



## ***Nutrition for the Maintenance of Psychological Health***

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### **Abstract**

*The health status of human beings includes mental health along with their physical development. However, all over the world, millions of people are the victims of various mental health disorders, in many forms. The most common mental disorder is anxiety disorder. About 301 million people globally suffer from these. In USA, the number of victims from mental illness is increasing, and psychotherapy or applied psycho-pharmacotherapy always may not be effective in curing the issues. Therefore, other therapeutic and/or management interventions are receiving increasing attention to bring comfort to people with these issues. In recent years, there has been a dramatic increase in nutrition research to examine any effects on mental abnormalities. This review is to search for experimental evidence to support how diet affects the mental health, in normal and in abnormal conditions.*

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### **Abbreviations**

PTSD: Post-traumatic Stress Disorder

ADD/ADHD: Attention Deficit Disorder / Attention Deficit Hyperactivity Disorder

OCD: Obsessive Compulsive Disorder

HPA: Hypothalamic-Pituitary-Adrenal Axis

GABA: Gamma-Aminobutyric Acid

SAM: S-Adenosylmethionine

EPA: Eicosa-Pentaenoic Acid

DHA: Docosahexaenoic Acid

Veg EPA: Vegetarian Eicosapentaenoic Acid.

CRP: C-Reactive Protein

MCI: Mild Cognitive Impairment

RCTs-HELFIMED: Randomized Controlled Trials- Health Literacy and Medical Education

PREDI-DEP: Predictive Deployment

MooDFOOD: Foods that are said to have a positive impact on our mood.

RCT: Randomized Controlled Trial

PUFAs: Polyunsaturated Fatty Acids.

PACs: Proanthocyanidins, a Type of Flavonoid.

DASH Diet: Dietary Approaches to Stop Hypertension diet

MIND Diet: Mediterranean-DASH Intervention for Neurodegenerative Delay

CVD: Cardiovascular Disease.

## Introduction

Common mental disorders include abnormal changes in the mood, issues with anxiety such as post-traumatic stress disorder (PTSD), unnecessary panic disorders, attention deficiency disorder/attention deficiency hyperactivity disorder (ADD/ADHD), and also autism. In addition, the four most common mental disorders that cause disabilities are depression, bipolar disorder, schizophrenia, and obsessive compulsive disorder (OCD) [1,2]. To date, 58 million people in USA are diagnosed with some form of mental disorders, and this number is expected to increase over the next few decades [3,4]. Psychotherapy and applied psycho-pharmacotherapy do not always bring the expected result [5], therefore search for alternate therapies and/or management of the diseases are warranted.

In recent years, there has been a dramatic increase in research on the effects of food-nutrients on the prevention of many mental disorders, and the researchers have observed that the prevalence of mental health disorders has increased in developed countries in correlation with the deterioration of the Western diet, that includes pre-packaged foods, refined grains, red meat, processed meat, high-sugar drinks, candy, sweets, fried foods, conventionally raised animal products, high-fat dairy products, and high-fructose products [6].

## Causative Factors of Psychological Disorders and their Treatment Options:

- Developmental disorders, any earlier traumatizing events and use of harmful psychoactive substances may influence the onset of psychiatric disorders. These factors and the genotype may not only influence the onset of the disorder but also its progression. Early detection and treatments of psychotic disorders result in a better response [7].

Some biomarkers that include hypothalamic-pituitary-adrenal axis (HPA) dysfunction with elevated cortisol levels are due to increased inflammation and oxidative stress [8,9]. Elevated levels of pro-inflammatory cytokines are observed in depressive, psychotic, and manic states , [10,11]. The anti-inflammatory and antioxidant compounds, statins, can reduce depressive disorders [12].

This review aims to discuss, with scientific evidence(s), the effects of nutrition on mental health. Specifically, we are trying to focus on:

- Correlations between nutrition and mental health
- To what extent there is any psycho-protective effect of food
- Examine scientific evidence(s) of preventive potential of food on mental disorders

### A: Correlations between Nutrition and Mental Health.

Previously it was shown that nutritional deficiencies correlate with some types of mental disorders [13, 14]. Western diets, along with the lack of fruits and

vegetables, are involved with some mental disorders. The most common nutrients deficiency that are found to be related to mental disorder includes omega-3 fatty acids, B vitamins, minerals, and amino acids precursors of neurotransmitters [15-17]. Many micronutrients like zinc, magnesium, B vitamins including folic acid, and vitamin D are mentioned to play a significant role as an anti-depressant effect [18-22]. Experimental observation and some meta-analysis indicated that vitamin D supplementation can reduce the intensity of mental depression-disorder [23-25].

## **B: The Common Mental Health Disorders and Nutritional Influence**

### **B-1: Major mental Depression:**

Major mental depression includes decreased mood, increased sadness and anxiety, loss of interest in any group activities, and sometimes also loss of appetite [26]. Those patients are at-risk, as they are very prone to committing suicide any time for no reason. Psychotherapy, along with some antidepressants, are generally given to them [27]. Tryptophan and tyrosine amino acids are obtained from proteins, and they are the precursors of various neurotransmitters such as serotonin, dopamine, noradrenaline, and GABA, deficiencies which cause depression [28-31]. Another amino acid, methionine, combined with ATP, produces S-adenosylmethionine (SAM), and facilitates the production of neurotransmitters in the brain [32-34].

Omega-3 fatty acids that can be obtained from fish have anti-depressive effects [35]. Two other fatty acids, eicosa-pentaenoic acid (EPA) and docosahexaenoic acid (DHA), found in fish oil, also elicit anti-depressant effects in humans. In addition, vitamin B (e.g., folic acid), and magnesium have been shown to exhibit anti-depressive effects [36-38]. Randomized, controlled trials exhibit decreased depression symptoms after administration of folic acid and magnesium in their diet [39,40].

### **B-2: Bipolar Disorder:**

Bipolar patients generally show depression, mania, and melancholy. These patients biochemically express excessive acetylcholine receptors and an elevated level of vanadium [41,42]. Vitamin C, and its food sources like citrus fruits intake has been shown

to protect the body from vanadium-induced harmful effects [43].

Taurine, which is made from another amino acid, cysteine, in the liver, exhibits a calming effect in the brain. A deficiency of this amino acid may increase the symptoms of bipolar mania [44]. Further, low level of omega-3 also causes the onset of bipolar symptoms [45].

### **B-3: Schizophrenia:**

Schizophrenia is a mental disorder that breaks the normalcy of the real perception of human beings. The victims, generally during their adolescent age, are paranoid and suffer from hallucinations, delusions, and impairments in speech/thinking abilities [46]. Abnormal amino acid metabolisms have been indicated in the pathophysiology of schizophrenia.

Specifically, a low level of serotonin in the central nervous system has been found in schizophrenic patients [47-49]. Administration of high doses of glycine amino acid (~30 g) can reduce the symptoms of schizophrenia [48-50]. Eicosa-pentaenoic acid (EPA), which is found in omega-3 fish oils, has been shown to help depression in schizophrenic patients [51,52].

### **B-4: Obsessive-Compulsive Disorder:**

Obsessive-compulsive disorder (OCD) is an anxiety disorder followed by stressful thoughts and compulsions [53]. It is well documented that nutrients like protein, which increase serotonin levels, help patients with OCD [53, 54]. These results clearly suggest how and why the use of nutritional supplements can be effective treatments for various mental disorders. Here, in Table-1, we show the Psychoprotective effects of the bioactive components contained in foods (vitamins, minerals, omega-3, and more).

**Table. 1:** Psycho-protective effects of the bioactive components found in foods  
A table with food with bioactive ingredients could be helpful

Bioactive Ingredients	Effects
Folate (Vit B9)	<ul style="list-style-type: none"> <li>Prevents migraine, especially in patients with high homocysteine and a specific gene mutation [55]</li> </ul>
Omega-3 Fatty acid	<ul style="list-style-type: none"> <li>Stimulates neurotransmission, verbal and non-verbal communication processes [56]</li> </ul>
Flavonoids	<ul style="list-style-type: none"> <li>Increases BDNF secretion, and reduces the patho-mechanism of depression [57]</li> </ul>
Exogenous amino acid – tryptophan	<ul style="list-style-type: none"> <li>Forms serotonin that regulates the diurnal rhythm and emotional state [58]</li> </ul>
Micronutrients	<ul style="list-style-type: none"> <li>Reduces oxidative stress and inflammation, along with a decrease in CRP, IL-6, WBC indices and psychological symptoms in a depressed state [59]</li> </ul>
(Mg, Ca, Se, Zn, Mn, Cu, Vits. D, E, C, A)	<ul style="list-style-type: none"> <li>Regulates the neuromodulator and neurotransmitter expression, synaptic plasticity and activation of microglia [60]</li> </ul>
Complex carbohydrates, Eicosapentaenoic acid, Amino acid – glycine, polyphenols, anthocyanins	<ul style="list-style-type: none"> <li>Prevents inflammation through inactivation of lipid peroxidation, and activation of catalase and superoxide dismutase [61]</li> </ul>

### C: Importance of Gut-Brain Axis in Psychiatric Issues

The gut-brain axis involves the bidirectional relationship between the gastrointestinal tract and the central nervous system [62,63]. The microbiota can also produce various neurotransmitters like butyric acid, - aminobutyric acid, serotonin, dopamine, and short-chain fatty acids, which have positive effects on mental disorders, including anxiety and depression [64,65]. The psychoprotective effects of probiotics are shown in Table 2.

**Table. 2:** Psycho-Protective Substances Found in Probiotics

Bioactive Ingredients in Foods	Biological Effects
<ul style="list-style-type: none"> <li>Lactobacillus acidophilus Rosell-52</li> <li>Bifidobacterium longum Rosell-175</li> </ul>	<p><b>Healthy adults, Blinded, randomized study:</b></p> <ul style="list-style-type: none"> <li>Reduces stress [66]</li> <li>Reduces Depression and anxiety [67]</li> </ul>
<ul style="list-style-type: none"> <li>Lactobacillus fermentum</li> <li>Lactobacillus plantarum</li> <li>Bifidobacterium lactis</li> <li>Lactobacillus acidophilus</li> <li>Bifidobacterium bifidum</li> <li>Bifidobacterium longum</li> </ul>	<p><b>In Alzheimer's Disease:</b></p> <ul style="list-style-type: none"> <li>Probiotic consumption and selenium for 12 weeks had a positive effect on cognitive function [68,69]</li> </ul>
<ul style="list-style-type: none"> <li>Lactobacillus plantarum C29 + powdered fermented soybeans (DW2009)</li> <li>Bifidobacterium breve A1</li> </ul>	<p><b>In Cognitive dysfunction:</b></p> <ul style="list-style-type: none"> <li>Oral supplementation of DW2009 and B. breve A1 can improve cognitive function in people with mild cognitive impairment (MCI) [70,71]</li> </ul>

### Discussion

Epidemiological studies have demonstrated that various food components can have either beneficial or detrimental effects on mental health [72]. The emerging field of nutritional psychiatry relies on evidence-based research to clarify the specific roles of diet and nutrients in different aspects of mental well-being [73-75]. The challenge for “nutritional psychiatry” depends on evidence-based studies to define the role of diet and nutrients in different aspects of mental health [73-75]. A similar study, to date, reported a significant improvement in mood and depression after 12 weeks with the Mediterranean diet in adult humans [76,77]. More recently, RCTs – HELFIMED and PREDI<sub>1</sub> DEP – have confirmed the above results [78,79].

However, not all studies report positive outcomes. For instance, the Moodfood trial found that neither multi-nutrient supplementation nor food-related behavioral activation therapy reduced major depressive symptoms in overweight or obese adults over a one-year period. This suggests that such interventions may not be effective for preventing major depressive disorder in this population [80]. Additionally, this trial reported no significant effects of a multi-nutrient supplement, containing omega-3 PUFAs, vitamin D, folic acid, and selenium, on depressive or anxiety symptoms, nor on general health utility indices, when compared to placebo effect [81]. Similarly, randomized controlled trials and meta-analyses on vitamin D supplementation didn't show any improvements in depression among the victims [82].

A randomized trial found that long-term supplementation with folic acid, vitamin B6, and vitamin B12 had no significant effect on the risk of developing depression in older men and women compared to a placebo group [83]. Similarly, the combination of B-vitamins did not reduce the incidence or severity of depressive symptoms in older adults [84]. Although low selenium levels are associated with depression, selenium supplementation generally does not show any significant benefit on mood disorders in older adults. That may be due to the brain's unique selenium storage and further benefit [85].

Multiple studies confirm that a high-quality diet in adulthood is associated with a reduced risk of cognitive decline, dementia and Alzheimer's disease. Dietary patterns rich in fruits, vegetables, nuts, legumes, and seafood are linked to better brain health, while diets high in red and processed meats, as well as refined sugars and added salt, are associated with a greater risk of cognitive impairment. Adherence to established healthy eating patterns, such as the Mediterranean diet or the DASH diet, also shows a protective effect on cognitive function [86].

Furthermore, the consumption of antioxidant polyphenols has been linked to improved cognitive ability in older adults. Various studies demonstrate that higher polyphenol intake is associated with better cognitive performance and a reduced risk of cognitive decline and dementia. These benefits are thought to arise from polyphenols' ability to reduce oxidative and inflammatory stress in the brain, activate neuroprotective pathways, and potentially promote synaptic plasticity and new nerve cell growth [87,88]. A randomized clinical trial of older adults with cardiovascular risk showed that a Mediterranean diet supplemented with either nuts or extra virgin olive oil improved cognitive function, including memory and global cognition, compared to a low-fat diet that resulted in cognitive decline. Participants in the Mediterranean diet groups showed better performance on various tests of memory, attention, speed of thought, and executive function [89,90].

Mental illnesses are associated with numerous metabolic disorders such as obesity, diabetes, and CVD. A cluster of metabolic syndromes including abdominal obesity, high blood pressure, high blood sugar, and high triglycerides are found in people with mental health conditions [91]. The ketogenic diet (KD) is an evidence-based treatment for epilepsy that works by altering brain metabolism and neurotransmitter function to stabilize neuronal activity and reduce seizures [92, 93]. By providing ketone bodies as an alternative brain fuel to glucose, the KD enhances GABAergic (inhibitory) neurotransmission, reduces glutamatergic (excitatory) neurotransmission, and improves mitochondrial function, all contributing to decrease in seizure frequency [94,95].

A study by Kang et al. on the ketogenic diet in epilepsy

reported that 36% of the 14 children (approx. 5 children) experienced a greater than 50% reduction in seizures, and 12% became seizure-free. These results differ from another dataset reporting 10 patients with over 50% seizure reduction and 7 who became seizure-free [96].

Overall, the present review indicates that the advances in nutritional psychiatry are crucial for preventing and treating mental health disorders, and requires more replicated, refined, and scaled-up dietary intervention studies, particularly randomized controlled trials (RCTs), to establish acceptable evidence for nutrition's role in mental well-being.

## Conclusion

Mental health disorders such as depression and anxiety are among the leading health challenges worldwide. Although these conditions differ in their symptoms and treatments, research consistently shows that nutrition plays a significant role in their management and prevention. Dietary habits can truly influence how individuals cope with these disorders. Food doesn't just fuel the body. It fuels the brain as well. Food can help balance neurotransmitters, stable blood sugar, or help the brain not get inflamed. In general, a good diet will work as a catalyst for being healthy, both physically and psychologically. Choosing to eat fruits, vegetables, whole grains, and foods with lots of Omega-3, individuals can maintain stable mental well-being.

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## Authors Contribution

All the authors contributed equally, in searching the information, writing and visualizing the concept.

## Ethics Declarations

**Ethical Approval:** None.

**Informed Consent:** Not applicable.

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