data of the articles were collected by diet rather than their brain effect.

Limitations were also addressed to acknowledge review constraints. Reference management was done with EndNote for accuracy and consistency. For clarity and professionalism, the manuscript was written in Microsoft Word or LaTeX. Professionals in nutrition and neurology reviewed and revised the text to improve clarity, accuracy and completeness. Two independent reviewers (OVDR and AAMB) conducted the study selection, data extraction and quality assessment to ensure a fair and unbiased review process.

This strategy provided a rigorous, methodical and well-structured evaluation of the relationship between food patterns and memory loss in the elderly, connecting nutrition and neuroscience. By presenting results in a transparent and evidence-based manner, this review upholds the scientific integrity of the included studies and ensures that their contributions are appropriately represented in the synthesis of knowledge.

RESULTS

According the mentioned and the methodology section and the study selection criteria, the search strategy yielded 65 studies, reviews and meta-analyses concerning diet and cognition, supplemented by an additional 33 studies identified through reference lists of the reviews and meta-analyses. A total of 98 studies were identified, with 36 selected based on comprehensive abstracts and texts. A total of 26 studies were identified regarding the Mediterranean diet's impact on cognitive function or dementia, alongside 15 studies examining other dietary patterns related to cognitive function. Five studies conducted analyses on the Mediterranean diet in comparison to other dietary patterns.

Food with potential benefits in dementia and Alzheimer's disease

Diets with various compositions can support brain health and potentially reduce the risk of dementia and Alzheimer's disease. Incorporating elements from these diets can promote overall health and well-being, which is particularly important for individuals at risk for or are diagnosed with cognitive decline. An overview of 15 different diets for their potential benefits in dementia and Alzheimer's disease, along with their key components are shown in Table 1.

Mind Diet and Brain Health

Results showing the association between MIND Diet and memory loss in the geriatric population are summarized in Table 2. MIND diet was shown to be highly beneficial to support brain health and its cognitive functions. The beneficial effect of MIND diet is shown in Table 3.

These studies collectively suggest that adherence to the MIND diet may offer protective benefits against cognitive decline and Alzheimer's disease, highlighting its potential as a dietary intervention for brain health.

DISCUSSION

It has been shown that many dietary regimens were effective in reducing cognitive deterioration, especially in elderly patients [35]. Vast majority of dietary patterns include components like total fat, cholesterol and sodium, as well as components like fruits, vegetables, grains, dairy and fatty fish. It has been suggested that all of the diet factors working together might impact several biological processes, which could account for how specific dietary patterns can influence cognitive health and decline [37-42]. Oxidative stress and risk factors associated with cardiovascular disorders are pre-existing mechanisms thought to contribute to the pathophysiology of age-related diseases, such as Alzheimer's disease (AD) and cognitive impairment [43-48]. These mechanisms are the best objects for diet intervention focusing on different kind of diets like the Mediterranean diet, which are rich in MUFAs and antioxidants [11,49,50]. The MIND diet, a hybrid of the Mediterranean and DASH diets, has been shown to have a significant impact on reducing the risk of Alzheimer's disease and slowing cognitive decline in older adults. Studies indicate that higher adherence to the MIND diet correlates with lower rates of dementia and improved cognitive function, highlighting the importance of dietary patterns in brain health [52-54].

The MIND diet, which combines elements of the Mediterranean and DASH diets, has been studied for its potential benefits in reducing the risk of Alzheimer's disease and slowing cognitive decline [55-58]. A study involving 569 decedents found that a higher MIND diet score was associated with better global cognitive functioning proximate to death, independent of common brain pathologies. The association remained significant even when controlling for Alzheimer's disease pathology [1,4,5]. In a longitudinal study with 960 participants, the MIND diet score was positively associated with slower decline in global cognitive scores over an average of 4.7 years. The difference in decline rates for those in the top tertile of MIND diet scores compared to the lowest was equivalent to being 7.5 years younger in age [2,7]. A population-based study from the Rotterdam Study indicated that adherence to the MIND diet was linked to a decreased risk of dementia. The study showed that a higher MIND diet score was associated with a lower risk of dementia over various follow-up intervals [3,5].

Combining the Mediterranean lifestyle with dementia prevention strategies can result in improved MeDi compliance and, consequently, higher MeDi scores [37,54,55,59].

It has been shown that the MeDi protects older people from developing symptoms associated with depression [31, 56] and is also associated with lower Aβ plaque formation in elderly people [57,60]. Improved memory and support for memory loss were found to be associated with increased adherence to the MeDi diet [58,61-63]. MeDi postulates a non-pharmacological way to improve circulation and memory retention when adopted consistently.

The KD stresses a high-fat, low-carb diet to achieve ketosis. The strict carbohydrate restriction of the KD method makes it challenging for patients with AD [64] and may be harmful to those with a high risk of heart disease [65,66]. Nonetheless, considering the high price of some of these diets, non-adherence to them due to the unexpected cost of maintaining these customized diets for memory retention is evident [67,68].

The Ketogenic Diet (KD) has been studied for its potential benefits in patients with Alzheimer's Disease (AD). Studies have indicated that the ketogenic diet can enhance cognitive functions in patients with Alzheimer's disease. Improvements in various types of memory and overall cognitive abilities have been reported, particularly in patients with mild to severe AD [1,69]. Patients on a ketogenic diet have shown improvements in their quality of life. This includes better performance in daily activities and overall life satisfaction, which are crucial for individuals living with dementia [3,70].

The presence of ketone bodies, which are produced during the ketogenic diet, has a neuroprotective impact on aging brain cells. This effect may help mitigate some of the neurodegenerative processes associated with Alzheimer's disease [2,70]. The ketogenic diet may reduce the expression of inflammatory mediators in the brain, which is beneficial since neuroinflammation is a significant factor in the progression of Alzheimer's disease [2]. The diet has been associated with enhanced mitochondrial function, which is often impaired in Alzheimer's patients. Improved mitochondrial health can lead to better energy production in brain cells [2]. In a randomized crossover trial, patients on a modified ketogenic diet showed significant improvements in daily functioning as measured by the Activities of Daily Living (ADCS-ADL) scale [3]. The ketogenic diet presents several potential benefits for patients with Alzheimer's disease, including improved cognitive function, enhanced quality of life and neuroprotective effects. However, further research is needed to fully understand its long-term effects and mechanisms. The studies regarding non-adherence to ketogenic diets due to unexpected costs affecting memory retention raise several logical concerns [70]. Insights that highlight the complexities of this issue, emphasizing the importance of patient well-being were as follows:

Financial Constraints

- High Costs of Ketogenic Foods: Many ketogenic diets require specialized foods that can be significantly more expensive than standard dietary options. This financial burden can lead to non-adherence, particularly for individuals on fixed incomes or those facing economic hardships [21]
- Impact on Healthcare Budgets: The costs associated with maintaining a ketogenic diet may divert funds from other essential health needs, potentially compromising overall well-being and access to necessary medical care [22,23]

Nutritional Quality and Accessibility

- Limited Food Choices: The restrictive nature of ketogenic diets can limit access to a variety of foods, which may lead to nutritional deficiencies if individuals cannot afford high-quality options. This lack of essential nutrients can negatively impact cognitive health and memory retention [71]
- Alternative Diets: More affordable dietary options that still promote cognitive health may be overlooked due to the focus on ketogenic diets. A balanced diet rich in fruits, vegetables and whole grains can also support brain health without the high costs associated with ketogenic foods [72]

Psychological and Social Factors

- Stress and Anxiety: The financial strain of adhering to a costly diet can lead to increased stress and anxiety, which are known to adversely affect cognitive function and overall mental health [73].
- Social Isolation: The high cost and restrictive nature of ketogenic diets may limit social interactions, such as dining out with friends or family, which are important for emotional well-being and cognitive engagement [74]

Patient Well-Being

- Holistic Approach to Health: Patient well-being should be the primary focus. If the financial burden of a ketogenic diet leads to stress or compromises other aspects of health, it may be more beneficial to explore alternative dietary strategies that are both effective and sustainable [11,75]
- Long-Term Adherence: Sustainable dietary changes are crucial for long-term health benefits. If a diet is too costly or restrictive, individuals are less likely to adhere to it over time, which can negate any potential cognitive benefits [76]

In conclusion, while ketogenic diets may offer certain benefits for memory retention, the high costs associated with them can lead to non-adherence, ultimately impacting patient well-being. A ketogenic MIND diet that incorporates new substances like saffron and curcumin are examples of a novel diet that has been thoroughly studied for its neuroprotective properties. One such diet is the KetoFLEX 12/3, which combines the MIND diet's tenets with a mild ketogenic impact. Due to their higher fiber, polyunsaturated fat and neuroprotective minerals and compounds, these diets have been linked to protective outcomes on dementia. In addition to improving cerebral blood flow and reducing oxidative stress, they can also promote neuroplasticity, enhance neurogenesis and decrease neuroinflammation.

According to the gut microbiota–brain axis, whole grains also improve cognition through their effects on the gastrointestinal tract and the circulatory system [77]. Nuts contain beneficial fatty acids that have several advantages that contribute to brain protection, including reducing blood pressure and having anti-inflammatory qualities [78]. Vitamins B9, B12 and E have been associated with neurogenesis in adults due to their antioxidant qualities [79]. Many of these nutrients function by reducing blood pressure, insulin resistance, blood sugar and lipid levels to enhance cognitive health [80].

It is essential to consider more accessible and sustainable dietary options that support cognitive health without imposing financial strain. Incorporating MUFAs into the diet is recommended for promoting heart health and overall well-being. They are a key component of healthy dietary patterns, such as the Mediterranean diet [81]. Research on the effects of different dietary interventions such as the Nordic, Okinawa and NU-AGE diet on mood and mental abilities should be publicized [82]. Several factors, including financial, social and physiological ones, influence the amount and quality of their food intake in elderly people. Lifestyle factors, sociodemographic factors and psychosocial difficulties are a few examples of these personal determinants [83]. In actuality, there is a considerable correlation between living arrangement and marital status and diet quality. Living in a community or with a companion enables older individuals to share food and get social support [83]. Furthermore, recent studies show that socioeconomic status affects how dietary variables and neurocognition interact, with the effects of nutrition being more pronounced in people in lower socioeconomic positions 84]. Additionally, poor oral health, mastication issues and loss of sensations are among the conditions that impact elderly adults' dietary habits.

These conditions are obstacles to a varied and healthful diet. Specifically, dementia may cause sensory abnormalities that result in decreased appetite [85]. Additionally, some drugs and medical procedures might exacerbate vitamin deficits, so it's important to pay attention to what they eat. Similar to this, most older persons lose dexterity as they age, which can cause problems in the kitchen and when preparing meals [86].

In patients with dementia and Alzheimer's disease, various factors, including comorbidities, medication regimens and other health-related issues, can significantly influence treatment outcomes [87]. Understanding different factors influences is crucial for optimizing care and improving the quality of life for these patients. Comorbid conditions such as diabetes, cardiovascular disease and depression are frequently associated with Alzheimer's disease. These conditions can exacerbate cognitive decline and complicate the management of dementia. For instance, diabetes has been linked to an increased risk of developing Alzheimer's disease, often referred to as "type 3 diabetes" due to shared pathophysiological mechanisms [88]. Other factors as age and Severity of Dementia and lifestyle factors also can contribute in disease progression and the management outcomes [89].

In summary, the interplay between comorbidities, dietary patterns, medication regimens and other health-

related factors plays a critical role in influencing treatment outcomes for patients with dementia and Alzheimer's disease. A comprehensive approach that considers these factors is essential for optimizing care and improving patient quality of life. Yassine *et al.* [90] discuss the argument over the best cognitive health diet, emphasizing the variety of diets investigated. Their analysis presents the Mediterranean, DASH, MIND and ketogenic diets, each with unique components and differing levels of cognitive benefits evidence. Mediterranean diets, rich in fruits, vegetables, whole grains, nuts and healthy fats, have been linked to reduced cognitive decline due to their anti-inflammatory and antioxidant qualities. The DASH diet, originally designed for hypertension management and the MIND diet, which combines Mediterranean and DASH elements with a focus on brain-beneficial foods, have also shown positive cognitive outcomes and may slow cognitive decline [91]. The ketogenic diet, high in fat and low in carbs, may protect the brain. Yassine *et al.* [90] highlight that while some studies suggest cognitive benefits-particularly from ketones as an alternate brain energy source-long-term adherence and dietary balance remain problems. They also emphasize genetic, metabolic and lifestyle factors' impact on dietary response variability. Variability makes it difficult to generalize findings and emphasizes the need for individualized diets. In addition to food, the authors recommend incorporating physical activity, social involvement and mental stimulation to maintain cognitive performance. They found significant evidence supporting the Mediterranean and MIND diets but noted the need for more research to refine dietary advice and account for individual variability. The topic is multifaceted, emphasizing the need to study cognitive health diets [80].

What sets this review apart is its integrative approach that bridges nutritional science with neuroscience, offering a comprehensive perspective on how specific dietary patterns influence cognitive health in older adults. Unlike previous reviews that focus solely on dietary intake or clinical outcomes, this analysis delves into the underlying biological mechanisms-such as neuroinflammation reduction, neuroplasticity enhancement and gut-brain axis modulation-that explain how diet affects brain function. By synthesizing findings across multiple high-quality studies and dietary patterns, this review provides a clearer understanding of how targeted nutrition can be leveraged as a preventive and therapeutic strategy for age-related cognitive decline.

Doctors can apply the findings of this review by incorporating evidence-based dietary guidance into routine care for older adults at risk of cognitive decline. Recommending brain-healthy eating patterns such as the Mediterranean, DASH, or MIND diets-rich in antioxidants, anti-inflammatory components and neuroprotective nutrients-can serve as effective, non-pharmacological strategies to support cognitive health. Clinicians can personalize these recommendations based on patients' comorbidities, such as suggesting the ketogenic diet for individuals with diabetes or the MIND diet for those with obesity. Additionally, educating patients about the gut-brain axis and encouraging consumption of microbiome-supporting foods may further enhance cognitive outcomes. By integrating dietary counselling with regular cognitive monitoring and complementary lifestyle interventions, healthcare providers can play a pivotal role in preventing memory loss and improving quality of life in the aging population. Additionally, it emphasizes the importance of educating not only patients but also their families and caregivers on brain-healthy eating habits, fostering supportive home environments that promote long-term cognitive well-being.

CONCLUSIONS

One of the most significant modifiable components influencing dementia risk seems to be diet. Geographical locations, plant-based eating patterns and related risk factors all generally exhibit a favorable link with the reduction of dementia incidence. This review highlights that specific dietary pattern—particularly the Mediterranean, DASH, MIND and ketogenic diets—are associated with improved cognitive function and reduced memory decline in older adults. The Mediterranean and DASH diets, rich in antioxidants and anti-inflammatory nutrients, show the strongest evidence for preventing neurodegeneration. The MIND diet, which combines elements of both, demonstrates benefits especially in individuals with obesity, while the ketogenic diet appears effective for older adults with diabetes mellitus. These diets may work by reducing neuroinflammation, enhancing neuroplasticity and supporting gut-brain axis health. Overall, consistent adherence to these nutritional strategies can play a significant role in preserving cognitive health and delaying dementia-related symptoms in the elderly. Recommending brain-healthy eating patterns such as the Mediterranean, DASH, or MIND diets—rich in antioxidants, anti-inflammatory components and neuroprotective nutrients—can serve as effective, non-pharmacological strategies to support cognitive health.

Limitations

Limited research on eating trends and memory loss in the elderly makes it difficult to draw conclusions. Inconsistencies in findings due to study design, sample size and dietary assessment techniques are a serious issue. The diversity of the geriatric population-age, sex, ethnicity and socioeconomic status-complicates diet-cognitive health generalizations.

Another restriction is the prevalence of cross-sectional research, which might identify connections but not causality. The temporal link between nutrition and memory decline is better understood using longitudinal studies, but they are scarce. Many dietary assessment studies use self-reported data, which is prone to recall bias and mistakes. The lack of defined standards for dietary patterns makes categorizing and assessing diets variable and cultural variances in eating habits make it hard to generalize findings uniformly. Many studies' short follow-up periods make it harder to assess food patterns'

long-term impact on cognitive deterioration. While several research show a link between diet and memory loss, few examine the molecular underpinnings, limiting our understanding of how nutrition affects cognitive performance. Future study on nutrition and cognitive health could increase reliability by using standardized dietary measurements, longer follow-up periods and more mechanistic studies.

Recommendation

After reviewing the evidence, it is advisable for healthcare providers to promote dietary patterns among older adults that have robust, long-term evidence indicating cognitive benefits—specifically the Mediterranean, DASH and MIND diets. The diets in question have undergone extensive research and are consistently linked to a decreased risk of cognitive decline, dementia and enhanced brain function over time. Longitudinal studies indicate that consistent adherence to these dietary patterns—characterized by an abundance of fruits, vegetables, whole grains and healthy fats, while minimizing processed foods—can yield enduring positive outcomes for brain health. Future clinical guidelines must emphasize the incorporation of nutrition education into standard care for the elderly, while public health initiatives should adopt family-centered approaches to promote healthy eating habits. It is advisable to conduct additional research with extended follow-up and varied populations to enhance and broaden these findings. Also, the combined effect of healthy diet with exercise is recommended to be tested.

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