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Best Evidence Summary Postprint: Dietary Nutrition Management for Brain Health in Community Residents

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Abstract

Background Maintaining brain health is a higher-order goal in the pursuit of healthy aging, and proper nutrition is considered one of the promising approaches to reduce dementia risk. However, current clinical practice lacks targeted measures and strategies for nutritional management to promote brain health, leading to inadequate or insufficient relevant health guidance. Objective To retrieve, evaluate, and summarize evidence related to dietary and nutritional management for promoting brain health, and to provide a basis for clinical implementation of brain health dietary and nutritional management. Methods A computerized search was conducted on databases and websites including UpToDate, BMJ Best Practice, Joanna Briggs Institute (JBI) Evidence-Based Health Care Center Database, National Institute on Aging (NIA), Registered Nurses' Association of Ontario (RNAO), Cochrane Library, PubMed, CNKI, and Medlive for literature related to dietary and nutritional management for promoting brain health, including clinical decisions, recommended practices, guidelines, evidence summaries, expert consensus, and systematic reviews. The search period was from January 1, 2017 to March 29, 2022. Two researchers trained in evidence-based medicine conducted quality assessment and evidence grading of the included literature. Results A total of 28 documents were included, comprising 3 guidelines, 5 expert consensus, 1 clinical decision, and 19 systematic reviews; the overall quality of the included literature was high. A total of 23 best evidence items were summarized across seven aspects: intervention timing, dietary and nutritional assessment and screening, dietary patterns and components, specific nutrients, coffee intake, weight management, and health education and guidance. Conclusion Dietary nutrition promotes brain health. Community healthcare providers should select the best evidence based on clinical context, residents' current dietary and nutritional status, and preferences

to formulate individualized brain health dietary and nutritional management plans.

Full Text

Preamble

Summary of Best Evidence for Dietary Nutrition Management to Promote Brain Health in Community Residents

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Abstract

Background: Maintaining brain health is an advanced goal of healthy aging. Nutrition has been identified as a promising approach to reduce the risk of dementia, but there is currently a lack of targeted nutritional management to promote brain health in clinical practice, resulting in lack or inadequate health guidance.

Objective: To search and evaluate studies about dietary nutrition management to promote brain health, and to provide evidence-based basis for clinical development of dietary nutrition management of brain health.

Methods: We searched UpToDate, BMJ Best Practice, JBI Library, NIA, RNAO, Cochrane Library, PubMed, CNKI, Medlive and other databases to collect clinical decisions, best practices, guidelines, evidence summaries, expert consensus and systematic reviews regarding dietary nutrition management to promote brain health from January 1, 2017 to March 29, 2022. The quality and evidence level of the literature were assessed by two researchers systematically trained on evidence-based medicine.

Results: A total of 28 articles were included, including 3 clinical guidelines, 5 expert consensus, 1 clinical decision and 19 systematic reviews. Their methodological qualities were rated high overall. Finally 23 pieces of best evidence involving 7 aspects were intervention timing, dietary nutrition assessment and screening, dietary patterns and components, specific nutrients, coffee intake, weight management, health education and guidance.

Conclusion: Dietary nutrition can promote brain health. Community medical staff should choose and apply the best evidence based on clinical situation, residents'dietary nutrition status and preferences, so as to develop individualized dietary nutrition program for brain health.

Keywords: Brain health; Dementia; Dietary nutrition; Community; Evidence summaries; Evidence-based medicine

Introduction

Healthy aging is an important strategic response to population aging, with maintaining brain health as its advanced goal [1]. Brain health refers to maintaining optimal brain integrity, mental and cognitive function at a specific age, without overt brain diseases affecting normal brain function [2]. As the population aging process accelerates, the burden of age-related neurodegenerative diseases and the challenge of maintaining brain health have increased dramatically. In 2018, approximately 50 million people worldwide were living with dementia [3], and China has the largest number of dementia patients, accounting for about 25% of total cases [4]. The prevention and treatment of dementia has been listed as a global public health priority [5]. Given the current lack of effective treatments, urgent action is needed to prevent or delay the onset and progression of dementia [6], and brain health should be considered a top priority in global health policy [7]. Research shows that dementia is associated with several modifiable risk factors such as cardiovascular, lifestyle, and psychosocial factors [8]. Approximately 40% of dementia worldwide can be attributed to 12 modifiable risk factors including unhealthy diet, insufficient physical activity, and smoking [9]. An increasing number of studies have demonstrated the beneficial effects of nutrition on cognitive function, and proper nutrition has been recognized as a promising approach to reduce dementia risk [10, 11], receiving strong recommendation in the 2019 World Health Organization (WHO) Guidelines for Risk Reduction of Cognitive Decline and Dementia [12]. However, the role of dietary nutrition in promoting brain health has not received adequate attention in current clinical practice. Nutritional management for dementia prevention adopts generic management protocols for hypertension and diabetes, lacking specificity for promoting brain health. This results in community medical staff being unable to provide specific, scientific guidance and management for community residents. Therefore, this study summarizes high-quality evidence on dietary nutrition management to promote brain health based on evidence-based methods, aiming to provide reference for community medical staff in implementing brain health dietary nutrition management.

1. Materials and Methods

1.1 Evidence Selection Criteria

Using the PICO framework, we defined the following criteria: P (Population): Adults aged $ $18 years with normal cognitive health (no diagnosed cognitive impairment or dementia) at baseline, without other neuropsychiatric diseases (such as stroke, depression, etc.). For studies with mixed healthy and non-healthy cognition (such as mild cognitive impairment), results for the cognitively healthy population must be reported separately. I (Intervention): Dietary nutrition intervention or management; P (Professional): Community medical staff; O (Outcome): At least one outcome measure being cognitive function assessment or incidence of dementia or Alzheimer' s disease; S (Setting): Community health service institutions; T (Type of evidence): Clinical decisions, recommended practices, guidelines, evidence summaries, expert consensus, systematic reviews.

1.2 Search Strategy

Using "cognition/cognitive function/cognitive dysfunction/cognitive decline/cognitive impairment/dementia/*alzheimer disease*/brain health" and "nutritional support/dietary supplement/*diet therapy/food supplement*/dietary intervention/diet/*diet* pattern/food*/nutrition" as English keywords, and "认知/认知功能/认知衰退/认知障碍/认知下降/痴呆/阿尔茨海默病/脑健康" and "营养/营养支持/膳食/饮食/食物/饮食管理/饮食干预/饮食模式" as Chinese keywords, we searched UpToDate, BMJ Best Practice, Joanna Briggs Institute (JBI) Evidence-Based Healthcare Database, National Institute on Aging (NIA), Registered Nurses' Association of Ontario (RNAO), New Zealand Guidelines Group (NZGG), Scottish Intercollegiate Guidelines Network (SIGN), Centers for Disease Control and Prevention (CDC), National Institute for Health and Care Excellence (NICE), Cochrane Library, Web of Science, PubMed, Embase, Medlive, CNKI, Chinese Biomedical Database, Wanfang Database, WHO official website, and Alzheimer' s Disease International (ADI) website, referencing the 6S evidence model [14]. The search period was from January 1, 2017 to March 29, 2022.

1.3 Inclusion and Exclusion Criteria

Inclusion criteria: (1) Study population: Adults aged $ $18 years with normal cognitive health (no diagnosed cognitive impairment or dementia) at baseline, without other neuropsychiatric diseases (such as stroke, depression, etc.). For studies with mixed healthy and non-healthy cognition (such as mild cognitive impairment), results for the cognitively healthy population must be reported separately. (2) Study content: Evidence on dietary nutrition intervention or management. (3) Outcome measures: At least one outcome being cognitive function assessment or incidence of dementia or Alzheimer' s disease. (4) Study types: Clinical decisions, recommended practices, guidelines, evidence summaries, expert consensus, systematic reviews. (5) Publication language: Chinese or English.

Exclusion criteria: (1) Study populations from special clinical settings, such

as hospitalized patients, military personnel, etc. (2) Literature for which full text could not be obtained. (3) Protocols, conference abstracts, or guideline interpretation literature. (4) Literature that failed quality assessment.

1.4 Quality Assessment Criteria

(1) Guidelines were assessed using the Appraisal of Guidelines for Research and Evaluation II (AGREE II) [15]. (2) Systematic reviews were assessed using AMSTAR 2 [16], which includes 16 items. (3) Expert consensus statements were evaluated using the JBI Evidence-Based Healthcare Center Expert Consensus Appraisal Standard (2016 version) [17], which includes 6 items. (4) For clinical decisions, recommended practices, and evidence summaries, quality assessment was traced back to the original literature and evaluated according to document type.

1.5 Quality Assessment Process

Two researchers trained in evidence-based medicine independently conducted quality assessments according to the standards. When disagreements arose, an experienced researcher made the final determination.

1.6 Evidence Synthesis and Grading

We read each included article thoroughly, extracted evidence based on PICO (Population, Intervention, Comparison, and Outcome) [13], and synthesized it by theme. The JBI Evidence Pre-grading System [18] was used to grade evidence into levels 1-5. When evidence conclusions conflicted, priority was given to higher-level evidence, higher-quality literature, and more recent publications. Recommendation grades were determined based on the FAME structure (Feasibility, Appropriateness, Clinical meaningfulness, and Effectiveness), classified as Grade A or Grade B recommendations.

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2. Results

2.1 Basic Characteristics of Included Literature

The initial search retrieved 4,632 articles, with 28 articles ultimately included, comprising 3 guidelines [12, 19, 20], 5 expert consensus statements [9, 21-24], 1 clinical decision [25], and 19 systematic reviews [26-44]. See Table 1 .

Table 1 General characteristics of the included literature

2.2 Quality Evaluation

2.2.1 Quality Evaluation of Guidelines This study included 3 guidelines [12, 19, 20]. The quality evaluation results are shown in Table 2 .

Table 2 Quality evaluation of included guidelines

2.2.3 Quality Evaluation of Clinical Decisions This study included 1 clinical decision [25] from UpToDate, from which 1 piece of evidence was extracted, originating from 1 practice guideline [45]. The quality assessment was Grade A, with AGREE II scores in the 6 domains of 91.7%, 83.3%, 86.5%, 94.4%, 64.6%, and 79.2%, respectively.

2.2.4 Quality Evaluation of Systematic Reviews This study included 19 systematic reviews [26-44]. The quality evaluation results are shown in Table 3 .

Table 3 Quality evaluation of included systematic reviews

Note: Whether the research question and inclusion criteria include PICO; Whether the study protocol was predetermined and registered; Whether types of included studies were specified; Whether the search strategy was comprehensive; Whether literature screening was reproducible; Whether data extraction was reproducible; Whether a list of excluded literature with reasons was provided; Whether characteristics of included studies were described; Whether appropriate tools were used to assess risk of bias in included studies; Whether funding sources of included studies were reported; Whether statistical methods for meta-analysis were appropriate; Whether the impact of bias risk on results was assessed in meta-analysis; Whether bias risk was considered in discussion of results; Whether heterogeneity of results was explained; Whether publication bias was discussed; Whether any funding and potential conflicts of interest were reported.

Y = Yes; N = No; PY = Partial Yes; X = No meta-analysis conducted.

2.3 Evidence Synthesis

Through evidence synthesis and analysis of included literature, we extracted 23 pieces of best evidence across 7 main aspects: intervention timing, dietary nutrition assessment and screening, dietary patterns and components, specific nutrients, coffee intake, weight management, and health education and guidance. See Table 4 .

Table 4 Evidence summary of dietary nutrition management in communities to promote brain health

1. Early identification and intervention of AD-related risk factors such as unhealthy diet, obesity, and hyperhomocysteinemia [19, 20, 24].
2. Healthcare professionals should assess dietary patterns and habits of residents aged 45 and above at least annually [23].
3. Regular blood tests are recommended to check homocysteine levels. Patients with hyperhomocysteinemia should receive vitamin B and/or folic acid treatment, with attention to their cognitive function [22, 42, 43].
4. Screening for vitamin B12 deficiency and hypothyroidism is recommended for residents undergoing dementia evaluation [25].

5. Routine nutrition risk screening is recommended for adults aged $ $65 years and those visiting cognitive impairment clinics. Screening tools include: MNA-SF, NRS-2002 [24].
6. For populations at high malnutrition risk, comprehensive nutrition assessment should be completed, including medical history, anthropometry, laboratory tests, and functional status, to identify causes of malnutrition; make diagnosis and classification of malnutrition and develop nutrition treatment plans [24].
7. A healthy, balanced dietary pattern is recommended, following the principle of "grains as nourishment, livestock as benefit, vegetables as supplement, fruits as assistance" to advocate dietary diversity [12, 19, 24, 38].
8. High adherence to MeDi or MIND is recommended, which helps reduce dementia risk and delay cognitive decline [9, 12, 19, 21, 24, 29, 31, 40].
9. Increase intake of legumes, high-fiber nuts, whole grains, and non-red meat such as chicken rich in monounsaturated and polyunsaturated fatty acids (MUFA and PUFA), and reduce intake of high-fat dairy products rich in saturated fatty acids (SFA) (such as butter, cheese), red meat, fried foods, and processed foods to reduce cognitive decline risk [21, 23, 34].
10. Increase fruit and vegetable intake. Each 100g increase in daily fruit and vegetable intake can reduce cognitive impairment and dementia risk by approximately 13% [21, 23, 26, 30].
11. Consume 2 servings of fish (250g) weekly to reduce all-cause dementia and AD risk [32, 39].
12. Polyphenol-rich supplements have potential benefits for cognitive function, but at least moderate doses ($ $500 mg) of polyphenols with moderate bioavailability (9%) to high bioavailability (43%) (such as isoflavones, gallic acid, catechins, and flavanones) are required to be effective [35].
13. Folic acid deficiency (<13.5 nmol/L) increases AD and cognitive decline risk. Adequate dietary folic acid ($ $400 g/day) is beneficial for cognition [41].
14. Dietary vitamin C or supplementation has small positive effects on cognition [33, 43].
15. Low vitamin D levels are associated with poorer cognitive function [27].
16. Eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) from fish have positive effects on executive function but not on overall cognitive performance [39].
17. Nutrient deficiency may be associated with AD cognitive function changes, but individual supplementation or restriction of specific nutrients and their compounds is not recommended to improve cognitive function or prevent AD development [9, 12, 19, 24].
18. Coffee intake shows a "J-shaped" relationship with cognitive impairment risk, with the lowest risk at 1-2 cups per day [28].
19. Adults under 65 should maintain or reduce weight through calorie restriction and appropriate exercise to maintain BMI between 18.5-24.9 kg/m^2. Adults over 65 should not be too thin [43].
20. Cognitive status of adults over 65 with weight loss trends should be closely

monitored [43].
21. Healthcare professionals should provide education and guidance on MIND, DASH, and MeDi dietary patterns for residents [23].
22. For residents with unhealthy dietary status, healthcare professionals should provide health guidance on the importance of healthy diet for brain health, propose acceptable brain health-related dietary nutrition interventions during each annual visit, and promote healthy dietary habits through shared decision-making [23].
23. Identify potential motivations and barriers to residents' dietary patterns [23].

Note: AD = Alzheimer' s disease; MNA-SF = Mini Nutritional Assessment-Short Form; NRS-2002 = Nutritional Risk Screening 2002; MeDi = Mediterranean diet; MIND = Mediterranean-DASH Intervention for Neurodegenerative Delay; DASH = Dietary Approaches to Stop Hypertension.

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3. Discussion

3.1 Intervention Timing

There is a preclinical stage of Alzheimer' s disease (AD) that exists for several years or even 20 years before clinical symptoms appear, known as preclinical AD [46]. Although there are no obvious cognitive symptoms, this provides an important window of opportunity for preventive intervention [47]. Research shows that unhealthy diet, obesity, and hyperhomocysteinemia are important risk factors for AD, and early identification and active intervention can help reduce or delay AD onset [24, 43].

3.2 Dietary Nutrition Assessment and Screening

The life-course model of dementia risk proposed by The Lancet Commission on Dementia Prevention, Intervention, and Care [9] indicates that some risk factors begin to accumulate from midlife. Expert consensus [23] recommends assessing and intervening on dietary patterns in individuals aged 45 and above, which can be completed through several simple questions such as daily intake of fruits, vegetables, and meats. Dietary pattern assessment is the foundation of health management to identify priority populations and provide basis for developing individualized dietary nutrition management plans. Research shows that elevated homocysteine, vitamin B12 deficiency, and hypothyroidism are common in older adults [22, 43, 45] and increase dementia risk; therefore, early screening and timely correction are necessary. Additionally, older populations generally face "nutritional frailty" risk. Consensus recommends nutrition risk screening for adults over 65, with recommended screening tools including MNA and MNA-SF, followed by further nutrition assessment and treatment for high-risk populations identified through screening [24].

3.3 Dietary Patterns and Components

Due to complex interactions between nutrients and foods, overall dietary patterns provide better understanding of diet' s impact on cognitive impairment [11]. MeDi is a well-studied dietary pattern characterized by high intake of vegetables, fruits, legumes, nuts, grains, and olive oil; moderate intake of fish, dairy products, and red wine; and low intake of saturated fats and meats [29]. DASH also emphasizes high intake of plant-based foods and additionally restricts SFA, total fat, cholesterol, and sodium intake [24]. MIND is a novel dietary pattern designed to promote brain health, combining MeDi and DASH, emphasizing increased intake of plant-based foods, particularly berries and leafy green vegetables, and limiting animal-based foods and high saturated fat foods [48]. Although there are some differences between dietary patterns, notably all emphasize high intake of fruits, vegetables, and whole grains, restrict saturated fats, processed foods, and sugars, and advocate dietary diversity. Research shows that higher adherence to MeDi, DASH, and MIND is associated with lower cognitive decline and AD risk, with MIND showing more prominent protective effects for brain health [40, 48]. Currently, MeDi and MIND have been recommended by multiple guidelines and consensus statements [12, 19, 21, 24]. However, it is important to manage based on dietary assessment results and personal dietary patterns to enhance adherence to healthy dietary patterns and maximize brain health benefits.

3.4 Specific Nutrients

Polyphenols are widely present in fruits, vegetables, tea, and red wine. In addition to strong antioxidant activity, recent studies suggest polyphenols may also be associated with regulating neuroinflammation, improving cerebral blood perfusion, and enhancing cognitive function [10, 49]. Meta-analysis [35] shows that dosage and bioavailability are important factors affecting polyphenol supplement efficacy. Only polyphenols reaching effective thresholds can cross the blood-brain barrier to induce neuroprotective responses and improve brain function. Deficiency of some vitamins (such as folic acid, vitamins C and D) may increase cognitive decline and AD risk. However, results have methodological limitations regarding study populations, vitamin doses, and intervention duration. Guidelines and consensus statements do not recommend individual supplementation or restriction of specific nutrients to improve cognitive function or prevent AD development [9, 12, 19, 24]. Additionally, evidence suggests that to maximize nutrient benefits for brain health, the most appropriate approach is consuming a diversified, multi-nutrient diet [50].

3.5 Coffee Intake

Some studies suggest that moderate coffee intake should be part of a healthy diet [51], and coffee' s impact on brain health has received widespread attention. A meta-analysis shows a "J-shaped" relationship between coffee intake and cognitive impairment risk, with the lowest incidence of cognitive impair-

ment at 1-2 cups per day, while excessive coffee intake ($ $3 cups) has no significant effect on cognitive impairment incidence [28]. Moderate coffee intake may reduce pathological brain amyloid deposition [52] and exert antioxidant and anti-inflammatory effects on gastrointestinal mucosa, thereby reducing AD and cognitive decline risk through the gut-brain axis [53]. However, excessive caffeine can impair memory function in rodents [54]. Therefore, to promote brain health, moderate daily coffee intake may be considered.

3.6 Weight Management

Numerous studies have confirmed that midlife obesity (BMI $ $30kg/m^{2}$) increases dementia risk in later life [9, 12, 43]. However, the relationship between BMI and dementia is not linear [19]. A systematic review showed that BMI begins to decline approximately 10 years before dementia diagnosis [55]. Unexplained short-term weight loss in older adults is considered a manifestation of preclinical AD [24], and increased BMI in later life may be a protective factor for AD [43]. Therefore, community medical staff should strengthen weight management while providing dietary nutrition guidance and closely monitor cognitive status in older adults with significant short-term weight loss.

3.7 Health Education and Guidance

Community medical staff are in a strategic position to identify and manage risk factors for cognitive decline, making health education and guidance for residents crucial. Previous studies show that only 14.10% of residents obtain dementia prevention knowledge through medical staff [56], indicating a serious deficiency in health education among community medical staff. Additionally, behavior change is not easy for people, and many barriers exist in translating theoretical guidance into real-world practice [57]. Dementia prevention knowledge and health beliefs are important factors affecting health behaviors. Therefore, in addition to providing health education, community medical staff should identify potential motivations and barriers to dietary nutrition behaviors, engage in shared decision-making with residents [23], and integrate healthy diets into daily life.

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4. Conclusion

This study summarizes the best evidence for dietary nutrition management to promote brain health, covering 7 aspects: intervention timing, dietary nutrition assessment and screening, dietary patterns and components, specific nutrients, coffee intake, weight management, and health education and guidance, providing evidence-based guidance for community brain health dietary nutrition management. Although considerable research exists on proper dietary nutrition to promote brain health, most evidence originates from foreign countries. Given significant differences in racial genetic characteristics and dietary habits

between Eastern and Western populations, evidence translation into practice should be combined with clinical context and consider community residents' current dietary nutrition status and personal preferences to ensure effectiveness and compliance of dietary nutrition management for maintaining or improving brain health. Future research should investigate local healthy dietary patterns in China, such as the Jiangnan diet, and explore how to implement evidence within China' s healthcare system context to develop brain health dietary nutrition management programs suitable for Chinese population lifestyle habits.

Author Contributions

Xiao Liu, Jinying Zhang, and Yan Peng were responsible for topic selection and design; Xiao Liu and Jinying Zhang conducted literature retrieval; Xiao Liu and Yan Peng performed literature quality assessment; Xiao Liu, Jinying Zhang, Yan Peng, and Li Wang synthesized evidence; Xiao Liu drafted the manuscript; Xiaomei Chen, Jia Liu, and Menghui Deng revised the paper; Yanni Yang was responsible for quality control and final approval, overall responsibility for the article, and supervision.

Conflict of Interest

The authors declare no conflict of interest.

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