Review Article

The Role of Nutrition in Dementia Prevention and Management

Priya Sharma[1], Jafar Karim Mohamad[2]

[1]Department of Neuro-Physiotherapy, College of Physiotherapy, Dayananda Sagar University,[2]3rd Year BPT Student, Jain (Deemed-to-be University), Bengaluru, Karnataka, India

Abstract

Dementia is a progressive neurodegenerative disorder that presents significant challenges to individuals, caregivers, and healthcare systems worldwide. Among various modifiable lifestyle factors, nutrition has emerged as a critical determinant in the prevention and management of cognitive decline. Evidence indicates that malnutrition is prevalent among older adults with dementia, with reported rates ranging from 6.8% to 75.6% in long-term care settings. Malnutrition contributes to oxidative stress, neuroinflammation, and the accumulation of pathological proteins such as amyloid-beta and tau – key features of Alzheimer's disease pathology. Literature search was done across multiple databases, identified articles on the nutrition impact on dementia, cognitive decline, and Alzheimer's, using specific keywords and criteria. It examines the pathophysiological links between nutrition and neurodegeneration, the cognitive consequences of nutrient deficiencies, and the role of specific dietary patterns and supplements in maintaining brain health. Diets such as the Mediterranean and Mediterranean-DASH Diet Intervention for Neurodegenerative Delay diets have been associated with improved cognitive outcomes and a reduced risk of dementia. Key nutrients – including omega-3 fatty acids, B Vitamins, and Vitamin D – are shown to support neuronal function, reduce inflammation, and lower vascular risk factors. Despite promising findings, inconsistencies in study outcomes highlight the need for personalized nutrition strategies that account for individual metabolic profiles, comorbidities, and genetic predispositions. Further large-scale, longitudinal studies are needed to establish standardized dietary guidelines for dementia prevention. Overall, the review underscores the pivotal role of early nutritional assessment and intervention in enhancing cognitive health and quality of life for individuals at risk of or living with dementia.

Keywords: Alzheimer's disease,Cognitive decline, Dementia, Dietary interventions Nutrition, Malnutrition, Mediterranean diet, Mediterranean-DASH Diet Intervention for Neurodegenerative Delay diet

Address for correspondence: Dr. Priya Sharma, College of Physiotherapy, Dayananda Sagar University, Main Campus, Devarakaggalahalli, Harohalli Kanakapura Road, Ramanagara - 562 112, Karnataka, India.
E-mail: priyasharma782@yahoo.com

INTRODUCTION

Dementia is a progressive neurodegenerative disorder characterized by the decline of cognitive functions, including memory, reasoning, and communication abilities. As the global population ages, the prevalence of dementia continues to rise, posing significant challenges to healthcare systems and caregivers alike. According to The Lancet Healthy Longevity,[1] dementia is increasingly recognized as a multifactorial disease influenced not only by genetic

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and environmental factors but also by lifestyle choices, particularly nutrition.

Poor nutritional status, including malnutrition, may accelerate the onset and progression of dementia. Malnutrition is particularly common among older adults with cognitive impairment, with prevalence ranging from 6.8% to 75.6% in long-term care settings.[2] The mechanisms through which malnutrition influences cognitive decline include increased oxidative stress, neuroinflammation, and the exacerbation of amyloid-beta (Aβ) and tau protein accumulation, all of which are key pathological features of Alzheimer's disease (AD).

Furthermore, studies such as those published in The Journal of Nutrition, Health and Aging[3] emphasize the importance of early nutritional assessment and intervention to prevent further cognitive and functional decline. Research from BMC Geriatrics[4] highlights the bidirectional relationship between nutritional status and cognitive health, where poor diet exacerbates cognitive impairment, and dementia symptoms often lead to reduced food intake and poor nutritional choices.

The link between diet and cognitive health is further supported by dietary patterns like the Mediterranean and Mediterranean-DASH Diet Intervention for Neurodegenerative Delay (MIND) diets, which have been associated with a reduced risk of dementia and improved cognitive outcomes.[5] Nutrient-rich diets focused on high intake of fruits, vegetables, whole grains, and healthy fats have shown protective effects against neurodegenerative processes. These findings underscore the need for a holistic approach to dementia care, where nutritional interventions play a pivotal role in prevention and management.

Given the growing body of evidence, this review explores the intricate relationship between nutrition and dementia, focusing on how malnutrition increases the risk of cognitive decline and the progression of dementia. By synthesizing findings from multiple studies, including clinical trials and systematic reviews, this paper aims to highlight the importance of nutritional interventions in dementia care and prevention.

METHODOLOGY

A comprehensive literature search was conducted across multiple electronic databases, including PubMed, Google Scholar, Scopus, and Web of Science, to identify relevant articles published in 2006–2024 concerning the relationship between nutrition and dementia, cognitive decline, and AD. The search used a combination of keywords and MeSH terms such as "dementia," "cognitive decline," "Alzheimer's disease," "nutrition," "dietary interventions," "malnutrition," as well as specific dietary patterns like the "Mediterranean diet" and "MIND diet." To enhance the scope and accuracy of retrieval, Boolean operators (AND, OR) were employed, and search strings were iteratively refined. Articles were selected based on the following inclusion criteria: (i) original research articles, systematic reviews, and clinical or cohort studies focusing on human subjects; (ii) studies addressing nutritional factors, dietary interventions, and their effects on cognitive outcomes or risk of dementia; and (iii) publications in the English language. The article selection process involved two stages: Initial screening of titles and abstracts for relevance, followed by a full-text review to confirm eligibility.

The pathophysiological link between dementia and nutrition

Dementia encompasses a group of neurodegenerative disorders, including AD, vascular dementia, and Lewy body dementia, characterized by progressive cognitive decline and loss of functional independence. The central pathological hallmarks of dementia include the accumulation of Aβ plaques, tau protein tangles, and progressive synaptic dysfunction. Malnutrition accelerates these changes through several interconnected mechanisms. Inadequate intake of antioxidants such as Vitamins C and E heightens oxidative stress, which destabilizes neuronal membranes and promotes Aβ aggregation. Deficiencies in B Vitamins (B6, B12, and folate) elevate homocysteine levels, leading to excitotoxicity, vascular injury, and increased phosphorylation of tau proteins, thereby favoring tangle formation. Insufficient omega-3 fatty acids impair membrane fluidity, disrupt neurotransmitter signaling, and weaken synaptic plasticity, all of which make neurons more vulnerable to degeneration. Protein-energy malnutrition further exacerbates neuroinflammation by reducing the availability of amino acids required for neurotransmitter synthesis and repair processes. Collectively, these nutritional deficits amplify oxidative stress and chronic inflammation, driving protein misfolding, synaptic loss, and the progressive cognitive decline characteristic of dementia, all of which contribute to neuroinflammation and oxidative stress. Nutritional deficiencies can exacerbate these processes, making adequate nutrition essential for brain health.[6]

Oxidative stress is a key driver of neuronal damage in dementia. Poor dietary intake of antioxidants, such as Vitamins E and C, can contribute to increased free radical production and lipid peroxidation, damaging cell membranes and impairing neuronal function.[7] Similarly,

deficiencies in B Vitamins, particularly B6, B12, and folate, lead to elevated homocysteine levels, a known risk factor for cognitive decline and cerebrovascular damage.[8]

Neuroinflammation, another crucial factor in dementia pathogenesis, is closely linked to dietary patterns. Diets high in processed foods and saturated fats promote systemic inflammation, increasing the production of pro-inflammatory cytokines like interleukin-6 and tumor necrosis factor-alpha, which disrupt the blood-brain barrier and exacerbate neurodegenerative processes.[9] Conversely, anti-inflammatory nutrients such as omega-3 fatty acids, found in fish and nuts, have demonstrated neuroprotective effects by reducing inflammation and supporting synaptic plasticity.[10]

Cognitive effects of malnutrition in dementia

Malnutrition, defined as an imbalance of nutrient intake relative to the body's needs, is particularly prevalent among individuals with dementia due to factors such as reduced appetite, difficulty swallowing, and behavioral changes affecting eating patterns. A systematic review reported malnutrition rates ranging from 6.8% to 75.6% in dementia patients residing in long-term care settings.[11]

The consequences of malnutrition on cognitive function are profound. Insufficient intake of essential nutrients such as iron, zinc, and magnesium impairs neurotransmitter synthesis and energy metabolism, leading to cognitive dysfunction and increased neuropsychiatric symptoms.[12] Protein-energy malnutrition, characterized by inadequate protein and caloric intake, has been associated with muscle wasting, frailty, and increased risk of hospitalization and mortality among dementia patients.[13]

Nutritional strategies for preventing and managing dementia

Emerging evidence supports the role of specific dietary patterns and nutrient supplementation in reducing dementia risk and slowing disease progression. The Mediterranean and MIND diets have gained attention for their protective effects on cognitive health. Both diets emphasize high consumption of fruits, vegetables, whole grains, lean proteins, and healthy fats, providing a rich source of antioxidants, anti-inflammatory compounds, and essential Vitamins and minerals.[14]

Clinical trials have demonstrated that adherence to the Mediterranean diet is associated with a lower incidence of AD and improved cognitive performance in older adults. The MIND diet, designed specifically to support brain health, has shown similar benefits, with studies indicating a 53% reduction in Alzheimer's risk among participants with high adherence.[15]

Nutrient supplementation also plays a crucial role in dementia management. Omega-3 fatty acids, particularly docosahexaenoic acid, support neuronal membrane integrity and reduce neuroinflammation, while B Vitamins lower homocysteine levels, mitigating vascular damage and cognitive decline.[16] Vitamin D supplementation has been linked to improved cognitive function, potentially through its role in calcium homeostasis and neuroprotection.[17]

Challenges and future directions

Despite the growing body of evidence linking nutrition to cognitive health, several challenges remain in implementing effective dietary interventions for dementia prevention and management. Variability in dietary assessment methods, differences in study populations, and the complex interplay of genetic and environmental factors contribute to inconsistent findings across studies.[18]

Future research should prioritize large-scale, long-term clinical trials with standardized dietary protocols and comprehensive cognitive assessments to establish clear dietary guidelines for dementia prevention. Personalized nutrition approaches, considering individual genetic profiles, metabolic health, and lifestyle factors, hold promise for optimizing intervention outcomes.[19]

CONCLUSION

The relationship between nutrition and dementia is well-established, with mounting evidence indicating that malnutrition accelerates cognitive decline and exacerbates neurodegenerative processes. Nutritional interventions, including adherence to the Mediterranean and MIND diets and targeted nutrient supplementation, offer promising strategies for dementia prevention and management. Early nutritional assessment and individualized dietary planning are essential to improving quality of life and cognitive outcomes for individuals at risk of or living with dementia.

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Conflicts of interest

There are no conflicts of interest.

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