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EXPLORING THE ROLE OF NUTRITION IN ENHANCING MENTAL AND EMOTIONAL WELL-BEING

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Abstract

The relationship between nutrition and mental health has garnered increasing attention in recent years, with emerging evidence highlighting the profound impact of dietary choices on emotional and psychological well-being. This review explores the intricate links between nutrition and mental health, focusing on the roles of macro- and micronutrients in regulating mood, cognitive function, and stress resilience. Nutritional deficiencies, such as those involving omega-3 fatty acids, B vitamins, and magnesium, have been associated with an increased risk of depression, anxiety, and other mood disorders. Conversely, diets rich in whole foods, such as fruits, vegetables, whole grains, and lean proteins, promote better mental health outcomes by supporting gut-brain axis communication, reducing inflammation, and enhancing neuroplasticity. The article also examines the emerging field of nutritional psychiatry, emphasizing personalized dietary interventions to improve mental health. By integrating nutritional strategies into mental health treatment plans, healthcare professionals can offer a holistic approach to fostering emotional resilience and cognitive well-being. This study underscores the need for further research and public awareness to optimize nutrition as a tool for enhancing overall mental health.

Key words*: nutrition, mental health, emotional well-being.*

INTRODUCTION

Quality of life, overall well-being, and psycho-emotional stability are closely associated with dietary quality, levels of physical activity, and adequate rest, as well as with the avoidance of narcotic substances, tobacco use, and excessive alcohol consumption (Gheonea et al., 2023) (as shown in Figure 1).

According to the data presented by World Health Organization (WHO, 2025), mental health represents a state of psychological state of mind that allows individuals to effectively manage life's stressors, recognize and utilize their abilities and productive work, and actively contribute to their communities. It possesses both intrinsic and instrumental value and constitutes an essential dimension of overall human health and well-being.

Mental health is influenced by a multifaceted combination of individual, familial, community, and structural factors that can either support or compromise psychological well-being. Although many individuals display resilience, exposure to unfavourable circumstances - such as poverty, violence, disability, or social inequality - has been consistently associated with an increased risk of developing mental health conditions.

Individuals experiencing mental health conditions frequently face stigma and discrimination and are at an increased risk of encountering violations of their fundamental human rights (WHO, 2025).

Mental health conditions comprise a wide range of phenomena, including mental disorders, psychosocial disabilities, and other mental states marked by significant psychological distress, functional impairment, or an increased risk of self-injurious behavior. In 2019, an estimated 970 million individuals worldwide were affected by a mental disorder, with anxiety and depressive disorders being the most prevalent.

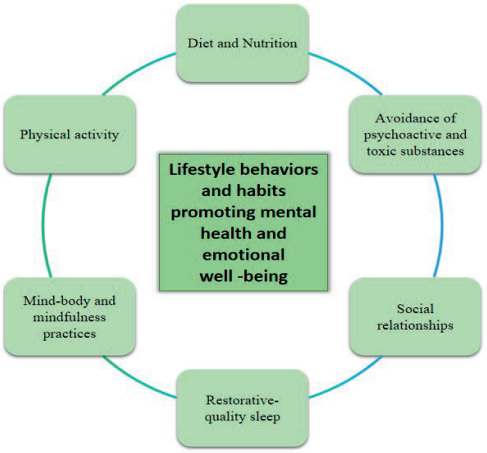

Figure 1. Healthy lifestyle behaviours and habits contributing to the promotion of mental health and overall well-being

These conditions can profoundly impact multiple domains of life, including interpersonal relationships, educational attainment, and occupational functioning. They may both result from and contribute to difficulties in these areas. Globally, mental disorders account for approximately one in six years lived with disability. Individuals with severe mental health conditions experience a markedly reduced life expectancy - on average, 10 to 20 years shorter than that of the general population - and face an increased risk of suicide as well as human rights violations.

In 2021, it was estimated that approximately 727,000 individuals died by suicide worldwide. Suicide represented the third leading cause of death among individuals aged 15-29 years - ranking second among females and third among males. More than half of all suicides globally (56%) occurred before the age of 50, with the majority (73%) taking place in low- and middle-income countries. The reduction of suicide mortality constitutes a key indicator within the United Nations Sustainable Development Goals (SDGs) and is also a priority objective of the *Comprehensive Mental Health Action Plan 2013–2030* (WHO, 2025).

It is estimated that, globally, around 322 million individuals are affected by depression, 50 million by dementia, 45 million by bipolar disorder, and 20 million by schizophrenia. Collectively, these conditions contribute substantially to the overall global burden of disability (Dal and Bilici, 2024).

Over the past decade, there has been a notable increase in research examining the relationship between nutrition and mental health, highlighting the potential of dietary factors to contribute to the prevention and therapeutic management of a range of mental disorders (Gheonea et al., 2023). Recent research indicates that dietary patterns have a significant impact not only on physical health and body composition but also on mood regulation and overall mental well-being (Muscaritoli, 2021).

This review aims to synthesize current knowledge regarding the impact of specific micro- and macronutrients, on stress reduction, improvement in sleep disorders, attenuation of anxiety, mitigation of mild cognitive impairment, and their role in various neuropsychiatric disorders, all of which significantly impact the quality of life for a growing number of individuals.

ROLE OF NUTRITION IN MENTAL AND EMOTIONAL WELL-BEING

It is well known that diets characterized by high consumption of processed foods, refined sugars, and saturated fats have been consistently linked to adverse mental health outcomes, including heightened risks of stress, anxiety, and depressive symptomatology (Hepsomali et al., 2024; Hassan et al., 2023). The results underscore the critical importance of dietary choices in modulating neurobiological processes and maintaining optimal mental health. This intricate connection necessitates a deeper exploration into the mechanisms through which nutrients impact brain health, such as enabling metabolic reactions, supporting mitochondrial function, reducing inflammation, and assisting with detoxification (Rucklidge et al., 2021). A healthy dietary profile, encompassing both macro- and micronutrients, is crucial for modulating endogenous hormones, neuropeptides, neurotransmitters, and the intricate microbiota-gut-brain axis, thereby playing a pivotal role in stress management and the cognitive function preservation (Muscaritoli, 2021). Optimal nutritional intake is therefore considered an essential, yet often

overlooked, component in the holistic management of psychiatric conditions (Villagomez et al., 2023). Research indicates that while pharmacological and psychological interventions are available for mental health issues, daily preventive measures, including proper nutrition, are crucial for stress reduction and addressing minor mental abnormalities (Suzuki et al., 2024). Many patients, unfortunately, consume diets high in ultra-processed foods, necessitating a focus on adequate nutritional intake as a fundamental component of any comprehensive psychiatric treatment plan (Villagomez et al., 2023). However, due to various biological, behavioural, and environmental factors, including modern farming practices, achieving nutritional requirements through diet alone can be challenging (Villagomez et al., 2023). This difficulty highlights the potential utility of broad-spectrum micronutrient supplementation as a viable strategy to bridge nutritional gaps and support brain function (Villagomez et al., 2023). Indeed, compelling evidence now positions nutritional medicine centrally within psychiatric discourse, demonstrating robust associations between dietary quality and mental health outcomes, often indicating a protective effect of healthy diets on mood (Sarris et al., 2015; Martins et al., 2023). For instance, studies indicate that individuals adhering to high-quality diets tend to exhibit a reduced incidence of neuropsychiatric conditions, highlighting the preventive potential of nutritional interventions (Martins et al., 2023). Furthermore, growing evidence from large observational studies confirms that dietary quality is inversely related to the risk of common mental disorders such as depression across diverse populations and age groups (Jacka, 2017). This robust relationship between a healthy diet and mental well-being is further supported by evidence indicating that specific foods and their compounds can modulate biomarkers and molecular mechanisms implicated in the aetiology of several mental disorders, thereby offering avenues for disease progression containment and prophylaxis (Offor et al., 2021). Consequently, the emerging consensus posits that dietary intake and nutritional status are critical determinants of mental health and the predisposition to psychiatric disorders, underscoring the potential for nutritional interventions to enhance treatment outcomes (Lim et al., 2016). Despite significant advancements in psychopharmacotherapy and psychotherapy, a substantial proportion of patients do not achieve optimal treatment outcomes, thereby accentuating the imperative for complementary strategies like nutritional interventions to address unmet therapeutic needs in neuropsychiatric disorders (Martins et al., 2023; Grajek et al., 2022). This growing recognition has led to the establishment of nutritional psychiatry, an interdisciplinary field that investigates the complex interplay between diet, nutrition, and mental health (Sarris et al., 2015). This field explores how specific nutrients can act as adjunctive treatments or even monotherapies for various mental disorders, leveraging the understanding that optimal brain function is fundamentally dependent on a comprehensive nutritional foundation (Jacka, 2017).

The Role of Macro and Micronutrients in Mental Health

Current research highlights inflammation, oxidative stress, dysbiosis of the intestinal microbiota, mitochondrial dysfunction, and altered neural plasticity as critical biological pathways mediating the complex interaction between dietary components and the pathophysiology of mental disorders (Dal & Bilici, 2024). For example, studies indicate that specific dietary patterns, such as the Mediterranean diet, are associated with a reduced risk of depression due to their anti-inflammatory properties and positive influence on the gut microbiome (Magzal et al., 2023). On the contrary, diets high in ultra-processed foods can exacerbate these detrimental pathways, contributing to increased systemic inflammation and dysbiosis, which are increasingly recognized as contributors to neuropsychiatric symptoms (Grajek et al., 2022). This understanding underscores a paradigm shift in mental health aetiology, moving beyond purely neurochemical explanations to encompass a broader physiological perspective that includes systemic factors like inflammation and gut health (Kaplan et al., 2015). Consequently,

nutritional counselling is increasingly viewed as a vital, yet often underutilized, component within comprehensive mental healthcare strategies, particularly for patients whose conditions may be exacerbated by poor dietary habits (Fenton et al., 2024; Granero, 2022). Furthermore, emerging research consistently demonstrates a bidirectional relationship between major depressive disorder and nutritional status, where individuals with depression frequently exhibit critical nutrient deficiencies and aberrant dietary patterns (Ortega et al., 2022). These nutritional problems often stem from altered appetites, stress-related eating habits, and medication side effects, further complicating their overall health status (Uysal and Altuncevahir, 2023).

Deficiencies in omega-3 fatty acids, along with other essential nutrients such as B vitamins, vitamin D, magnesium, zinc, selenium, iron, calcium, and protein, are frequently observed in individuals with depressive symptoms and can significantly impair brain and nervous system function (Zielińska et al., 2023). Such deficiencies can disrupt cellular membrane fluidity, a crucial factor in the pathogenesis of depression, by increasing cellular vulnerability to injury and death (Barzegaran et al., 2023). This bidirectional relationship between major depressive disorder and malnutrition highlights the critical need for dietary interventions as a promising therapeutic avenue, as depressed individuals frequently lack key nutrients and exhibit aberrant dietary patterns (Ortega et al., 2022).

Omega-3 fatty acids. These essential polyunsaturated fatty acids are critical for brain health, influencing neuronal membrane fluidity, neurotransmitter function, and anti-inflammatory pathways (Hoepner et al., 2021). Their supplementation has been shown to improve symptoms in several mental disorders, including major depression and bipolar disorder, by modulating inflammatory responses and supporting synaptic plasticity (Bozzatello et al., 2024). Docosahexaenoic acid and eicosapentaenoic acid, two prominent omega-3 fatty acids, are particularly vital for neurodevelopment and maintaining cognitive function throughout the lifespan. Their presence is crucial for regulating synaptic plasticity, neurogenesis, and neurotransmission, thereby impacting mood, cognitive functioning, anxiety, and depression (Magzal et al., 2023). Moreover, the anti-inflammatory effects of omega-3 fatty acids contribute to neuroprotection and may mitigate processes implicated in neurodegenerative conditions, further broadening their therapeutic potential (van Zonneveld et al., 2024). Additionally, an imbalanced ratio of omega-3 to omega-6 fatty acids, prevalent in modern diets, is frequently correlated with an elevated risk of major depressive disorder (Aly and Engmann, 2020). This imbalance underscores the need for dietary adjustments to optimize brain health and reduce susceptibility to mood disorders.

These polyunsaturated fatty acids contribute to the modulation of neuroinflammation and neurotransmitter function, which are key mechanisms implicated in depressive disorders (Serefko et al., 2024). Considering the widespread prevalence of depressive disorders, affecting approximately 280 million individuals globally in 2019 and projected to be the leading cause of disease burden by 2030, the exploration of dietary interventions such as omega-3 supplementation becomes increasingly pertinent, especially given the suboptimal responses and side effects associated with conventional treatments (Chen et al., 2024). Although numerous studies address the efficacy of omega-3 and omega-6 fatty acids as adjunctive therapies for mood disorders, evidence regarding their monotherapy use for major depressive disorders as an alternative to established treatments remains limited (Accinni et al., 2022).

Vitamin B complex. A wide range of micronutrients are integral to the maintenance of mood stability and cognitive function. In particular, B vitamins - especially B6, B9, and B12 - serve as critical cofactors in neurotransmitter biosynthesis and one-carbon methylation cycles that regulate gene expression implicated in mental health. Deficiencies in these vitamins have been linked to an elevated risk of depressive disorders and cognitive decline (Muscaritoli, 2021). These water-soluble vitamins, particularly B9, B12, are crucial cofactors in numerous metabolic pathways vital for brain function, including neurotransmitter synthesis and homocysteine

regulation, a key process implicated in epigenetic modifications and neuronal health (Khiroya et al., 2023). For instance, deficiencies in vitamin B12 can lead to neurological dysfunctions, mood disorders, and cognitive decline due to its role in myelin formation and neurotransmitter synthesis (Baik, 2024). Similarly, B9 vitamin plays a critical role in the methylation cycle, impacting the production of monoamine neurotransmitters such as serotonin, dopamine, and norepinephrine, which are directly associated with mood regulation (Khiroya et al., 2023). Abnormal levels of vitamin B9, homocysteine, and S-adenosylmethionine have been consistently linked to an elevated risk of depression, highlighting the intricate connection between B-vitamin status and mental well-being (Hoepner et al., 2021). Moreover, evidence suggests that supplementation with B vitamins can significantly reduce depressive symptoms, particularly in populations with documented deficiencies (Rao et al., 2008). Specific B vitamins, including thiamine, riboflavin, and niacin, play essential roles in maintaining normal neurological function, and deficiencies in these nutrients have been associated with an increased prevalence of depressive symptoms (Jahan-Mihan et al., 2024). It is obvious that suboptimal nutrition, particularly a lack of micronutrients such as B9 and B12 vitamins, directly impacts the neuroendocrine system and has been identified as a contributing factor to the underlying pathology of depressive disorders (Liwinski and Lang, 2023). The interplay between these micronutrients and neurotransmitter production underscores their significance in the aetiology and management of mood disorders, with folate (vitamin B9) supplementation, in particular, demonstrating potential in improving mood and enhancing antidepressant efficacy (Matta et al., 2020). Vitamin B9, specifically, is essential for the metabolism of 5-methyltetrahydrofolate (5-MTHF) and homocysteine, with deficiencies in 5-MTHF strongly linked to treatment-refractory depression (Rodriguez et al., 2017). Individuals suffering from depression frequently exhibit low levels of serum and red blood cell folate, with approximately one-third experiencing outright deficiency (Liwinski and Lang, 2023; Miller, 2008). Furthermore, vitamin B12 deficiency specifically leads to elevated levels of neurotoxic homocysteine and methylmalonic acid, disrupting myelin stability and neurotransmitter biosynthesis, including serotonin, epinephrine, and dopamine (Ceolin et al., 2023; Baik, 2024). Low B9 and B12 concentrations have been correlated with depressive disorders, while evidence has suggested that both of these vitamins may enhance the effectiveness of antidepressants (Laird et al., 2021). This is particularly relevant as B vitamins, such as B9 and B12, are integral to key neurochemical pathways, including serotonergic and dopaminergic systems, and play a crucial role in epigenetic regulation and DNA/RNA synthesis within the brain (Ryan et al., 2020). A biological plausibility exists between B12 and depression due to B12's role as a necessary cofactor for methionine synthesis, which provides the precursor for S-adenosylmethionine, essential for neurotransmitter formation (Laird et al., 2021). Given the widespread prevalence of major depressive disorder and the suboptimal efficacy of conventional treatments, a holistic approach integrating nutritional interventions, such as specific nutraceuticals, has emerged as a promising strategy to mitigate depressive symptoms and enhance overall treatment outcomes (Davis et al., 2025). Specifically, folates and S-adenosylmethionine, intrinsically linked within the one-carbon cycle metabolic pathway, have garnered significant attention due to substantial evidence supporting their involvement in mood disorders (Papakostas et al., 2012). These nutrients are critical for the normal development and function of the central nervous system, with their metabolism directly supporting the synthesis of S-adenosylmethionine, a primary methyl group donor vital for various methylation reactions in the brain (Bottiglieri, 2013). For instance, genetic polymorphisms in the methylenetetrahydrofolate reductase gene, such as the A1298C missense mutation, can impair the synthesis of 5-methyltetrahydrofolate, leading to elevated homocysteine levels and a diminished response to antidepressant treatments (Yuan et al., 2020). The enzyme methyltetrahydrofolate reductase plays a crucial role in converting

5,10-methylenetetrahydrofolate to 5-methyltetrahydrofolate, which is the biologically active form of folate essential for one-carbon metabolism and the synthesis of S-adenosyl-L-methionine, a universal methyl donor (Khiroya et al., 2023). This conversion is critical as S-adenosyl-L-methionine is indispensable for numerous methylation reactions in the brain, impacting neurotransmitter synthesis, epigenetic regulation, and the overall integrity of neuronal function (Cicero & Minervino, 2022).

Magnesium. This essential mineral serves as a cofactor for over 300 enzymatic reactions in the body, including those vital for energy production, DNA synthesis, and nerve impulse transmission. Its involvement in the regulation of neurotransmitters like serotonin and dopamine, along with its role in modulating the hypothalamic-pituitary-adrenal axis, underscores its significant impact on mental and emotional well-being. Research indicates that magnesium deficiency is frequently observed in individuals with depression and anxiety, and supplementation has shown promise in ameliorating symptoms by influencing NMDA receptor activity and reducing neuronal excitability (Zielińska et al., 2023).

Other micronutrients. In addition to B vitamins, other essential micronutrients - including choline, zinc, and vitamin A - play crucial roles in neurodevelopment, cognitive performance, and the regulation of emotional processes (Sarkisova and Luijtelaar, 2022; Rodriguez et al., 2017). Robson (2012) argued that choline plays a crucial role in neurotransmitter synthesis, particularly acetylcholine, which is vital for learning and memory. Zinc is indispensable for synaptic plasticity and neurotransmission, while vitamin A contributes to neurogenesis and cellular differentiation, thereby collectively underpinning robust mental and emotional health (McGarel et al., 2014). Furthermore, imbalances in one-carbon metabolism, often stemming from deficiencies in B vitamins like B9 and B12, have been directly implicated in neurodevelopmental disorders such as Autism Spectrum Disorder, highlighting the critical role these micronutrients play in maintaining neurological homeostasis and preventing neuropsychiatric conditions (Avram et al., 2025). Moreover, inadequate provision of nutrients like vitamin A can impair cognitive function and has been implicated in neurological disorders like Parkinson's and Alzheimer's disease (Robson, 2012). These micronutrients, beyond their individual contributions, often interact synergistically, emphasizing the need for a comprehensive dietary approach rather than focusing on isolated nutrients for optimal brain health (Rucklidge et al., 2023). This comprehensive perspective extends to early developmental stages, where maternal diet directly influences foetal brain development and subsequent cognitive function (Riaz, 2024). Deficiencies in essential micronutrients like vitamin B12 and B9 during critical periods of neurodevelopment, including gestation and early childhood, can lead to significant neurological and psychiatric consequences, underscoring the necessity of adequate maternal and infant nutrition (Anmella et al., 2025; Rodriguez et al., 2017). Research has demonstrated that supplementing the maternal diet with specific nutrients such as choline and lutein can yield beneficial effects in mitigating anxiogenic behaviours in offspring (Lindsay et al., 2018). The impact of diet extends beyond specific micronutrients, as broader dietary patterns, such as Western dietary habits, have also been linked to adverse mental health outcomes (Muscaritoli, 2021). This underscores the importance of a balanced and varied diet, rich in both macronutrients and micronutrients, for the preservation of normal brain function and mental well-being, even into adulthood (Muscaritoli, 2021).

The Impact of Nutritional Deficiencies

The impact of nutritional deficiencies on mental and emotional well-being is profound, with numerous studies demonstrating a clear link between inadequate nutrient intake and an increased risk of neuropsychiatric disorders (Shayganfard, 2021; Muscaritoli, 2021). Specifically, insufficiencies in vital micronutrients such as vitamin B12, B9, calcium, iron, selenium, zinc, and magnesium are consistently associated with depressive symptoms, particularly in vulnerable populations like pregnant women (Monk et al.,

2019). Moreover, early life nutritional deficits, often stemming from such maternal deficiencies, have enduring consequences, potentially influencing neurodevelopment and increasing susceptibility to neuropsychiatric disorders later in life (Mattei & Pietrobelli, 2019). Evidence also suggests that lower serum levels of vitamin D, zinc, and vitamin B12 and B9 are linked to heightened depressive symptoms, although further research is needed to predict individual risk (Bradley et al., 2020). Therefore, a well-balanced diet rich in various micronutrients and macronutrients can positively influence mental health through mechanisms involving anti-inflammatory and antioxidant pathways, neurogenesis, and modulation of the gut-brain axis (Muscaritoli, 2021). This underscores the critical importance of nutritional interventions, not only as a preventative measure but also as a therapeutic strategy in addressing mental health challenges (Villagomez et al., 2023). Nutritional interventions show promise in alleviating mental health disorders, but more long-term studies are needed to confirm their exact effectiveness. Furthermore, a diet characterized by high fat and sugar content has been implicated in adverse neurodevelopmental outcomes and an elevated risk of depression (Monk et al., 2019). This emphasizes that nutritional choices play a critical role throughout the lifespan in influencing brain health and emotional stability (Martins et al., 2023). Moreover, modern dietary patterns, often characterized by nutrient-poor ultra-processed foods, necessitate a re-evaluation of current nutritional guidelines to better support mental well-being (Villagomez et al., 2023). This dietary shift towards processed foods, coupled with widespread nutritional deficiencies, creates a pressing nutritional health crisis that demands a multi-faceted approach, including policy changes to improve food environments and education (Townsend et al., 2023). Specifically, the prevalence of magnesium deficiency, estimated at approximately 60% in Western populations, highlights a critical but often overlooked nutritional imbalance that may contribute to mood disorders (Khiroya et al., 2023). This widespread deficiency in magnesium, along with other critical micronutrients, underscores the systemic issue of inadequate dietary intake in modern societies, necessitating a deeper exploration into the interconnectedness of nutrition and neuropsychiatric conditions (Villagomez et al., 2023). Research in nutritional psychiatry has extensively demonstrated a robust association between dietary patterns and mental health outcomes, identifying specific nutritional factors as causative or sustaining elements in conditions like depression (Khiroya et al., 2023). This rapidly advancing field has evolved from observational studies showing correlations to intervention trials that are beginning to demonstrate causality, indicating that nutritional interventions may be a promising approach for both the prevention and treatment of mental disorders (Jacka, 2017). The protective effects of healthy diets on mood are well-established, while unhealthy diets have been shown to have a detrimental impact on the mental health of both young people and adults (Sarris et al., 2015). The emerging field of *Nutritional Psychiatry* holds significant promise for alleviating the global burden of mental disorders, as it consistently demonstrates an association between diet quality and the risk of common mental illnesses, such as depression, across various populations and age groups (Jacka, 2017). Furthermore, the multifactorial nature of psychiatric conditions necessitates a multidimensional approach where adequate nutritional intake is deemed essential for optimal mental health and should be an integral part of any psychiatric treatment plan (Villagomez et al., 2023). This growing body of evidence supports the notion that dietary considerations should be integrated into mainstream psychiatric care, moving beyond conventional pharmacological approaches to embrace a holistic view of patient well-being (Sarris et al., 2015). This shift in perspective is especially relevant in light of the increasing global prevalence of mental illness and the well-documented tendency for individuals with psychiatric disorders to experience poorer nutritional status (Fenton et al., 2024). Such integration can enhance the efficacy of existing psychotherapeutic and psychopharmacological interventions by addressing underlying nutritional imbalances that may impede

recovery (Shah et al., 2021). In fact, patients with neuropsychiatric disorders often exhibit unhealthier dietary and lifestyle habits, which, coupled with medication-related side effects, can exacerbate issues like obesity and other metabolic diseases (Martins et al., 2023).

The Holistic Diet and Its Benefits

A holistic dietary approach, often exemplified by the Mediterranean Diet, emphasizes whole, unprocessed foods and has been consistently linked to improved mental and emotional well-being by mitigating inflammation, oxidative stress, and supporting a healthy gut microbiome (Bayes et al., 2023; Gheonea et al., 2023). This dietary pattern, rich in fruits, vegetables, whole grains, nuts, seeds, and olive oil, provides a diverse array of micronutrients and bioactive compounds that are crucial for neuronal health and neurotransmitter synthesis (Grajek et al., 2022). Beyond these macroscopic benefits, a high-quality diet, characterized by an abundance of fruits, vegetables, whole grains, and lean proteins, directly correlates with enhanced mental health outcomes (Hassan et al., 2023). This association is mediated by various biological mechanisms, including the modulation of neurotransmitter pathways, regulation of the gut-brain axis, and reduction of systemic inflammation, all of which are critical for optimal cognitive function and mood regulation (Dal and Bilici, 2024; Offor et al., 2021). Conversely, diets high in ultra-processed foods, often laden with unhealthy fats, refined sugars, and artificial additives, are increasingly recognized as detrimental to mental health, potentially contributing to systemic inflammation, dysbiosis, and impaired neuroplasticity (Ribeiro et al., 2024). This reinforces the imperative for dietary interventions that prioritize nutrient-dense whole foods to foster resilience against mental health challenges and support comprehensive well-being (Mörkl et al., 2024). The intricate interplay between nutrition and mental health highlights the necessity of considering dietary patterns as a fundamental component of preventative and therapeutic strategies for psychological disorders (LaChance et al., 2021). Recognizing this, nutritional counselling, though not exclusively confined to psychiatric settings, is becoming an increasingly vital component of comprehensive mental healthcare (Fenton et al., 2024). However, despite the growing evidence, nutritional considerations are frequently overlooked in mental health treatment plans, with interventions often focusing solely on pharmacological or psychotherapeutic approaches (Granero, 2022). This oversight can be attributed to a lack of specialized training in nutritional science among mental health professionals, limiting their ability to effectively integrate dietary advice into clinical practice. This gap in professional development underscores the need for comprehensive educational initiatives to equip practitioners with the knowledge and skills necessary to incorporate evidence-based nutritional strategies into their therapeutic repertoires. This includes understanding the complex interplay between macro and micronutrients, their impact on neurobiology, and the specific dietary patterns that optimize mental well-being (Rucklidge et al., 2021). Future research should focus on robust, clinically relevant trials to further elucidate effective nutrition interventions for mental disorders, potentially leveraging dietitians to improve the feasibility and efficacy of these interventions (Cherak et al., 2020). Moreover, the brain's substantial metabolic activity underscores its reliance on precise nutritional inputs to maintain crucial functions such as neurogenesis, synaptic plasticity, and overall neuroprotection (Clemente-Suárez et al., 2025). This dependency highlights the critical role of specific nutrients, such as branched-chain amino acids, selenium, and fatty acids, in mitigating neurological and psychiatric disorders (Martins et al., 2023). Consequently, deficiencies in these critical nutrients can significantly impair neuronal function and exacerbate neuropsychiatric symptomology, emphasizing the need for a comprehensive nutritional assessment in clinical practice (Muscaritoli, 2021). Such assessments can identify specific nutritional gaps or imbalances that, when addressed through targeted dietary adjustments or supplementation, may significantly improve patient outcomes and complement traditional psychiatric treatments (LaChance et al., 2021). This evolving understanding underscores the critical need for

integrating nutritional expertise into multidisciplinary mental healthcare teams to optimize patient prognosis and foster long-term mental resilience.

Psychobiotics - a specific class of probiotics with mood-regulating properties - have attracted increasing scientific interest for their capacity to modulate gut microbiota and positively influence mental health. Clinical evidence indicates that supplementation with particular probiotic strains, such as *Lactobacillus rhamnosus* and *Bifidobacterium breve*, can alleviate symptoms of anxiety and depression by modulating gut–brain communication pathways and reducing cortisol levels. Consequently, diet plays a pivotal role in mood regulation through its effects on neurotransmitter synthesis, inflammatory processes, and gut microbiota composition. Nutritional interventions - such as anti-inflammatory dietary patterns, targeted micronutrient supplementation, and probiotic intake - represent promising strategies for enhancing mental well-being (Figure 2).

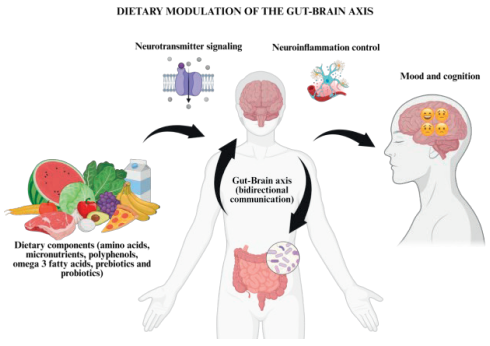

Figure 2. The role of nutrition in promoting the mental health and emotional well-being. Designed with Biorender (accesed on 01 november 2025)

The integration of dietary approaches into psychiatric care may offer a more comprehensive framework for the management of mental health, with potential benefits for both individuals and healthcare systems.

Nutritional Psychiatry - A Developing Field

This emerging discipline explores the intricate connections between diet, mental health, and neurobiological processes, seeking to leverage nutritional interventions for the prevention and treatment of psychiatric disorders (Kaplan et al., 2015). It draws upon a burgeoning body of research demonstrating how dietary patterns and specific nutrients can influence brain function, mood regulation, and cognitive processes (Horovitz, 2024). For instance, modulating the gut-brain axis through specific dietary interventions has been identified as a key strategy to mitigate the onset and progression of various mental health disorders (Larroya et al., 2021). This bidirectional communication network (Figure 2), linking the enteric nervous system and the central nervous system, integrates information from the gut and the brain to regulate bodily functions and mental health (Randeni & Xu, 2025). Furthermore, aberrations in gut microbiota composition, often induced by poor dietary habits, have been directly implicated in the pathophysiology of depression and anxiety (Bozzatello et al., 2024). This highlights the therapeutic potential of prebiotics and synbiotics, which can favourably alter gut microbiota and subsequently improve mood and reduce psychological distress, as evidenced by randomized controlled trials (Bertocchi et al., 2023). Beyond this, various individual nutrients are increasingly recognized for their profound impact on brain health, with deficiencies in compounds like B vitamins, vitamin D, magnesium, zinc, selenium, iron, calcium, and omega-3 fatty acids significantly affecting neurological and psychiatric function (Zielińska et al., 2023). For instance, B12 and B9 vitamins are critical for methylation reactions and homocysteine regulation, both of which are implicated in the pathophysiology of depression (Khiroya et al., 2023). Similarly, omega-3 fatty acids, particularly eicosapentaenoic acid and docosahexaenoic acid, are crucial for neuronal membrane integrity, neurotransmitter synthesis, and anti-inflammatory processes, with their deficiency linked to an increased risk of mood disorders (Lim et al., 2016). Given this, targeted nutritional interventions, including supplementation with these essential micronutrients, demonstrate considerable promise as adjunctive therapies in managing psychiatric conditions and fostering overall mental well-being (Linsmayer et al., 2024). This burgeoning field of nutritional psychiatry further investigates how specific dietary

components influence the gut microbiome, which in turn modulates the gut-brain axis, thereby impacting mental health outcomes (Horn et al., 2022; Yu et al., 2024). Specifically, an imbalanced gut microbiota, often resulting from inadequate nutrition, can lead to systemic inflammation that contributes to the development of mental health disorders like anxiety and depression (Portillo et al., 2024; Kumar et al., 2023). This intricate communication between the gut and brain, facilitated by neural, endocrine, immune, and metabolic pathways, is profoundly influenced by the gut microbiome, which produces crucial neurotransmitters and modulates inflammation (Moshfeghinia et al., 2025). Conversely, specific dietary patterns, such as the Mediterranean diet, rich in fibres, omega-3 fatty acids, and antioxidants, have been shown to foster a diverse and healthy gut microbiome, which is associated with reduced inflammation and improved mental health outcomes (Tae and Kim, 2024). Emerging evidence underscores that insufficient nutrition compromises brain health, mental well-being, and psychological functioning, largely mediated by the intricate dynamics of the brain-gut-microbiota system (Merlo et al., 2024).

CONCLUSIONS

The economic burden associated with mental health conditions is substantial, as productivity losses considerably exceed the direct costs of treatment and care.

Physical inactivity, along with a diet high in ultra-processed, hypercaloric, and nutrient-poor foods, combined with inadequate hydration, can negatively affect both the quality and duration of sleep and contribute to increased restlessness. Over time, these factors may lead to chronic fatigue and psycho-emotional disturbances, including irritability and depressive symptoms.

Functional foods containing bioactive constituents - such as polyphenols, flavonoids, probiotics, prebiotics, and omega-3 fatty acids - have been identified as key nutritional factors capable of modulating neurobiological pathways that influence mood regulation and mental well-being.

Understanding the direct impact of specific micronutrients, such as B vitamins, vitamin D, and zinc, on neurotransmitter function, neuroinflammation, and overall brain health is paramount for developing effective dietary interventions for mood disorders. Further research is needed to delineate the precise mechanisms through which these nutrients exert their therapeutic effects, particularly in diverse populations and clinical contexts. Vitamin B12 deficiency, for example, is strongly linked to neurological dysfunction, mood disorders, and cognitive decline, especially in older adults. Moreover, emerging evidence suggests that the broader brain-gut-microbiota system plays a crucial role in these processes, influencing nutrient absorption, utilization, and subsequent impact on cognitive and emotional well-being. This bidirectional communication network, linking the gastrointestinal system and the brain, significantly influences mood regulation, neuroplasticity, and other indices of mental health through the production of neurotransmitters, immune signalling molecules, and various metabolic substances. Furthermore, dietary patterns significantly impact molecular processes governing energy metabolism and synaptic plasticity through their influence on microbiome composition, microbial metabolites, gastrointestinal signalling, and neurotransmitters. Dietary interventions aimed at modulating the gut microbiome, therefore, hold considerable promise for therapeutic applications in various brain disorders. This includes exploring how whole-dietary approaches, rather than isolated nutrient interventions, can influence the microbiota–gut–brain axis to foster improved brain and mental health, especially within clinical populations. Further investigations into the nuanced interactions between personalized dietary interventions, gut microbiota composition, and mental health outcomes are essential for developing targeted and effective strategies. Such research should encompass comprehensive methodologies, including advanced metabolomics and metagenomics, to unravel the complex biochemical pathways mediating these interactions. Furthermore, while the precise mechanisms are still being elucidated, dietary interventions are emerging

as a promising tool for managing major depressive disorder, as nutritional deficiencies and aberrant dietary patterns are frequently observed in individuals with depression.

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