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# Brain Foods for Cognitive Performance and Mental Health: A Scoping Review of Essential Nutrients

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## Abstract

The recent breakthroughs in nutritional neuroscience indicate that food is a key factor in brain development, consolidation of memory, concentration ability and long-term cognitive ability. This article is a synthesis of the role played by the necessary nutrients that support brain activity and enhance mental sharpness. It follows a systematic review approach, which summarizes and reviews the available literature on nutrition science and neuroscience in order to explain how dietary ingredients can regulate cognitive functions. Empirical evidence shows that omega-3 fatty acids, B-vitamins, antioxidants, minerals, amino acids and complex carbohydrates have significant effects on neuronal structures, neurotransmitter production, and the general cerebral metabolism. These nutrients promote important cognitive functions, such as memory retention, attention and learning, and emotional control. Besides, the growing body of literature surrounding the gut-brain axis underscores the mutual interchange between dietary habits, gut microbiota, and neurophysiological processes that regulate affect and cognitive functionality. The finding of the paper highlights that nutritionally adequate dietary behaviors in combination with other lifestyle-based interventions are undoubtedly the key to maintaining cognitive performance and psychological well-being.

**Keywords**: Brain nutrition, cognitive health, memory, mental clarity, antioxidants, gut-brain axis



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## Introduction

Brain is the central organ that is in charge of cognition, memory, learning, emotional regulation as well as decision making. Although it comprises of just about two percent of the body mass, it uses up almost a fifth of all energy input into the body. This high metabolic intensity highlights how crucial nutrition is in ensuring that the brain operates optimally. Recent studies in neuroscience and nutrition show that nutritional compounds affect neuronal plasticity, neurotransmitter synthesis and cognitive abilities (Berthoud, 2007; Gomez-Pinilla, 2008). Imbalanced diets cause concentration impairment, reduced memory functions and increased susceptibility to neurological conditions, while balanced diets lead to increased mental sharpness, faster learning, and long-term protection of the brain (Gómez-Pinilla, 2008).

Brain food is a concept that describes foods with high nutrient contents that enhance the cognitive functions, protect the neurons against oxidative injury, and nourish the brain metabolism (Bear et al., 2025; Kiefer, 2007). They comprise omega -3 fatty acids, vitamins, antioxidants, minerals, amino acids and complex carbohydrates. In addition to its direct effects on nutrients, the gut -brain axis is an important part of cognitive functioning. The gut microbiome interacts with the central nervous system through neural, endocrine, and immune pathways hence controlling mood, cognition, and mental health (Joseph et al., 2009a; Prabakar et al., 2025).

Scientific studies on nutrition and brain functioning is especially relevant to the context of youth development, aging, and the increasing rates of such neurological conditions as dementia and Alzheimer disease. Following this research gap, this paper will address the most important nutrients that can be used to support the wellbeing of the brain and outline the benefits of such nutrients in improving concentration, memory, and cognitive ability.

## Methodology

The paper is based on a narrative literature review of the studies focusing on empirical research of the correlation between nutrition and mental functioning. Peer-reviewed journal articles, nutrition research studies, and neuroscientific reviews were used to obtain relevant literature.

Sixty-five scientific studies have been systematically reviewed out of eighty-three initially screened and consulted by taking the reference of thematic coverage, number of citations of particular studies and the rank of the journal. The paper, then, summarizes the results of various fields such as nutrition science, psychology, neuroscience, and population health. For the systematic review, the thematic focus of the analysis was based on the following five areas:

(i) Nutrition determinants of cognition
(ii) Brain supportive micronutrients and macronutrients
(iii) Diet-cognition neurochemical links
(iv) The role of the gut-brain axis
(v) Dietary patters and food habits for improved mental performance.

## Results and Findings

### Omega-3 Fatty Acids and Brain Structure

The indispensable building blocks of neuronal membranes, omega-3 fatty acids are highly significant to the brain structure and functioning. Eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) increase the plasticity of the synaptic system and promote brain cell communication (Alijani et al., 2025). There is empirical evidence that diets rich in omega -3 fatty acids enhance memory performance and decimate cognitive decline (Gomez- Pinilla, 2008; Yurko- Mauro et al., 2010). Further, fatty acids reduce inflammation and oxidative stress in nerve tissues. Furthermore, omega -3 fatty acids also play a role in neuronal integrity maintenance and neurogenesis that is essential in the process of learning and memory (Dighriri et al., 2022). Sufficiency of it has been correlated with enhanced cognitive resilience and reduced occurrence of neurodegenerative disorders like Alzheimer disease and age-related cognitive impairment.

The major food sources of omega-3 fatty acids include fatty fish which include salmon, sardines and mackerel, which are particularly high in both DHA and EPA and hence the most useful foods as far as cerebral health is concerned (Qin et al., 2013). In addition to seafood sources, plant foods, including walnuts, flaxseeds, and chia seeds, also provide alpha-linolenic acid (ALA), the precursor that could be partially transformed into

DHA and EPA in the body. The regular intake of these foods in the diet is linked with the cognitive increase, memory improvement and positive long-term neurological outcomes.

## B-Vitamins and Neurotransmitter Synthesis

Vitamin B-complex plays a critical role in cerebral metabolism and formation of essential neurotransmitters. Vitamins B six, folate (B nine) and B twelve maintain the levels of homocysteine and contribute to the functioning of the brain cells. Higher levels of homocysteine have been linked to cognitive impairment and the probability of dementia (Smith & Refsum, 2016; Ye et al., 2025). A proper consumption of B -vitamins in the diet is necessary therefore to keep the mind alert and to sustain cognitive functioning. These vitamins are also needed in various enzymatic processes that produce neurotransmitters, including serotonin, dopamine, and gamma-aminobutyric acid (GABA) and hence regulate mood, cognition, and emotional balance. Moreover, B-vitamins also aid in the creation of myelin sheaths, which help to protect the axons and ensure effective transmission of neural signals. The lack of these nutrients has been associated with such clinical manifestations as fatigue, a loss of concentration, memory impairment, and an increased susceptibility to neurological disorders (Kacerova et al., 2025).

The nutrient-dense food contains significant amounts of B – vitamins (Mahmudiono & Haliman, 2023). Whole grains, including oats, brown rice, and wheat, contain large quantities of B -vitamins which aid in energy metabolism and the functioning of the brain. Eggs are also an important source of vitamin B 12 and other substances which are essential in the health of the neuron and cognitive functions. Folate, a moiety that is essential in the development of the DNA and neural formation, is abundant in green leafy vegetables, such as spinach, kale, and broccoli. Legumes lentils, chickpeas, beans contain significant amounts of B -vitamins along with dietary fiber and plant-based proteins. Frequent intake of these foods is linked with an increase in cerebral metabolism, control of neurotransmitter systems and maintenance of clear thinking.

## Antioxidants and Cognitive Protection

Antioxidants protect the neuronal cells against oxidative damage caused by free radicals. Oxidative stress is one of the major contributors of aging-related cognitive impairment. Evidence-based studies show that the diets containing high levels of antioxidant compounds improve memory functions and reduce neuronal degeneration (Cammisuli et al., 2022; Joseph et al., 2009b). Further, antioxidants maintain neuronal membrane integrity and enable effective neural signaling, which are essential to the learning and memory processes (Kpolovie, 2012; Singh et al., 2022). They also suppress neuroinflammation, which is often associated with neurodegenerative diseases, like Alzheimer disease, and Parkinson disease (Alqahtani et al, 2023). As a result, long-term healthy cerebral condition and cognitive resilience in later life are supported by the consumption of antioxidant-rich diets.

Main sources of antioxidants are included into the category of fruits, drinks, and plant foods rich in polyphenols and vitamins (Abeyrathne et al., 2022). Berries- such as blueberries, strawberries- contain flavonoid, which have been proven to improve memory and delay cognitive aging. Dark chocolate particularly those rich in cocoa, provide flavonoids that increase cerebral perfusion and corpus cognition. Citrus fruits like oranges and lemons are sources of vitamin C which is a strong antioxidant that helps the neurons to withstand oxidative stress. The other source of value is the green tea, which is also abundant in catechins that help in brain activity and alertness. Moreover, nuts and seeds provide vitamin E and other antioxidant elements that can be used to maintain the integrity of the neurons and reduce potential symptoms of cognitive deterioration.

## Choline and Memory Formation

Choline is a required micronutrient that cannot be spared in the production of a neurotransmitter called acetylcholine, a crucial part of memory formation processes and learning. Adequate consumption of choline helps in the neurodevelopment and is linked to the improved cognitive performance (Zeisel & da Costa, 2009). Moreover, choline helps to maintain the integrity of the cellular membrane and provides effective

neuronal signaling. It is present throughout the lifespan, not only by promoting brain growth throughout the early stages of life but also protecting brain functioning in adulthood and alleviating age-related decline. Chronic choline deficiency has been observed to be associated with memory impairment, slow speed of cognitive processing and mental clarity (Kansakar et al., 2023).

Choline is found in large amounts in nutrient rich foods through diet (Obeid & Karlsson, 2023). The yolks of eggs are one of the richest natural stores of choline, which is highly bioavailable and can sustain cerebral metabolic rate and neurotransmitter synthesis. Plant foods especially soybeans, provide significant amounts of choline in partnership with proteins and other micronutrients that are useful to the cognitive health. Quinoa is a nutritional whole grain that provides moderate choline levels and dietary fiber, vitamins, and minerals that are important to the general functioning of the brain (Tardy et al., 2020). Legumes like lentils, chickpeas, and different beans even increase the choline level of the diet, providing a source of protein and complex carbohydrates which maintain mind power and cognitive abilities.

## Minerals and Neural Function

Important minerals such as iron, magnesium and zinc play a critical role in the metabolism of the brain and cognitive functions. Being cofactor to various biochemical reactions that are involved in maintaining neuronal functions, controlling neurotransmission, and maintaining the general health of the brain, they are known to be micronutrients (Stefanache et al., 2023). An example of this is iron, which is vital in ensuring that oxygen is transported to the neuronal cells and that the right amount of energy is metabolized by the neuronal cells; this is why adequate iron concentration is necessary in maintaining attentional focus, consolidation of memory and learning ability (Kpolovie, 2012). Magnesium plays a key role in regulating neuronal excitability and electrochemical stability in the central nervous system in addition to regulating stress-response pathways, and relaxation of the nervous system.
Zinc is also critical in the synaptic transmission, neuronal signaling and consolidation of memory traces (Stiles et al., 2024). The fact that it is

involved in neuroplasticity makes it easier to modify and form new neural networks during learning episodes. The deficiency of these necessary minerals has a negative effect on cognitive performance and mental health. Iron deficiency, in particular, can lead to fatigue and poor concentration; lack of magnesium and zinc, respectively, to high levels of anxiety, mood instability, and impaired cognitive abilities (Beard, 2003; Kirkland et al., 2018). Thus, proper intake of minerals in a balanced diet is very important in ensuring ideal cerebral activity and mental alertness.

**Vitamin D and Brain Health**

Vitamin D has a strong impact on the development of the neurons and cognitive ability. Empirical studies have always proved that low levels of vitamin D are related to poor memory performance and lower speed of processing mental functions (Annweiler et al., 2013; Navale et al., 2022). In addition to readily recognized functions in bone homeostasis, vitamin D has been found to play neuroprotection roles by regulating the balance of intracellular calcium in the neurons, as well as in the production of neurotrophic factors that promote neuronal survival. In addition, vitamin D also alleviates neuroinflammatory events and oxidative stress to cerebral tissues, which are pathophysiological pathways identified as critical mediators of neurocognitive dysfunction and a range of neurological diseases (Annweiler et al., 2009; Menéndez et al., 2024). Therefore, proper vitamin D levels are essential to save cognitive functioning, control affective moods, and the overall health of the nervous system.

Vitamin D sources include the synthesis and the intake of the vitamin to an optimum level (Wei et al., 2024). However, its deficiency and excessiveness both can have a critical issue for the performance of mind. The main cause of cutaneous production is ultraviolet radiation which triggers the change of 7 -hydroxycholesterol into vitamin D3. Nutritional intake is based on fish species such as salmon, tuna and mackerel, which contain a lot of vitamin D as well as fatty acids of omega 3 (Lin et al., 2000). Other examples of fortified dairy products that can be noted as a significant source of vitamin D daily include milk and yogurt. Therefore, a logical plan that implies frequent sun exposure with the intake

of vitamin D-contained foods is the basis of the preservation of the best cerebral activity and cognitive level.

## Carbohydrates and Brain Energy

Glucose is the major source of energy metabolism in the brain. Complex carbohydrates provide a constant flow of glucose and thus help in ensuring concentration and mental stamina (Benton & Donohoe, 1999; López-Ojeda, & Hurley, 2023). Unlike the simple sugars, which cause rapid surges and falls in blood glucose levels, the complex carbohydrates are slowly released to allow the brain to maintain cerebral functionality over more sustained periods. Therefore, sufficient levels of carbohydrates are believed to help in sustaining attention, memory processing and general mental productivity (Donohoe & Benton, 1999. Moderated intake of carbohydrates presupposes specific relevance in the case of students, professionals, and other people who have to perform some activity that requires constant mental activity. However, diets that radically limit the carbohydrate levels should be monitored closely because of the possible physiological and psychological consequences (Arshad et al., 2025).

Some of the healthy food sources of complex carbohydrates include whole grains including brown rice, whole wheat and barley which give long-term energy with critical nutrients and dietary fiber content (WHO, 2023). Another useful source is oats which encourage consistent glycemic controls and prolonged mental alertness. Complex carbohydrates are provided by legumes, such as lentils, chickpeas, and beans, in daily use along with plant-based protein and micronutrients that are associated with cognitive functioning. Sweet potatoes also have their own beneficial effects as they provide slow-absorbing carbohydrates, vitamins, and antioxidants, which help to maintain brain activity and metabolism of energy. Frequent consumption of such foods enables a stable supply of glucose to the brain and promotes long term cognition during the day.

## Amino Acids and Mental Performance

Proteins are invaluable macronutrients which aid brain functioning through the supply of amino acids. These amino acids are the precursors of neurotransmitters that are chemical messengers that regulate inter-neuronal

communication. Adequate intake of high-protein foods ensures the supply of these amino acids into the production of neurotransmitters, which strengthens the mind, focus, and emotional stability (Dye et al., 2000; Umeda et al., 2022).

Tyrosine is one of the various amino acids that are crucial in the production of dopamine which is a neurotransmitter associated with motivation, alertness, and cognitive functioning in the presence of pressureful circumstances. The other essential amino acid is tryptophan which is involved in the formation of serotonin which is responsible in regulating moods, emotional balance and sleeping patterns. All these amino acids build up on the psychological health and the cognitive process, and hence the importance of protein-rich foods in maintaining mental performance and emotional stability (Fernstrom, 2012; Vajdovich et al., 2025).

## Gut–Brain Axis and Cognitive Health

The gut-brain axis is a multi-faceted connection system that interconnects the central nervous system with the gastrointestinal system. This two-way system combines numerous physiological pathways hence allowing the sustained interaction of the gut and the brain. It consists of various large parts, among them the central nervous system (CNS), the processer of the cognitive and emotional response; the autonomic nervous system (ANS), the controller of the involuntary body functions and the communication between the gut and brain; and the hypothalamic-pituitary-adrenal (HPA) that is central and key in the habitual response of the body to stress. Signals have to do with digestion, hormones, immune responses, and microbial activity via these interrelated systems, which affect cognitive functioning and influence emotional regulation and mental wellbeing (Patil & Mehdi, 2025).

Diet is also a significant factor in determining composition and diversity of the gut microbiota, which subsequently influences mood, cognition and stress coping (Verma et al., 2024; Warren et al., 2025). The balanced diet promotes the positive microorganisms which generate the neuroactive agents like serotonin and short-chain fatty acids, and hence they affect the health of the brain. Fermented foods, yogurt and kefir, are

foods that are pro-gut health that offer helpful bacteria to achieve the microbial balance in the digestive system. The great amounts of fiber in vegetables help to develop healthy gut bacteria and increase the health of the digestive system as well as help to maintain a steady metabolic and neurologic performance (Khorasaniha et al., 2023). Foods containing probiotics also boost the diversity of microbes and the connection of the gut-brain, which helps to promote better mental clarity, emotional stability, and cognitive ability.

## Discussion

The evidences and empirical synthesis that are endorsed in the paper strongly show that nutrition is a core component that determines cognitive functioning and, in general, brain health. Brain needs constant access to fundamental nutrients in order to keep up neuronal activity, enhance communication between neurons via synapses, and control cognitive-related biochemical processes. Some of the nutrients that are connected to multiple neurobiological processes include omega 3 fatty acids, vitamins, minerals, antioxidants, amino acids and complex carbohydrates which are linked to neurotransmitter production, neuronal membrane conservation, and prevention of oxidative stress. All these processes influence memory formation, concentration and mental clarity. Nutrition, as Bourre (2006) highlighted, is one of the most determining factors of human mental performance in all age groups. This is more so during the aging process where it might lead to faster degeneration of the human mind due to nutritional deficiencies. It is therefore recommended that special types of food intakes to boost mental performance during the teen age and early youth age groups (Marwan, 2025).

The linkage between emotion regulation, the reward systems in the brain and diet is another vital feature that is brought out in the literature. Food consumption is directly related with the neural reward systems that engage neurotransmitters like dopamine that affect motivation, pleasure, and behavioural responses to food stimuli (Ma et al., 2024; Wise, 2006). Emotional reactions and food preferences are also influenced by sensory experiences including taste and smell and hence influence dietary behaviour and impact cognitive and psychological well-being (Fry &

Ferguson, 2007; Rolls, 2005, 2007). These exchanges prove that nutrition not only supplies physiological nourishment but also engages in interaction with emotional and behavioural processes that process in climactic ways, and thus affect mental functioning generally.

Nutrition and cognitive health have a special relationship especially at levels of development. Adolescence and early adulthood are crucial stages of development in the brain, enhancement of self-personality and emotional well-being. At these ages, sufficient nutrient consumption will facilitate neural development, cognitive functioning and psychological stability. Research has demonstrated that healthy eating habits that are balanced in terms of nutrients are conducive to academic achievements, high capacity to focus and foster better emotional control among the youths (Wendler, 2024). Healthy eating, in turn, is an important practice to promote not only the long-term cognitive and mental health of a person but also their mental resilience during youth.

On the whole, there is evidence to believe that there is an integrated reaction between dietary intake, physiological mechanisms and psychological processes that affect cognitive performance. A proper diet facilitates metabolism of the brain, safeguarding against neural cell structures and facilitates efficient transmission of information among the neural systems (Sinha et al., 2025; Westenhoefer et al., 2004). Thus, the balanced patterns of nutrition and preservation of nutrient diversity are two essential measures to promote cognitive performance and prevent the loss of neurological functions throughout the life span.

Nutritional neuroscience has actively recorded the linkage between particular nutrients and cognitive functioning (Barbey, 2026; Wu & Barbey, 2026). Implications of various nutrients have been associated with various physiological processes that maintain brain metabolism, neural signalling, and defence against oxidative stress. All the key nutrients related to cognitive health, their main functions in the brain processes, and the usual food sources that these nutrients may be found are summarized in Table 1.

Table 1 :Key Nutrients Supporting Brain Function

| Nutrient | Brain Function | Major Food Sources |
|---|---|---|
| Omega-3 Fatty Acids | Improve memory and neural communication | Salmon, walnuts, flaxseeds |
| Vitamin B Complex | Neurotransmitter synthesis | Eggs, whole grains, leafy vegetables |
| Antioxidants | Protect neurons from oxidative stress | Berries, dark chocolate, green tea |
| Choline | Supports memory and learning | Egg yolks, soybeans |
| Iron | Oxygen transport to brain | Legumes, spinach |
| Magnesium | Nerve transmission and stress control | Nuts, whole grains |
| Zinc | Synaptic communication | Seeds, legumes |
| Vitamin D | Cognitive performance | Sunlight, fatty fish |
| Complex Carbohydrates | Sustained brain energy | Oats, quinoa |
| Amino Acids | Neurotransmitter production | Dairy, poultry, tofu |

The linkage of nutrition and cognitive performance is explainable in the conceptual framework of integrated conceptual framework known to relate dietary intake, biological processes and cognitive outcomes. At the base level, the nature and quality of the food taken determines the supply of such essential nutrients as omega -3 fatty acids, vitamins, minerals, antioxidants, and amino acids (Kumar et al., 2022). These nutrients activate several neurobiological pathways that facilitate the work of the brain, such as synthesis of neurotransmitters, induction of neural plasticity, alleviation of oxidative stress, and communication between gut microbiome and central nervous system.

These processes lead to the different nutrient intake regulating multiple cognitive functions, which include remembering, mental attention, emotional control, and mental sharpness. Sufficient and balanced nutrition thus forms the base of efficient neural signaling and safeguards the cerebral structures against degenerative alterations. On the other hand, these processes are likely to be disrupted by nutritional deficiencies, leading to

the poor cognitive performance, feelings of fatigue and decreased mental resilience. This conceptual model points out that cognitive health is not defined exclusively through the neurological factors but also has a great impact on dietary behaviors, physical exercises and nutritional status (Feng, 2025; Ploughman, 2008). It also equally resonates with the daily activities and functions of body and mind together with yoga and meditation, spiritual well-being, positive mentality (Chaudhry et al., 2023; Tornóczky et al., 2026). It therefore highlights the need to maintain balanced and nutritious diets in order to maintain brain health in the long-term. Nevertheless, we cannot separate the food habits and nutritional status of people from health systems existing in the country which eventually requires a critical departure (Dahal, 2024)

## Conclusion

Optimal brain functioning depends on adequate consumption of most of the needed nutrients that form the basis of neuronal structure, biosynthesis of neurotransmitters and metabolism of the brain. Diets rich in omega-3 fatty acids, vitamins, antioxidants, minerals, and amino acids increase the working memory and concentration and improve mental sharpness, and also provides insurance against neurodegeneration. The modern studies on gut-brain axis bring an additional explanation to the complex relationships between diet, mood, and cognitive functioning. A nutritionally balanced diet and salutary lifestyle changes such as regular exercise, sleep and proper stress control, is a sound approach towards maintaining cognitive health throughout the lifespan.

The results of this paper have great implications in the education of nutrition, especially in the fields of Nutrition and Dietitecs. The inclusion of evidence-based information on the brain-beneficial nutrients in the educational programs can enable people to make informed decisions about their diets that enhance cognitive abilities and mental health. In addition, the promotion of the awareness of the nexus of nutrition and brain health can support the preventive health measures that attempt to reduce the impact of the risk of cognitive decline and mental disorders at all ages. Therefore, the major strategies are proposed as following:

(i) Preaching healthy diets that are rich in brain-supportive foodstuffs.

(ii) Promoting the intake of whole food instead of processed food.
(iii) Adding nutrition education to the school and university curricula.
(iv) Increasing the level of awareness regarding the gut -brain connection.

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