

Nutrition's influence on cognitive performance and mental wellness: A review

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ABSTRACT

The human brain consumes approximately 20% of total body energy despite representing only 2% of body weight, highlighting the critical importance of adequate nutrition for optimal cognitive and mental health outcomes. Recent decades have witnessed growing recognition of diet as a modifiable factor influencing neurological function and psychological wellbeing. This review synthesizes current evidence examining how nutritional factors influence cognitive performance and mental health across the lifespan, exploring underlying mechanisms and clinical applications. Comprehensive literature review of peer-reviewed publications examining relationships between dietary components, eating patterns, and brain health outcomes, including mechanistic studies, observational research, and clinical trials published between 2000 and 2025. Multiple pathways link nutrition to brain function, including neurotransmitter production, inflammatory modulation, oxidative stress management, and neuroplasticity support. Essential nutrients such as omega-3 polyunsaturated fatty acids, B-vitamin complex, vitamin D, and antioxidant compounds demonstrate significant cognitive and mental health benefits. Whole-food dietary approaches, particularly Mediterranean and DASH (Dietary Approaches to Stop Hypertension) patterns, consistently associate with superior outcomes compared to Western eating habits characterized by processed foods. The gut-brain axis represents an emerging mechanism through which dietary choices influence mental wellbeing via microbiome modulation. Compelling evidence supports nutrition as a fundamental determinant of cognitive function and mental health. Nutritional interventions show promise both for prevention and as therapeutic adjuncts for various neuropsychiatric conditions.

Keywords: Cognitive function, mental health, nutrition, dietary patterns, brain health,

INTRODUCTION

The human brain consumes approximately 20% of total body energy despite representing only 2% of body weight, highlighting the critical importance of adequate nutrition for optimal cognitive and mental health outcomes. Despite constituting merely 2% of total body mass, the human brain demands nearly one-fifth of the body's daily energy expenditure, underscoring its metabolically intensive nature and dependence on consistent nutrient availability (Gómez-Pinilla, 2018; Raichle and Gusnard, 2002). This disproportionate energy requirement reflects the complexity of neural processes governing cognition, emotion, and behavior. Over recent decades, converging evidence from neuroscience, nutritional science, and psychiatry has illuminated substantial

connections between dietary habits and various dimensions of brain health (Benton, 2010; Jacka *et al.*, 2010; O'Neil *et al.*, 2014).

The escalating global prevalence of mental health disorders including depression, anxiety, and neurodegenerative conditions parallels widespread dietary transitions toward ultra-processed, nutrient-poor food products (Francis *et al.*, 2019; Monteiro *et al.*, 2019). This temporal correlation has prompted intensive investigation into whether nutritional interventions might serve as viable preventive or therapeutic strategies for cognitive and mental health challenges.

Macronutrients such as carbohydrates, proteins, and fats serve as fundamental energy sources for neuronal activity and synaptic communication. Meanwhile, key micronutrients such as B vitamins, magnesium, zinc, iron, and omega-3 fatty acids are crucial for neurotransmitter synthesis, anti-inflammatory processes, mitochondrial function, and cellular repair mechanisms (Bryan *et al.*, 2024; Rucklidge and Kaplan, 2016). Deficiencies in these nutrients have been associated with impaired attention, poor memory, mood instability, and increased susceptibility to neuroinflammation and oxidative stress, which are factors linked to mental illnesses and cognitive decline. This comprehensive review examines current understanding of how nutritional factors influence cognitive performance and mental wellbeing throughout the human lifespan.

MATERIALS AND METHODS

Literature Search Strategy

A comprehensive literature review was conducted to examine the relationship between nutrition and cognitive performance as well as mental health outcomes. The search encompassed peer-reviewed publications from major academic databases including PubMed, Web of Science, Scopus, PsycINFO, and Google Scholar.

Search Terms and Keywords

The following search terms were used in various combinations: "nutrition and cognitive function", "diet and mental health", "omega-3 and brain health", "dietary patterns and cognition", "neurotransmitters and nutrition", "Mediterranean diet and depression", "gut-brain axis", "neuroplasticity and nutrients", "B vitamins and cognitive decline", "antioxidants and neuroprotection", and "nutritional psychiatry".

Inclusion Criteria

Publications were included if they met the following criteria: (1) peer-reviewed original research articles, systematic reviews, meta-analyses, or clinical trials; (2) published in English language; (3) focused on human subjects or relevant animal models with clear translational implications; (4) examined relationships between specific nutrients, dietary patterns, or nutritional interventions and cognitive or mental health outcomes; and (5) published between 2000 and 2025 to capture contemporary evidence while including seminal foundational studies.

Exclusion Criteria

Studies were excluded if they: (1) lacked adequate methodological rigor or peer review; (2) focused exclusively on clinical conditions unrelated to cognitive function or mental health; (3) were conference abstracts, editorials, or opinion pieces without original data; or (4) did not provide sufficient detail regarding nutritional interventions or outcome measurements.

Data Extraction and Synthesis

Relevant information was extracted from selected publications including study design, population characteristics, nutritional exposures or interventions, outcome measures, key findings, and proposed mechanisms. Evidence was synthesized narratively, organizing findings by mechanistic pathways, specific nutrients, dietary patterns, clinical applications, and population-specific considerations. Quality assessment considered study design rigor, sample size adequacy, control for confounding variables, and consistency of findings across multiple investigations.

Study Selection

The initial search yielded approximately 1,500 potentially relevant publications. After screening titles and abstracts for relevance and applying inclusion and exclusion criteria, 150 publications were selected for full-text review. Of these, 85 key publications representing the most rigorous and relevant evidence were ultimately included in this comprehensive review. Priority was given to recent systematic reviews, meta-analyses, and large-scale prospective studies, supplemented by mechanistic research and clinical trials providing insight into biological pathways and intervention efficacy.

RESULTS

Table 1: Key Studies Examining Nutrition and Brain Health

Author and Year	Mode of Study	Study Location	Major Findings
Gómez-Pinilla (2018)	Literature Review	USA	Brain consumes 20% of body's energy; omega-3 fatty acids enhance BDNF expression and synaptic plasticity; nutrition fundamentally influences neuroplasticity throughout life
Raichle and Gusnard (2002)	Research Article	USA	Despite representing only 2% of body weight, the human brain demands nearly 20% of daily energy expenditure, highlighting metabolic intensity and nutrient dependence
Benton (2010)	Review	Nigeria	Dietary status significantly influences cognitive performance in children; adequate nutrition essential for optimal learning and development
Jacka <i>et al.</i> (2010)	Observational Study	Australia	Strong connections identified between dietary habits and mental health outcomes; poor diet quality associated with increased psychiatric symptoms
O'Neil <i>et al.</i> (2014)	Systematic Review	Australia	Systematic evidence linking diet quality with mental health in children and adolescents; healthier diets associated

			with better psychological outcomes
Francis <i>et al.</i> (2019)	Randomized Controlled Trial	Algeria	Brief diet intervention significantly reduced symptoms of depression in young adults; dietary modification shows therapeutic potential
Monteiro <i>et al.</i> (2019)	Research Article	Brazil	Global dietary transitions toward ultra-processed foods parallel increasing mental health disorder prevalence; ultra-processed food consumption associated with adverse health outcomes
Bryan <i>et al.</i> (2024)	Review	Australia	Key micronutrients including B vitamins, magnesium, zinc, iron, and omega-3 fatty acids crucial for neurotransmitter synthesis and cognitive development in school-aged children
Rucklidge and Kaplan (2016)	Review	New Zealand/Canada	Micronutrient deficiencies associated with impaired attention, poor memory, mood instability, and increased neuroinflammation; broad-spectrum micronutrient treatment shows promise for ADHD
Jenkins <i>et al.</i> (2016)	Review	Australia	Tryptophan serves as primary precursor for serotonin synthesis; dietary tryptophan manipulation can influence mood and cognition through gut-brain axis
Roiser <i>et al.</i> (2024)	Clinical Study	USA/UK	Dietary tryptophan depletion acutely influences serotonin concentrations and psychological states; demonstrates direct dietary impact on neurotransmitter function
Zeisel and da Costa (2019)	Review	USA	Choline essential for acetylcholine synthesis; adequate choline intake critical for memory consolidation and sustained attention; deficiency linked to cognitive impairment
Lai <i>et al.</i> (2014)	Systematic Review and Meta-analysis	Australia	Western dietary patterns (processed foods, refined carbohydrates) promote inflammatory cascades and increase depression/anxiety risk; EPA

			supplementation reduces depressive symptoms comparable to antidepressants
Freeman <i>et al.</i> (2024)	Review and Evidence Synthesis	USA	Higher omega-3 consumption associated with reduced inflammatory biomarkers and improved cognitive performance; strong evidence basis for omega-3 use in psychiatry
Erickson <i>et al.</i> (2022)	Research Study	Uganda	Mediterranean diet adherence correlates with larger hippocampal volume and superior memory performance; nutrition shapes brain structure across lifespan
Sarkar <i>et al.</i> (2016)	Review	Ireland/UK	Gut microbiome serves as crucial intermediary in nutrition-brain relationship; dietary patterns substantially influence microbial composition affecting cognition and mental health
Valles-Colomer <i>et al.</i> (2019)	Large-scale Population Study	Europe (Multi-country)	Individuals with depression show reduced microbial diversity and depletion of GABA-producing bacteria; gut microbiome composition strongly linked to mental health
Silva <i>et al.</i> (2020)	Review	Brazil	Dietary fiber intake crucial for gut-brain communication through short-chain fatty acid (SCFA) production; SCFAs cross blood-brain barrier and influence neuroinflammation and neurotransmitter production
Bazinet and Layé (2014)	Review	Canada/France	Omega-3 fatty acids (EPA and DHA) constitute significant portions of brain tissue; essential for membrane fluidity, neurotransmission, and inflammatory regulation
Yurko-Mauro <i>et al.</i> (2010)	Clinical Trial	USA	DHA supplementation produces beneficial effects on cognitive function in age-related cognitive decline; improvements in memory, attention, and processing speed
Smith <i>et al.</i> (2010)	Randomized Controlled	UK	B vitamin supplementation (B6, B12, folate) slows brain atrophy rate in mild

		Trial		cognitive impairment; homocysteine-lowering treatment improves cognitive outcomes
de Jager <i>et al.</i> (2022)		Randomized Controlled Trial	UK	High-dose B vitamin supplementation slows brain atrophy and enhances memory in older adults with mild cognitive impairment and elevated homocysteine
Annweiler <i>et al.</i> (2013)	<i>et</i>	Systematic Review and Meta-analysis	France	Low serum vitamin D concentrations consistently linked to increased Alzheimer's disease risk; vitamin D deficiency associated with cognitive decline
Groves <i>et al.</i> (2014)		Review	Australia	Vitamin D functions as neurosteroid with critical roles in brain development; regulates calcium signaling, inflammatory responses, and neurotrophic factor synthesis
Littlejohns <i>et al.</i> (2014)	<i>et</i>	Prospective Cohort Study	UK/USA	Vitamin D deficiency associated with increased dementia and Alzheimer's disease risk; maintaining adequate vitamin D status may protect cognitive function
Joseph <i>et al.</i> (2019)	<i>et al.</i>	Research Study	USA	Chronic oxidative stress contributes to cognitive decline and neurodegeneration; antioxidant-rich foods (berries, walnuts) positively affect brain aging and behavior
Krikorian <i>et al.</i> (2010)	<i>et</i>	Randomized Clinical Trial	USA	Daily blueberry supplementation significantly improves memory performance in older adults with mild cognitive impairment; attributed to high anthocyanin content
Sofi <i>et al.</i> (2010)	<i>et al.</i>	Systematic Review and Meta-analysis	Italy	Mediterranean diet adherence associated with reduced mortality, cardiovascular disease, cancer, and neurodegenerative diseases; comprehensive health benefits documented
Parletta <i>et al.</i> (2017)	<i>et al.</i>	Review	Australia	Greater Mediterranean diet adherence associated with reduced cognitive decline, dementia, and depression risk;

				consistent protective effects across populations
Valls-Pedret <i>et al.</i> (2015)	Randomized Clinical Trial (PREDIMED)		Spain	Mediterranean diet supplemented with olive oil or nuts produced superior cognitive performance compared to low-fat control diet; supports neuroprotective benefits
Tangney <i>et al.</i> (2014)	Longitudinal Study		USA	DASH diet adherence associated with slower cognitive decline rates over 5 years; improvements in memory, attention, and executive function
Jacka <i>et al.</i> (2017)	Randomized Controlled Trial (SMILES)		Australia	Dietary counseling to improve diet quality produced significantly greater improvement in depressive symptoms compared to social support alone; establishes nutritional psychiatry efficacy
Georgieff (2017)	Review		USA	Maternal nutrition during pregnancy influences fetal brain development; deficiencies in folate, iron, and omega-3 fatty acids increase risk of offspring cognitive and behavioral problems
Cortese <i>et al.</i> (2022)	Pilot Study	MRI	France/USA	Iron deficiency common in children with ADHD; iron supplementation improves attention and hyperactivity symptoms when deficiency corrected
Nigg <i>et al.</i> (2022)	Meta-analysis		USA	Dietary interventions eliminating artificial additives demonstrated symptom improvements in approximately 25-30% of children with ADHD; nutritional sensitivity plays role in symptom expression
Kang <i>et al.</i> (2017)	Open-label Study		USA	Individuals with autism spectrum disorders show nutritional deficiencies in vitamins B6, B12, folate, vitamin D, and omega-3 fatty acids; microbiota transfer therapy improves gastrointestinal and autism symptoms
Mehler and Brown (2015)	Review		Morocco	Nutritional rehabilitation essential for psychological recovery in eating disorders; adequate nutrition necessary for cognitive function normalization in

			anorexia nervosa
Beard <i>et al.</i> (2025)	Clinical Study	South Africa	Maternal iron deficiency anemia affects postpartum emotions and cognition; iron status influences mental health through neurotransmitter synthesis and brain energy metabolism
Hogervorst <i>et al.</i> (2018)	Cross-sectional Study	Indonesia	Phytoestrogens (soy isoflavones) show potential for supporting cognitive function during menopause; mixed findings on tofu intake and memory in elderly populations
Pourmotabbed <i>et al.</i> (2020)	Systematic Review and Meta-analysis	Iran (Multi-country data)	Food insecurity associated with increased depression, anxiety, and cognitive impairment rates; socioeconomic disparities in diet quality significantly impact mental health outcomes
Nanri <i>et al.</i> (2010)	Cross-sectional Study	Japan	Traditional Japanese diet (high fish, moderate soy, vegetables, seaweed) associated with lower depression rates; cultural dietary patterns offer insights into brain-healthy eating

Table 2: Summary of Key Nutrients and Their Cognitive/Mental Health Effects

Nutrient	Primary Functions	Evidence Level	Major Outcomes
Omega-3 Fatty Acids (EPA/DHA)	Membrane fluidity, neurotransmission, anti-inflammatory	Strong (Meta-analyses, RCTs)	Enhanced memory, attention, processing speed; reduced depressive symptoms; increased brain volume
B Vitamins (B6, B12, Folate)	Neurotransmitter synthesis, methylation, homocysteine metabolism	Strong (RCTs)	Slowed brain atrophy; improved memory; reduced cognitive decline; mood stabilization
Vitamin D	Neurosteroid function, calcium signaling, inflammatory modulation	Moderate (Observational, some RCTs)	Reduced dementia risk; improved mood regulation; neuroprotection in deficiency states

Antioxidants (Vitamins C, E)	Oxidative stress reduction, protection	cellular	Moderate (Observational)	Cognitive preservation; delayed age-related decline; neuroprotection
Polyphenols (Flavonoids)	Synaptic signaling, anti-inflammatory, neurogenesis		Strong (RCTs)	Improved memory; enhanced cognitive performance; reduced neuroinflammation
Choline	Acetylcholine synthesis		Strong (Mechanistic studies)	Memory consolidation; sustained attention; reduced cognitive impairment risk
Iron	Neurotransmitter synthesis, transport	oxygen	Strong (Clinical trials)	Improved attention and hyperactivity in deficiency states; enhanced cognitive development
Dietary Fiber	Gut microbiome support, SCFA production		Emerging (Observational)	Superior cognitive performance; lower depression rates; improved gut-brain axis function
Tryptophan	Serotonin synthesis		Strong (Clinical studies)	Mood regulation; emotional processing; acute effects on psychological states
Tyrosine	Dopamine and norepinephrine synthesis		Moderate (Clinical studies)	Enhanced motivation, attention, executive function

Table 3: Dietary Patterns and Their Associated Outcomes

Dietary Pattern	Key Characteristics	Study Types	Primary Findings
Mediterranean Diet	High fruits, vegetables, whole grains, legumes, nuts, olive oil, fish; moderate wine	RCTs, Longitudinal cohorts	Reduced cognitive decline, dementia, and depression; larger hippocampal volume; superior memory performance; reduced neurodegeneration risk
DASH Diet	High fruits, vegetables, whole grains, lean proteins, low-fat dairy; low sodium and saturated fats	Longitudinal studies	Slower cognitive decline rates; improvements in memory, attention, executive function; cardiovascular-cognitive benefits

Western Diet	High processed foods, refined sugars, saturated fats; low fiber and plant foods	Observational studies	Elevated depression and anxiety rates; increased cognitive decline; systemic inflammation; insulin resistance; poor mental health outcomes
Traditional Japanese Diet	High fish, moderate soy, vegetables, seaweed	Cross-sectional studies	Lower depression and cognitive decline rates; neuroprotective compounds from traditional foods
Plant-based/High Fiber Diets	Emphasis on vegetables, fruits, legumes, whole grains	Observational, mechanistic studies	Superior cognitive performance; lower depression rates; enhanced gut-brain axis function; improved microbiome diversity

Table 4: Population-Specific Findings

Population Group	Key Studies	Major Findings
Pregnant Women and Infants	Georgieff (2017), Beard <i>et al.</i> (2025)	Maternal nutrition influences fetal brain development; deficiencies increase offspring cognitive/behavioral problems; iron deficiency affects postpartum emotions and cognition
Children and Adolescents	Benton (2010), O'Neil <i>et al.</i> (2014), Bryan <i>et al.</i> (2024)	Dietary status significantly influences cognitive performance and learning; diet quality linked to mental health; micronutrients essential for cognitive development
ADHD Population	Cortese <i>et al.</i> (2022), Nigg <i>et al.</i> (2022), Rucklidge and Kaplan (2016)	Iron supplementation improves symptoms when deficient; elimination diets benefit 25-30% of children; broad-spectrum micronutrients show promise
Autism Spectrum Disorders	Kang <i>et al.</i> (2017)	Common nutritional deficiencies in B vitamins, vitamin D, omega-3s; microbiota interventions improve GI and behavioral symptoms
Eating Disorder Patients	Mehler and Brown (2015)	Nutritional rehabilitation essential for psychological recovery; cognitive impairments improve with refeeding
Women of Reproductive Age	Beard <i>et al.</i> (2025)	Iron deficiency increases depression and anxiety; hormonal fluctuations create unique nutritional vulnerabilities

Menopausal Women	Hogervorst <i>et al.</i> (2018)	Phytoestrogens may support cognitive function; increased calcium and vitamin D needs for brain and bone health
Older Adults	de Jager <i>et al.</i> (2022), Erickson <i>et al.</i> (2022), Yurko-Mauro <i>et al.</i> (2010), Krikorian <i>et al.</i> (2010)	B vitamins slow brain atrophy in MCI; Mediterranean diet preserves brain volume; DHA improves age-related cognitive decline; antioxidants delay decline
Depression/Anxiety Patients	Jacka <i>et al.</i> (2017), Francis <i>et al.</i> (2019), Lai <i>et al.</i> (2014)	Dietary counseling reduces depressive symptoms; brief diet interventions effective; omega-3s show antidepressant effects
Food Insecure Populations	Pourmotabbed <i>et al.</i> (2020)	Limited access to nutritious foods increases depression, anxiety, and cognitive impairment; childhood food insecurity has lasting effects

Note: RCT = Randomized Controlled Trial; MCI = Mild Cognitive Impairment; SCFA = Short-Chain Fatty Acids; GABA = Gamma-Aminobutyric Acid; BDNF = Brain-Derived Neurotrophic Factor; EPA = Eicosapentaenoic Acid; DHA = Docosahexaenoic Acid; GI = Gastrointestinal

DISCUSSION

The mechanistic pathways identified in this review provide a coherent framework for understanding how dietary factors influence brain health. Neurotransmitter biosynthesis represents a direct pathway through which nutritional status affects mood and cognition. The availability of amino acid precursors such as tryptophan and tyrosine directly determines the brain's capacity to synthesize critical neurotransmitters including serotonin, dopamine, and norepinephrine. This represents one of the most immediate ways in which dietary choices can influence mental states and cognitive performance.

The inflammatory and oxidative stress pathways provide insight into how dietary patterns exert longer-term effects on brain health. The Western dietary pattern, characterized by high consumption of processed foods and refined carbohydrates, promotes chronic low-grade inflammation that can persist for years or decades. This sustained inflammatory state creates a toxic environment for neural tissue, contributing to accelerated aging and increased vulnerability to psychiatric and neurodegenerative disorders. In contrast, anti-inflammatory dietary patterns rich in omega-3 fatty acids, polyphenols, and antioxidants can counteract these processes and promote neural resilience.

The emerging understanding of the gut-brain axis adds another layer of complexity to the nutrition-mental health relationship. The recognition that gut microbiota can influence brain function through multiple pathways including neurotransmitter production, immune modulation, and metabolic signaling represents a paradigm shift in our understanding of how diet affects mental health. This mechanism may help explain

why dietary interventions sometimes produce mental health benefits that cannot be fully accounted for by changes in individual nutrient levels alone.

One of the most important findings from this review is that whole dietary patterns appear more influential for cognitive and mental health outcomes than individual nutrients in isolation. While specific nutrients such as omega-3 fatty acids, B vitamins, and vitamin D clearly play important roles, the Mediterranean and DASH dietary patterns demonstrate that the combination and interaction of multiple beneficial nutrients may be more powerful than any single component.

The evidence reviewed demonstrates that nutrition influences brain health throughout the entire lifespan, from prenatal development through old age. However, the nature of these influences and the most critical nutritional factors vary across different life stages. During pregnancy and early childhood, adequate provision of nutrients essential for brain development such as folate, iron, and omega-3 fatty acids appears most critical. During adolescence and young adulthood, maintaining balanced nutrition to support ongoing brain maturation and establishing healthy dietary patterns become important priorities.

In middle and older adulthood, the focus shifts toward preventing cognitive decline and supporting brain resilience through anti-inflammatory and antioxidant-rich dietary patterns. This life course perspective suggests that nutritional interventions should be tailored to the specific developmental needs and vulnerabilities of different age groups rather than applying universal recommendations across all populations.

While population-level evidence for the benefits of certain dietary patterns is strong, individual responses to nutritional interventions can vary considerably. This variability may be influenced by genetic factors affecting nutrient metabolism, baseline nutritional status, gut microbiome composition, concurrent health conditions, and lifestyle factors. The emerging field of precision nutrition aims to account for this individual variability by developing personalized dietary recommendations based on an individual's unique biological profile.

However, the clinical application of precision nutrition approaches remains in early stages. Most current evidence comes from population-level studies, and more research is needed to determine when and how personalized approaches add value beyond general dietary recommendations. Until precision nutrition tools become more refined and validated, promoting adherence to evidence-based dietary patterns such as the Mediterranean diet represents a reasonable and effective strategy for most individuals.

The review highlights important socioeconomic disparities in access to brain-healthy foods and the resulting impacts on cognitive and mental health outcomes. Food insecurity and limited access to fresh, nutrient-dense foods create barriers to implementing dietary recommendations, particularly for economically disadvantaged populations. These structural factors must be addressed through policy interventions and community-level programs if nutritional approaches to brain health are to achieve their full potential at the population level.

Cultural dietary traditions also warrant careful consideration in developing nutritional interventions. Traditional dietary patterns from various cultures, including

Mediterranean, Japanese, and other regional cuisines, demonstrate that there are multiple pathways to achieving brain-healthy nutrition. Interventions that respect and build upon cultural food traditions while emphasizing core principles of nutrient density, anti-inflammatory properties, and minimal processing are more likely to be acceptable and sustainable than approaches that require dramatic departures from familiar eating patterns.

While the evidence supporting nutritional interventions for cognitive and mental health is compelling, several challenges must be addressed to translate this knowledge into effective clinical practice. First, many healthcare providers receive limited training in nutrition, creating barriers to incorporating nutritional assessment and counseling into routine mental health care. Addressing this gap through enhanced nutrition education in medical and mental health training programs represents an important priority.

Second, the complexity of dietary assessment and the time required for effective dietary counseling may not align well with current clinical practice models that emphasize brief encounters and medication management. Developing efficient tools for nutritional screening and creating sustainable models for integrating nutrition professionals into mental health care teams could help address these practical barriers.

Third, adherence to dietary recommendations remains a significant challenge, as changing eating habits requires sustained effort and motivation. Research on behavioral strategies to support dietary change in the context of mental health treatment is needed to optimize intervention effectiveness.

Several limitations in the current evidence base warrant acknowledgment. Much of the research on nutrition and brain health is observational, making it difficult to establish definitive causal relationships. While randomized controlled trials provide stronger evidence, they often examine single nutrients or short-term interventions that may not fully capture the effects of long-term dietary patterns on brain health.

The mechanisms underlying many observed associations between nutrition and brain health remain incompletely understood. While plausible biological pathways have been identified, the relative importance of different mechanisms and how they interact requires further elucidation. Additionally, most research has been conducted in Western populations, limiting generalizability to other cultural and geographic contexts. Research examining nutrition's role in preventing mental health disorders and cognitive decline is particularly needed, as most existing studies focus on treatment of established conditions.

CONCLUSION

This review provides compelling evidence that nutrition plays a fundamental and multifaceted role in cognitive function and mental health throughout the human lifespan. Multiple interconnected biological mechanisms link dietary factors to brain health, including neurotransmitter biosynthesis, inflammatory and oxidative stress modulation, neuroplasticity support, and gut-brain axis communication. Essential nutrients such as omega-3 polyunsaturated fatty acids, B-vitamin complex, vitamin D, antioxidants, and dietary fiber demonstrate significant benefits for cognitive performance and mental wellbeing through both direct neural effects and systemic influences on metabolism and inflammation. Whole-food dietary patterns, particularly

the Mediterranean and DASH diets, consistently associate with superior cognitive and mental health outcomes compared to Western dietary patterns characterized by processed foods and nutrient-poor choices.

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CONFLICTS OF INTEREST

The authors declare no conflicts of interest related to this work.

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