

The Power of Nutrition: a Guide to Mental Health

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Abstract

Physical abilities psychological, social interactions, and spiritual wellness are all crucial to complete wellness. The prevalence of mental health issues among the world's population is rising, making it necessary to investigate alternate approaches for both prevention and treatment. Given the importance of diet in our everyday lives, if enough knowledge is raised, it will be simpler to make changes and comprehend how it relates to mental health. The importance of mental health, the range of issues related to it, and the nutrients that either directly or indirectly contribute to the rise in these issues are all examined in this review. Regardless of one's position on the spectrum, research indicates a beneficial correlation between mental health and proper diet. The interplay of genetic and environmental variables impacts numerous aspects of human growth and illness. Biochemical alteration of DNA is a significant epigenetic mechanism that seems to underpin the interplay between our genes and environmental variables, including nutrition. Regardless of one's position on the spectrum, research indicates a beneficial correlation between mental health and proper diet. Thus, it becomes critical to comprehend the obvious connection between diet and mental health as well as identify discrepancies in understanding.

Keyword : Mental health, Nutrition, Diet, Food Psychology ,Eating behaviour, Depression, Dietary deficiency diseases, anxiety.

Introduction

The wide range of actions and states pertaining to mental and emotional well-being that include managing day-to-day difficulties to behavioral health illnesses including anxiety, depression, and other psychiatric problems are together referred to as behavioral health conditions[1]. Due to the vital function that nutrients play in the neuroendocrine system, suboptimal diet has been linked to the underlying pathophysiology of behavioral health issues[2]. Neurotransmitters like serotonin, dopamine, and norepinephrine, which are involved in the regulation of mood, appetite, and cognition, are produced by the body using nutrients like tryptophan, vitamin B6, vitamin B12, folic acid (folate), phenylalanine, tyrosine, histidine, choline,

and glutamic acid. The omega-3 fatty (n-3) fatty acids obtained from marine sources control serotonergic and dopaminergic neurotransmission, which can lessen anxiety and depression. As a result, a poor diet that results in insufficient nutrient intake poses a risk factor for the emergence of mental health conditions and should be minimized[3,4]. According to contemporary estimates, 13% of the world's diseases are caused by mental, neurological, and substance-use disorders such as schizophrenia, depression, epilepsy, dementia, and alcohol dependency. This puts mental illness at the top of the list, accounting for more cases than both cancer and cardiovascular disease [5]. Although depressing, these numbers may not come as a surprise given that there is currently one new instance of dementia identified

every four seconds, or 77 million cases annually[6]. Over 300 million individuals worldwide currently suffer from depression, a rise of more than 18% from 2005 to 2015[7]. Between 15 and 30 million individuals are committing suicide in 2020, and 1.5 million people are expected to die by suicide annually[8]. The rush of life, the desire of self-actualization, and the ensuing overstimulation and lack of leisure are inherent in urbanization and the associated technical and cultural progress, and they have an impact on changes in eating habits and the intake of processed and high-calorie foods [9]. From the perspective of public health, we can view them as variables that are significant in shaping the development of diseases that affect civilization. Not to be overlooked among them are anxiety and depression disorders, which are spreading around the world [10]. In Poland and around the world, the number of people in need of professional mental health care is rising significantly. According to the International Health Metrics Evaluation (IHME), at the end of 2017, 13% of the world population suffered from mental disorders [11]. The COVID-19 epidemic and associated sanitary regulations did not help the situation; instead, they caused many people to feel alone, depressed, anxious, and misinformed [12]. Although perspectives on this type of help remain separated, statistics in the psychological and psychotherapy support field are thought to be superior. Additionally, it is uncommon to see psychologists' and psychotherapists' registrations. The psychiatric treatment model and mental health assistance are changing as a result of the phenomena that have been outlined. Over the coming decades, it is anticipated that the number of persons seeking psychiatric care would rise. Treatment outcomes are not always as anticipated when psychopharmacotherapy and psychotherapy are used [13]. Consequently, there is a growing focus on alternate therapies. Research on how nutrition affects mental health has increased dramatically in recent years, and this could be a significant factor

in the prevention of many mental illnesses. Consequently, the purpose of this review is to address the following questions: is there scientific evidence in favor of the relationship between diet and mental health? If so, how much does it affect mental health?

Psychoprotective Food and Mental Health

Research findings showing a clear connection between diet and mental health are just now starting to surface. That being said, a number of studies have found a strong link between mental health and eating healthily. This information can help guide dietary recommendations in the future [14]. For instance, consuming a diet higher in fresh fruits and vegetables has been linked to higher levels of well-being and mental health as well as higher levels of subjective happiness[15,16,17] It is believed that 1,014 bacteria make up the intricate ecosystem that is the gut microbiota. It surpasses the human genome in number by almost 150 times, with 3.3 million genes. It is constructed concurrently by about a thousand distinct kinds of microbes [18]. Multiple communication mechanisms are employed by the gut-brain axis, which describes the reciprocal link between the central nervous system and the gastrointestinal tract. The vagus nerve and the autonomic nervous system can facilitate information transmission between them [19]. Numerous effects of probiotics on mental health are linked to the vagus nerve's ability to transmit information [20]. Furthermore, the development and variety of gut microbiota are impacted by stress [21]. Immune system function is another channel of communication. The gastrointestinal mucosal immune system's appropriate development is aided by the microbiota [22]. Its appropriate operation is shaped by bacterial antigens such as lipopolysaccharides, polysaccharide A, and thymic acids [23]. Neurotransmitters that directly impact the neurological system are also produced by the microbiota, including butyric acid, gamma-

aminobutyric acid, serotonin, dopamine, and short-chain fatty acids [24]. Prebiotics are indigestible parts of food that ferment in the digestive tract to either increase or decrease bacterial growth or activity, or both, which results in the formation of advantageous intestinal microflora [25]. Fructooligosaccharides and inulin are examples of components that can be found in prebiotics. By preventing the formation of harmful bacteria, prebiotics may potentially be advantageous. Prebiotics can also lessen inflammation by altering the microbiota's composition, according to certain study findings [26].

Prebiotics and probiotics are both included in synbiotic substances. The utilization of these preparations' synergistic effects is made possible by such a constellation. Psychobiotics, on the other hand, are probiotic bacteria that have beneficial

outcomes in individuals undergoing treatment for mental health issues. Over the course of a month, oral replacement with probiotics like *Lactobacillus helveticus* and *Bifidobacterium longum* was linked to a decrease in the symptoms of anxiety and depressive disorders as well as a reduction in stress levels as determined by measuring cortisol levels in animal models [28]. Antidepressants, often known as antipsychotics, are currently the most effective treatment for mental illnesses. In the future, psychobiotics may be used in addition to other medications to treat anxiety or depressive disorders. It's also important to remember that common antidepressants and antipsychotics might harm the gut flora and alter the microbiome's composition by eradicating the cultures of bacteria that reside in the digestive system [29].

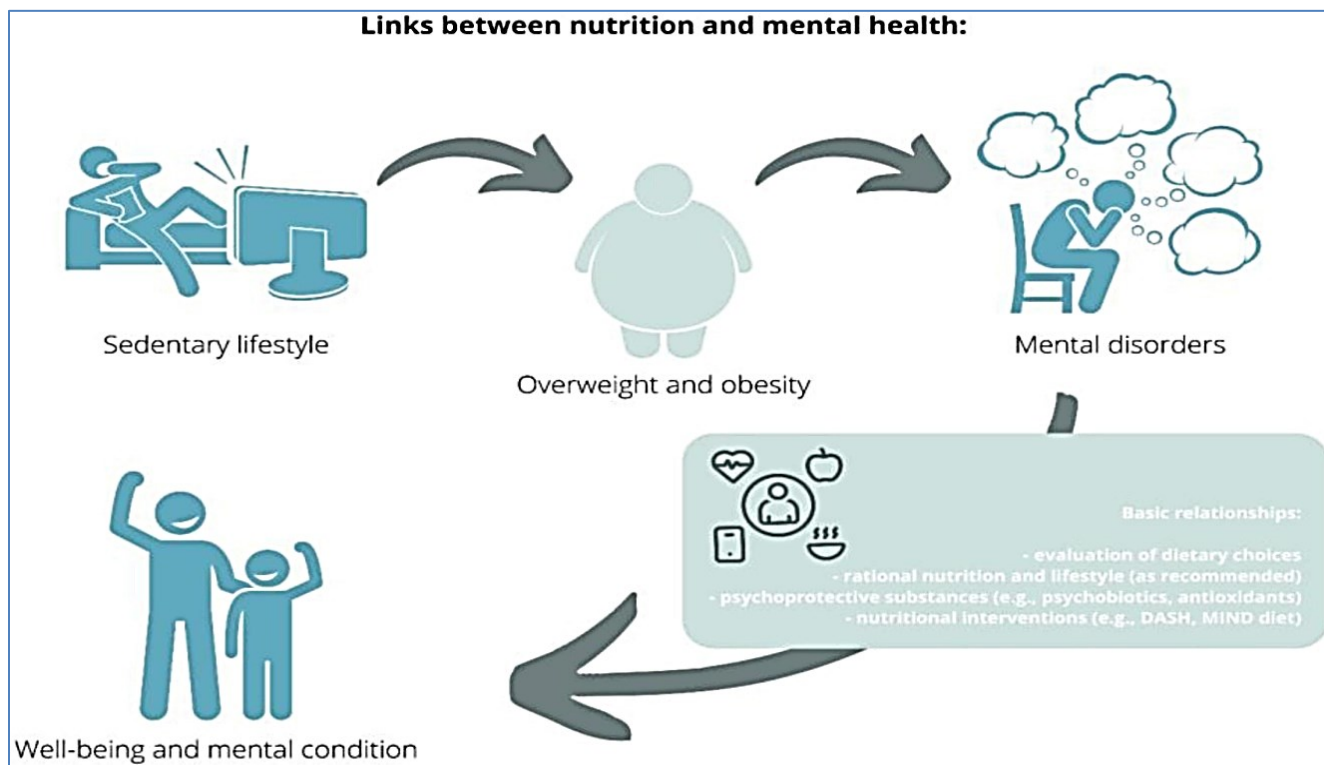


Figure 1 Connections between mental health and diet. [27]

Dietary restrictions associated with certain diseases and vitamin deficiencies that affect mental health

For children with epilepsy, the ketogenic diet is a well-known illustration of a dietary intervention that impacts brain health [30]. The exact mechanism in this instance is unknown, but the fact that ketone bodies—which give the brain its energy while fasting—reduce epileptic seizures suggests that something changed in the energy supply may be important [31]. Another example of how an elimination diet can stop cognitive deterioration is phenylketonurea [32]. Furthermore, research has demonstrated that shortages in a number of nutrients, particularly vitamins, affect cognitive function [33,34]. The strongest correlation is shown with vitamin B12, whose insufficiency is linked to mania, psychosis, depression, exhaustion, and lethargy [35]. The deficiencies of thiamine (vitamin B1), folic acid (vitamin B9; deficits have deleterious effects on neurodevelopment in utero and infancy, and deficits are linked to an increased risk of depression during adulthood and niacin (vitamin B3), which results in Pellagra with dementia as a consequence, [36,37]. Even so, it is unknown how many moderate deficits or mild "subclinical" deficiencies contribute to the development of mental disorder. For instance, there have been inconsistent findings from multiple trials evaluating the impact of vitamin D on mental health.

Effect of macronutrient on anxiety

According to a recent analysis, physicians treating patients with anxiety disorders who are already taking medication does not show any advantage from n-3 fatty acids in terms of clinical trial evidence[38]. Nevertheless, a few modest clinical trials have shown some support for the beneficial effects of n-3 fatty acids on anxiety. A combination of n-3 and n-6 fatty acids (2 capsules daily, totaling 360 mg of linoleic acid and 90 mg of a-linolenic

acid) improved measures of appetite, mood, concentration, fatigue, and organization in a study of undergraduate students who experienced significant anxiety related to taking tests[39]. Anger and anxiety scores were considerably reduced in a study involving twenty-two persons with substance use disorders when they were supplemented with 2250 mg/d of EPA and 500 mg/d of DHA for three months[40].

Micronutrients and anxiety

Anxiety can be caused by deficiencies in magnesium and zinc, according to preclinical and clinical research, and sensations similar to anxiety can be reduced with supplements[41]. Three research trials found that using magnesium supplements in addition to other combination therapy was useful in treating anxiety and associated conditions[42,43]. According to one study, taking magnesium (200 mg/d) and vitamin B6 (50 mg/d) together reduced symptoms associated with anxiety and had a slight synergistic impact[44]. Another study found that people with magnesium shortage experienced less anxiety-like symptoms while taking magnesium taurinate or glycinate (125–300 mg at each meal and bedtime)[45]. Vitamin C pills may help reduce anxiety in both type 2 diabetics and young, healthy people, according to some research[46]. Providing with a combination of L-lysine and L-arginine (3g of each per day) corrected stress-induced hormone responses in another trial involving healthy males with high levels of subjective anxiety[47]. In a similar vein, a different study discovered that giving men and women daily supplements containing 2.64 grams of L-arginine and L-lysine lowered their levels of both trait and state anxiety[48]. Therefore, a combination of L-arginine and L-lysine may be a potentially helpful solution for people who experience high levels of anxiety and mental stress.

Recomdation for Attention-deficit hyperactivity disorder (ADHD) and Autism

Numerous dietary therapies for ADHD have been investigated. Based on parent reports, a meta-analysis of 20 trials with 794 participants discovered a modest impact size of food additive reduction, 0.18, which dropped to 0.12 when potential publication bias was taken into consideration [49]. Furthermore, numerous randomized clinical trials have demonstrated the efficacy of stricter elimination diets. According to two separate meta-analyses, effect values ranging from 0.29 to 0.51 were found in six controlled trials[50]. These studies also indicated that a third of the children diagnosed with ADHD showed some degree of response (>40% symptom reduction)[51]. Furthermore, contrary to the possible protective impact of a diet heavy in fruits and vegetables, a recent meta-analysis revealed that a diet high in refined sugar and saturated fat may display an elevated risk for ADHD or hyperactivity [52]. However, it was also noted that the paucity of research in the literature and design flaws erode the strength of the existing data, necessitating the performance of longitudinal studies in the future. The outcomes of dietary therapies (which range from micronutrient and vitamin D supplements to gluten- and casein-free diets) for autism are likewise incredibly varied and haven't been the focus of thorough meta-analyses. Therefore, more controlled research is needed, especially in the case of autism, and several pathways may account for effectiveness[53].

Nutrition, mental well-being, and cognitive abilities throughout life

In addition to affecting a person's vulnerability to illness, early childhood growth establishes an environment for later stages of growth. Thus, early childhood growth should be considered while customizing nutrition for mental health. The

influence of nutritional interventions on brain growth during the first 1000 days, which includes the period from conception to two years of age, may be greater on later health outcomes than treatments made later in life. Enhancing the basic knowledge of how nutrition impacts immunological, endocrine, metabolic, and other signaling processes—including those mediated by the gut microbiota—will also lead to advancements in the understanding of how nutrition impacts brain function[54,55,56]. Approximately thirteen percent of a newborn's gross body mass is made up of the brain, and there are dietary and energy limitations on how big the brain may grow [57]. It is crucial to have consistent access to a sufficient food supply during this time of fast growth. The cognitive deficits brought on by early-life malnutrition have received a lot of attention in the field of nutritional psychiatry thus far [58,59,60]. In both humans and animals, early nutrition has been demonstrated to impact cognitive performance in adolescence[61,62,63,64]. Breast milk contains lipids, specifically the omega 3- and 6-polyunsaturated fatty acids DHA (docosahexaenoic acid) and ARA (arachidonic acid). However, the mother's diet has an impact on the amount of these fatty acids in the breast milk [65]. A diet high in omega-3 fatty acids or low in omega-6 fatty acids has a good effect on the incorporation of omega-3 fatty acids in neuronal membranes, according to studies conducted on mice [66,67]. According to new research, adult mice's early-life stress-induced cognitive deficits can be totally reversed by following a diet low in omega-6 fatty acids [68]. The results presented here emphasize the significance of young life development in one's susceptibility for subsequent mental illness and the significance of a well-rounded diet for offering a sufficient amount of nutrients to support the brain's growth for later mental abilities. The result could potentially explain, perhaps in part, the observed variation in the impact of therapy.

Maternal nutrition is a determinant of offspring's mental health problems

The developing baby is predisposed to a variety of chronic disorders throughout pregnancy, especially in the early stages of pregnancy, when it is exposed to an adverse environment [69]. Maternal food has been found to have a significant impact on the development of the offspring's central nervous system, neurological system, and immune system—all of which can be critical in the later emergence of mental problems. This theory is supported by data from animal models, which show a connection between perinatal essential fatty acid shortages and less favorable biological development (such as less brain plasticity) in children with mood disorders [70]. Additional evidence from animal research has shown how inadequate diet for mothers (high added sugar and high saturated fat content, for example) affects the sympathetic nervous system's activation and hyperactive behaviors[71]. The consumption of processed meat products, refined cereals, sugary drinks, and salty snacks was indicative of a poor eating pattern during pregnancy. Pizza, soft drinks, cakes, chocolate, chips, and other high-fat/high-sugar meals were indicative of an unhealthy eating habit in youngsters. Fruit, vegetable oils, high-fiber cereals, and vegetables were the staples of a "wholesome" pregnant diet. Children who followed a 'wholesome' diet pattern consumed more fruits, vegetables, eggs, white and oily fish, and other things. Higher scores on an unhealthy dietary pattern during pregnancy were found to predict significant externalizing difficulties among

children, regardless of other potential confounding factors and childhood diet, using data from 23,020 eligible women and their offspring[72]. The aforementioned research underscore the significance of a mother's diet in the development of her kids. Furthermore, they suggest that dietary manipulation throughout the periconception and postpartum period could serve as a crucial approach to enhance the health outcomes of children. "Teachable moments" for bettering food habits to lower the risk of disease start in children may arise during early pregnancy or family planning phases. Higher levels of motivation at this time and regular interactions with family planning or healthcare specialists are mostly to blame for this[73].

Scientifically updated dietary guidance

Diet has an effect on mental health, as epidemiological research has shown, and intervention studies have confirmed this association. Furthermore, people who suffer from specific hereditary and non-genetic illnesses, such as gluten sensitivity, phenylketonuria, and lactose intolerance, benefit from following specific diets. Even still, a lot of relationships are debatable, and it is very hard to find solid proof of a causative mechanism. The precise food ingredients that improve an individual's mental health are not well understood. If a strong body of data supporting dietary recommendations in relation to mental health is to be produced, this research gap must be filled.

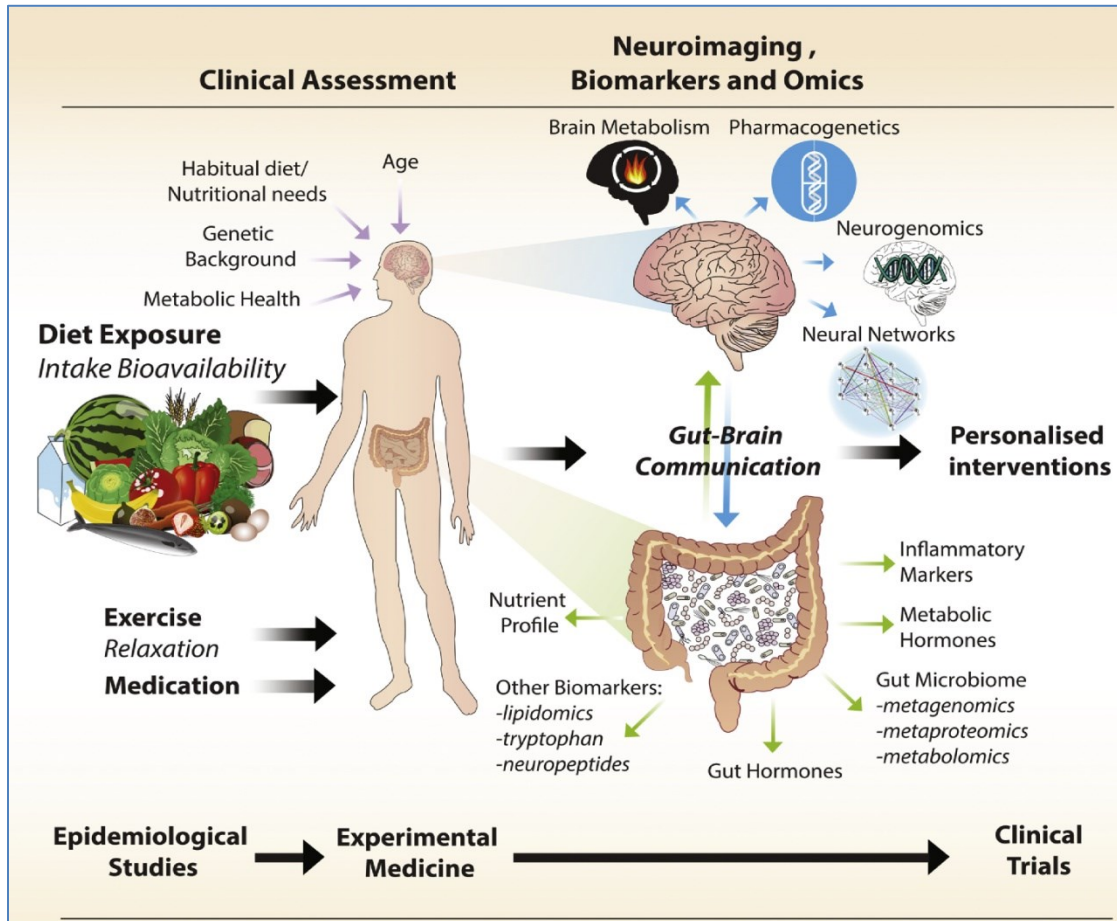


Figure 2 Research and treatment of emotional disorders utilizing integrated dietary intervention and care.[74]

There are several obstacles to be cleared. Diets can improve mental health, but first they must be used with a mechanistic understanding of how diet affects gut metabolism (including microbiota), how this affects gut-to-brain signaling (including through gut hormones), how diet affects blood metabolite levels and target organ levels, how cells and cellular networks (neural networks) respond, how genetic background affects how diet affects mental health, and how diet affects gene expression and downstream effects. Developing thorough, coherent, and scientifically rigorous evidence-based research that identifies the impact of

nutrition and food in many aspects of mental health is the problem facing "nutritional psychiatry" [75]. In particular, more research is needed to determine the relationship between the body's exposure to particular micro- and macronutrients—which depend on intake, bioavailability, metabolic function, and the organ systems involved—and a variety of mental health problems, such as mood, cognitive function, and stress resilience. These problems involve both direct and indirect mechanisms that modulate neuronal function and synaptic plasticity[76, 77].

Sample	Bioactive ingredients	Result or Conclusions	Reference
Review article-group struggling with migraine headaches	Folate in the form of folic acid – B9	Addition of a methyl group to DNA methyltransferase during the DNA methylation process and adequate serum homocysteine secretion levels prevent migraine headaches	Gazerani[78]
Review article-neurotherapeutic properties among healthy human populations and newborns	Docosahexaenoic acid-omega-3	Stimulates neurotransmission and development of the cerebral cortex and visual organ through the blood-brain barrier. Increased neuro-efficiency of non-verbal and verbal communication processes	Cater et al[79]
Review article among a population of people with nervous system conditions – depression and newborns with encephalopathy	Alpha-lipoic acid, lignans, soluble fiber, phytoestrogen – secoisolariciresinol diglucoside	Development and size of cortical cells in the prenatal and postnatal periods.Neuromodulates cognitive-behavioral behavior. Prevention against depressive symptoms in offspring and hypoxic-ischemic encephalopathy among newborns.	Parikh et al[80]
Depressed patients. Blinded randomized study. N= 40, duration 8 weeks An obese mouse model of neuronal impairment. Blinded, randomized study. Duration - 14 weeks	Flavonoids	Improving brain-derived neurotrophic parameter (BDNF), reducing symptoms in the pathomechanism of depression. PSD-95 protein expression affects dysfunction within synapses and neurons	Park et al. [81] Mulati et al. [82]
Review article-reduction in symptoms and progression of Parkinson's disease	Exogenous amino acid – tryptophan	Metabolic transformations to the starting compound serotonin allow to achieve regulation of the diurnal rhythm, emotional state. Participation in the	Mittal et al. [83]

		metabolism of catecholamines regulating processes at the level of the brain-gut axis. Prevention in the pathomechanism of Parkinson's disease	
Review studies, meta-analysis of studies. Improvement of neuronal and cognitive impairment in patients with Parkinson's disease, schizophrenia, depression	Magnesium calcium, selenium, zinc, manganese, copper, antioxidants – vitamin D, E, C, carotenoids	Reducing the mechanism of oxidative stress achieving systemic balance. consequently the absence of chronic inflammation along with a decrease in CRP, IL-6, WBC indices and somato-psychological symptoms in a depressed state.	Fernández et al. [84] Dogan-Sander et al. [85]
Review studies, meta-analysis of studies Improving neuronal and cognitive impairment in patients with Alzheimer's disease, inflammation within neurons	Complex carbohydrates, eicosapentaenoic acid, amino acid-glycine, polyphenols, anthocyanins	Activation of the hypothalamic-pituitary-adrenal axis under the influence of lower levels of endogenous stress-lower corticosterone concentrations. Proper insulin secretion and glucose ejection into cells adequate GLUT receptor functionality. Modulation of the processes of neurogenesis, synaptic plasticity and activation of microglia in the central nervous system. Prevention of inflammation, neurodegenerative changes through inactivation of the process of oxidation of the LDL fraction, lipid peroxidation and activation of the enzymes catalase and superoxide dismutase	Godos et al.[86] Burton-Freeman et al. [87]

Table 1 A review of a few studies on the role of nutrition in mental health.

Advantages and drawbacks

As this review does in showing the role of nutrition in psychoprevention and stressing the psychoprotective effects of nutrients, it is one of the few scientific works that highlights the key results about the impact of nutrition on mental health. The abundance of studies on the subject is the main drawback of the review of the literature on the connection between nutrition and mental health that is being provided. The abundance of research offered here does not imply that all of them deal with the problem this manuscript raises. Many of the studies that were looked up and questioned made the assumption that diet and mental health are related, but these were typically quite speculative and unsupported by science. Furthermore, it was noted that the effects of food and diet on mental health are not well covered in major meta-analyses in the present body of scientific literature. Thus, it is challenging to talk about whether or not it is beneficial to approach nutrition as the exclusive method of prevention or to introduce nutritional therapies among individuals with mental problems. Moreover, the main risk associated with these kinds of therapies is the challenge of tracking dietary habits or component intake. Furthermore, their metabolism and absorption vary on numerous variables that hardly ever follow a predictable path. It is therefore hypothesized that more research ought to be focused on developing clear dietary guidelines for mental health issues.

Conclusion

Nutrition, stress susceptibility, mental health, and mental function across the lifetime are all directly correlated, according to mounting data. The evidence is correlational, though, and it is unclear how these benefits are produced. In order to improve diet-related public health policies, new and groundbreaking research on the reciprocal links between nutrition and brain function is

desperately needed. Enhanced mechanistic comprehension of the relationship between nutrition and mental health and cognition will direct the creation of novel dietary interventions and evidence-based recommendations aimed at sustaining and enhancing brain fitness over the lifetime. The paucity of studies done in this field prior to the 21st century, which is referenced in this study, suggests that the connection between patients' mental health and nutrition has been underestimated in recent years. This tendency has reversed in recent years, as interest in nutropsychiatry and psychodietetics research has increased. Correlations between globalization, urbanization, the food business, and changes in people's eating and lifestyle patterns are becoming more significant in light of the current changes, as well as how these phenomena affect psychological status. Investigating these relationships may open up new avenues for the development of therapeutic, pharmacological, nutritional, and most importantly, preventative therapies.

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