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The Roles of Nutrition in Mental Health: A Review

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Abstract

Mental health is the state of having a fully functioning mind that allows you to deal with problems, handle stress, learn, interact with others, and work successfully. Millions of individuals worldwide suffer from mental health conditions like sadness and anxiety. A rising amount of research indicates that dietary habits and nutrient consumption may have an impact on mental health outcomes, making nutrition a crucial component of mental health. With an emphasis on dietary patterns, this review attempts to compile the body of research on the functions and connections between nutrition and mental health. It also highlights the significance of certain nutrients for brain function and mental health. Key nutrients like vitamin D, omega-3 fatty acids, and polyphenols have been demonstrated to have antidepressant and anxiolytic effects when consumed in a healthy pattern, according to the review articles. Additionally, gut microbiota is important for mental health in the gut-brain axis, with changes in gut bacteria being associated with anxiety and depression. In conclusion, mental problems may be prevented and treated with a nutritious diet high in fruits, vegetables, omega-3 fatty acids, and whole grains. To clarify the mechanism of action underlying the interaction of nutrition with mental health, more research is required.

Key words: Mental health, gut-brain axis, omega-3 fatty acids, antioxidants

Introduction

The World Health Organization (2008) defines a state of well-being that allows people to successfully learn and work, manage life's obstacles, reach their full potential, and give back to their communities as mental health. More than half of mental illnesses begin by the age of 14, and three-quarters begin by the age of 24 (Copeland et al., 2011). The World Health Organization (2001) estimates that 40 million Nigerians, or 20% of the population, suffer from a mental disorder. Lifespan number of cases varied from 3.3% to 9.8% for mood disorders, anxiety disorders ranged from 5.7% to 15.8%, then substance use disorders ranged between 3.7% to 13.3%, and between 1.0% to 4.45% for psychotic disorders in 36 studies from

12 African nations (Wu & Blazer, 2014). According to statistics, roughly 19 million Americans, or around 8% of the overall population, have suffered depression (Ettman et al., 2020). The two most common mental illnesses in 2019 were anxiety and depression, which affected 1 in 8 individuals, or 970 million people globally (Kumar et al., 2024). Major depressive disorder, psychotic disorder, anxiety disorders, manic depressive illness, affective disorders, cognitive developmental disorders, and post-traumatic stress reaction are among the most prevalent mental illnesses (Du et al., 2022). The symptoms of these mental diseases vary from mild to extreme, intense to persistent to chronic, and one to multiple, concurrent or pathological (Zimmerman et al., 2018). According to the findings of another study by Ossai (2024) on the subject, nutrition had a significant impact on the mental health of elementary school students. Considering the fact that mental health is influenced by the quality of one's food, a healthy and balanced diet should limit sugar, refined cereals, saturated fats, and processed meats while increasing fiber, cereals, whole grains, nuts, legumes, fish, and essential oils (Albuquerque et al., 2020). However, little is known about how nutrition affects mental health outcomes. Therefore, this paper aims to examine the functions that nutrition plays in mental health, identify the specific nutrients that affect healthy brain function, and discuss the mental health implications of the gut-brain axis.

Types of Mental Disorders Depression

Depression is a prevalent mental health disorder marked by a persistently low mood, diminished interest or pleasure in activities, feelings of guilt or worthlessness, disruptions in sleep or appetite, reduced energy levels, and difficulty concentration (Ercole, 2020). Of the 280 million individuals who experienced depression in 2019, 23 million were children and adolescents (Liu et al., 2024). According to Starr et al. (2017), depression is distinct from normal mood swings and transient emotional responses to daily life challenges.

Generalized Anxiety Disorder (GAD): According to DeMartini et al. (2019), Generalized anxiety disorder (GAD) is a prevalent and debilitating condition that frequently goes undiagnosed and untreated. The symptoms include persistent, widespread anxiety and worry together with vague physical and cognitive symptoms such as restlessness, exhaustion, trouble focusing, anger, muscle tension, or irregular sleep patterns (Demartini et al., 2019). In 2019, 301 million people suffered from anxiety disorders, including 58 million young individuals (Sabbagh et al., 2022).

Obsessive Compulsive Disorder (OCD): the traits of OCD include either compulsions or obsessions, but often both (Stein et al., 2019). Obsession is defined as an unwanted, intrusive thought, image, or urge that repeatedly occurs in a person's mind. Compulsions are mental patterns or

repetitive behaviors that a person feels obligated to perform (Cervin, 2023).

Post-traumatic stress disorder (PTSD): PTSD and other mental diseases are more common in places influenced by conflict (Lim et al., 2022). The fundamental traits of PTSD are prolonged severity, devastating, and defensive avoidance behaviours to triggers of the instigating factor, change of mood and reasoning, a widespread sense of impending harm, sleep disruptions, and over alertness (Shalev et al., 2017).

Schizophrenia: Schizophrenia affects about 24 million people worldwide, or 1 in 300 people (Mohamed et al., 2024). Schizophrenia is characterized by severe perceptual impairments and abnormal behaviours. Schizophrenia patients have a survival expectancy that is 10–20 years shorter than the average person (Correll et al., 2022). Symptoms include intense nervousness, cognitive disorientation, false perceptions, ongoing irrational convictions, and highly chaotic behaviour (Verma, 2023).

Attention deficit hyperactivity disorder (ADHD)

It is one of the most common brain development-related disorders in children. It results in restlessness, hyperactivity, impulsive actions, trouble concentrating, and an inability to regulate emotions (Dohrmann & Schneider, 2023).

Causes of Mental Disorders

Genes and family history: Genetic factors contributing to the development of mental disorders include epigenetic regulation, which describes environmental factors that determine the occurrence of a disorder, and genetic polymorphisms, which are changes in our DNA (Klengel & Binder, 2015).

Substance Abuse: Mental illnesses can be caused by exposure and overuse of some chemical substances such as alcohol, tobacco, and illegal drugs (Tanaree et al., 2021).

Psychological influences: Impairment in the neurotransmitters, particularly dopamine, plays an important role in schizophrenia (Mandal et al.,2022). Research indicates that individuals addicted to cocaine exhibit behaviours similar to those seen in schizophrenia, thereby leading to a link between dopamine activity and schizophrenia (Masroor et al., 2021). Cocaine affects brain chemistry by decreasing the levels of monoamine neurotransmitters, which are reabsorbed into presynaptic neurons. These neurotransmitters are serotonin, dopamine, norepinephrine, and adrenaline (Harbell et al., 2021).

The Role of the Gut-Brain Axis in Mental Health

The gut-brain axis (GBA) is the communication link between the central nervous system (CNS) and the human gastrointestinal (GI) tract. The communication is bi-directional and the neuronal, endocrine, and immunological systems are all involved (Skonieczna-Żydecka et al., 2018). According to Xiong et al. (2023), a healthy gut can boost mental health by affecting moods, stress levels, anxiety, and cognitive performance. It can also

lower the risk of depression. Based on available data, gut bacteria may have an impact on cognitive function and brain connectivity (Cooke et al., 2022). Neurotransmitters such as serotonin, norepinephrine, and dopamine are synthesized by the microbiota and play a role in regulating peristalsis and gastrointestinal secretion (Mittal et al., 2017). According to Kuijer and Steenbergen (2023), the gut microbiota significantly affects mice's hippocampal-dependent learning and memory (animal research provides the best evidence for the function of microbes in the gut-brain axis). In humans, the early development of children's temperament is mediated by relationships between diversity and composition (Ueda et al., 2024). The metabolism of tryptophan is influenced by gut microorganisms both directly and indirectly, which results in behavioral and cognitive alterations (Parolisi et al., 2023). The gut-brain axis has the following effects on mental health:

Gut microbiota: gut microorganisms play a role in brain-gut interactions. The production of several chemical neurotransmitters by gut microorganisms facilitates communication between the gut and the brain (Strandwitz, 2018). Dysbiosis, an imbalance in gut microbiota, raises the risk of mental illnesses (Mitrea et al., 2022). Numerous illnesses have been linked to gut microbiota dysbiosis, including diabetes, alcoholic liver disease, hepatocellular carcinoma, obesity, cancer, anxiety, depression, hypertension, cardiovascular disease, and inflammatory bowel disease (Philips et al., 2022).

Hormone: As part of the body's stress response, the hypothalamic-pituitary-adrenal (HPA) axis releases the hormone cortisol (DeMorrow, 2018). A weaker feedback loop in depressed people results in elevated cortisol levels (Nandam et al., 2020).

The role of nutrients in the management of mental health

B- Vitamins

The formation of short chain fatty acids (SCFAs) and gut microbiota are also influenced by vitamins, which are important mediators of mental health (Ortega et al., 2022). B- vitamins which are important cofactors in the production of neurotransmitters such as serotonin, dopamine and norepinephrine are crucial for mood regulation (Bhatia et al., 2023). Pantothenic acid, or vitamin B5, helps brain cells by being involved in the synthesis of fatty acids, cholesterol, amino acids, and phospholipids (Xu et al., 2020). Vitamins B_9 and B_{12} are all involved in methylation process, an essential brain functioning process (Theodosis-Nobelos et al., 2024). Deficits in B- vitamins are linked to mood disorders that ultimately result in stress or depression because of elevated blood homocysteine and neurotransmitter problems (Sofyan et al., 2022). The primary foods that contain vitamin B_{12} include fish, lean meat, poultry, eggs, and low-fat and fat-free milk.

Omega-3-fatty acids

Poly unsaturated, long-chain fatty acids that can be found in both marine and plant sources. According to Zinkow et

al. (2024), omega-3 fatty acids have an effect on mental health by affecting neurotransmitter activity, fostering neuroplasticity, and improving mood control, membrane fluidity, and the regulation of the Hypothalamus Pituitary Adrenal (HPA) axis. Their antidepressant action is also mediated by increased membrane fluidity, which increases the transport of serotonin by endothelial cells; increased dopamine concentration and dopamine 2 receptor in the frontal cortex; and direct interactions with other neuronal receptors and second messengers, which produce pleiotropic effects (Incontro et al., 2025). Serefko et al. (2024) suggest that omega-3 polyunsaturated fatty acids, found in walnuts, flax seeds, oily seafood, and oils such as canola and walnut oils, may help reduce the symptoms of sadness and anxiety. Omega-3 fatty acids docosahexaenoic acid (DHA) and eicosapentaenoic acid (EPA) are thought to have the most potential to benefit people with mood disorders. The most antidepressant benefits of omega-3 PUFA were attributed to EPA, not DHA, according to a meta-analysis of randomized control studies (Ortega et al., 2022). On the other hand, a 5-year follow-up showed that the DHA content had a significant impact on the protective function against depression of eating a lot of fish (≥2 times per week); nevertheless, other factors besides DHA might possibly be involved in the antidepressant effects of fish (Egerton et al., 2022).

Vitamin D

According to a 2017 study, vitamin D insufficiency and depression are related, and taking supplements of vitamin D can help with these symptoms (Zhu et al., 2020). In Alzheimer's disease, vitamin D levels have also been found to be lower, according to numerous research, which suggests that vitamin D plays a part in cognitive development (Panza et al., 2021).

Anti-oxidants

In order to reduce oxidative stress, which can damage cells and play a role in mental health disorders like anxiety and depression, antioxidants are crucial (Bhatt et al., 2020). Biological macromolecules such as proteins, DNA, and lipids can be harmed by oxidative stress, which is an imbalance between the oxidative and antioxidant systems in cells and tissues (Hajam et al., 2022). A meta-analysis encompassing 115 studies revealed that oxidative stress markers were increased and antioxidant markers were decreased in depressed patients (Liu et al., 2015). According to Cecerska-Heryć et al. (2022), persistent oxidative stress may make depression and other mental illnesses worse. Antioxidant supplements can be used as adjuvant therapy for patients with stress-related mental diseases (Poladian et al., 2023). Vitamin C, vitamin E, and beta-carotene are examples of antioxidants found in food that may enhance mental health.

Fibre

Higher dietary fiber intake was associated with a 49% decreased incidence of depression compared to lower intake (Swann et al., 2020).

Probiotics had a small but significant effect on anxiety and depression, according to a meta-analysis of randomized clinical studies (Lin et al., 2023). According to a Mulligan et al. (2023) study, there is a significant positive relationship between mean dietary fiber consumption and mood state, with cheerful persons ingesting more fiber on a daily average than people that are not happy.

Polyphenols

Polyphenols are chemical molecules that are widely present in plants and have important antioxidant and anti-inflammatory qualities. They also have a promising therapeutic and preventative effect in a variety of disorders (Gasmi et al., 2022). The following are examples of common polyphenols found in the diet: flavonols (quercetin in apples, tea, and onions), flavanols (cocoa, tea, apples, and broad beans), flavanones (hesperidin in citrus fruit), and anthocyanins (berries). Patients with major depressive disorder (MDD) may benefit from taking 1000 mg of the polyphenol curcumin daily, according to clinical investigations (Lopresti, 2022). In preclinical models, resveratrol, a well-known polyphenol found in red grapes, has accumulated evidence of antidepressant effects at dosages ranging from 10 to 80 mg/kg/day; however, the greatest advantages were observed at higher doses (Mony et al., 2022).

Magnesium

It acts as a modulator of neurotransmitter activity by decreasing the activity of glutamate at N- methyl-D- aspartate (NMDA) receptor which can alleviate depression by calming the nervous system (Kumar et al., 2024). Certain observational or epidemiological studies have linked a higher dietary intake of magnesium to a generally lower risk of depressive disorders (Li et al., 2022). In a study by Afsharfar et al. (2021), he stated that taking 500 mg of magnesium per day for eight weeks decreased the symptoms of depression.

Mediterranean diet (MD)

This dietary pattern includes mild intake of fish, low consumption of dairy and meat products, minimal-to-moderate alcohol consumption, and intake of foods high in vegetables, fruits, legumes, nuts, complex carbohydrates, and mono-unsaturated fats (Wojda & Małgorzewicz, 2021). In a study of 60 patients, Radkhah et al. (2023) found that anxiety and depression considerably improved after taking MD for 12 weeks. In the general population, eating a Mediterranean diet is associated with a lower risk of depression and cognitive decline (Vercambre, 2012). Furthermore, the Mediterranean diet has been shown to improve sleep through neuroprotection, melatonin biosynthesis regulation, oxidative stress and inflammation reduction, microbiota modulation, and metabolic and circulatory improvements (Scoditti et al., 2022).

(Mediterranean-DASH diet Intervention for Neurodegenerative Delay) MIND Diet

It encourages consumption of vegetables, berries, nuts, whole grains,

olive oil, fish, legumes, poultry, and wine (Kheirouri & Alizadeh, 2022). The MIND diet emphasizes natural plant-based foods and restricts consumption of animal and high-fat foods, especially those that come from animals (Salari-Moghaddam et al., 2019). Following the MIND diet reduced the risk of Alzheimer's disease, in one study (de Crom et al., 2022). Green leafy vegetables and berries are two special components of this diet. Berries have been found to improve motor function, increase speed, and reduce walking errors in humans (Shukitt-Hale et al., 2015).

Conclusion

Nutrition plays a vital role in supporting mental health by influencing brain function, mood regulation, and emotional well-being. Understanding the connection between diet and mental health is essential for raising public awareness of the risks associated with mental illnesses. Consuming whole foods and healthy fats would be beneficial to mental health. A diet rich in essential nutrients such as fibre and B vitamins, omega-3 fatty acids, iron, zinc, and antioxidants helps maintain proper brain function and reduces the risk of mental health conditions like depression and anxiety. Poor dietary habits, on the other hand, can contribute to mood disorders and cognitive decline. Diets high in processed foods make the symptoms of mental disorders worse. It is recommended that individualized dietary interventions be used in conjunction with conventional treatments to enhance mental health outcomes. To improve the mental health of those who appear with certain mental disorders, nutrition education programs should be put in place to increase understanding about appropriate nutrient consumption.

Recommendations

The following recommendations are made based on the findings of the review:

1. Integrating nutrition education into mental health care
2. Creating individualized dietary plans
3. Conducting further research on nutrition- mental health interactions.
4. Developing mental health interventions based on diet.

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