

Nutritional therapies for mental health disorders

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Abstract

Mental health disorders occur in a high proportion of the world's population, but are more common in developed countries. The prevalence throughout the world ranges from 26 percent in America to 4 percent in China. Though some of this difference may be attributable to differences in the availability of healthcare to make diagnoses, this noticeable distribution can be explained by studies showing that a lack of certain dietary nutrients, as occurs with the typical diet in developed countries, contributes to mental disorders. Notably, omega-3 fatty acids, as well as some vitamins and minerals, are often deficient in the general population in America and other developed countries--and are especially deficient in mental health patients. Studies have shown that supplementation with these nutrients often effectively reduces patients' symptoms. Supplementation with certain amino acids also reduces symptoms, because they are converted to neurotransmitters that alleviate depression and other mental health disorders. Such nutritional therapies may be appropriate for major depression, bipolar disorder, schizophrenia, anxiety disorders, eating disorders, ADD/ADHD, addiction, and autism, based on emerging scientific evidence. Most antidepressants and other mental health prescription drugs have severe side effects, which discourage patients from taking their medications. Such noncompliant mental health patients are at a higher risk for committing suicide or being institutionalized. One way for psychiatrists to overcome this noncompliance is to educate themselves about alternative or complementary nutritional therapies. Although further research needs to be done to determine the best recommended doses of most nutritional supplements, psychiatrists can recommend doses of dietary supplement therapies based on previous efficacious studies and then adjust the dosages based on the results obtained.

Introduction

Currently, approximately one in four adult Americans has a diagnosed mental health disorder in any given year, which translates into about 58 million affected people [1]. Though the incidence of mental disorders is higher in America than in other countries studied, a World Health Organization study of 14 countries reported a worldwide prevalence of mental health disorders of between 4.3 percent and 26.4 percent [2].

Common mental health disorders include mood disorders (such as depression and bipolar disorder), schizophrenia, anxiety disorders (such as post-traumatic stress disorder (PTSD), obsessive-compulsive disorder (OCD), and panic disorder), eating disorders, attention deficit disorder/attention deficit hyperactivity disorder (ADD/ADHD), and autism.

Typically, most of these mental health disorders are treated with prescription drugs, and many of these drugs cause unwanted side effects. For example, lithium is usually prescribed for bipolar disorder, but high-dose prescription lithium may have side effects, such as a dulled personality, reduced emotions, memory loss, tremors, or weight gain [3, 4]. These side effects can be so severe and unpleasant that many patients become noncompliant and, in cases of severe drug toxicity, the situation can become life threatening.

Researchers have observed that the prevalence of mental health disorders has increased in developed countries in correlation with the deterioration of the Western diet [5]. Previous research has shown nutritional deficiencies that correlate with some mental health disorders [6, 7]. The most common nutritional deficiencies seen in mental health patients are of omega-3 fatty acids, B vitamins, minerals, and amino acids that are precursors to neurotransmitters [8-14]. Compelling population studies link high fish consumption to a low incidence of mental health disorders; this lower incidence has been shown to be a direct result of omega-3 intake [8, 15, 16]. One to two grams of omega-3 fatty acids daily is the generally accepted dose for good health, but for mental health disorders, up to 9.6 g has been shown to be safe and efficacious [17-19]. Western diets are usually also lacking in fruits and vegetables, which further contributes to vitamin and mineral deficiencies.

This article will focus on the nutritional deficiencies already shown to cause or be associated with mental health disorders and will outline the recommended use of specific nutrients as a treatment (see **Table 1** for an outline). The mental health disorders and treatments covered here are not a complete list, but a focused sample of the information available, demonstrating the alternative or complementary nutritional options that mental health professionals can recommend to their patients.

Major Depression

Depression has long been known to be associated with deficiencies in neurotransmitters such as serotonin, dopamine, noradrenaline, and GABA [20-25]. As reported in several studies, the amino acids tryptophan, tyrosine, phenylalanine and methionine are often helpful in treating many mood disorders, including depression [26-31]. Tryptophan is a precursor to serotonin and is usually converted to serotonin.

Therefore, tryptophan can induce sleep and tranquility and, in cases of serotonin deficiencies, restore serotonin levels, diminishing depression [13, 29]. Tyrosine is not an essential amino acid, because it can be made from the amino acid phenylalanine. Tyrosine and possibly its precursor phenylalanine are converted into dopamine and norepinephrine [32]. Supplementation with both tyrosine and phenylalanine leads to alertness and arousal. Methionine combines with ATP to make S-adenosylmethionine (SAM), which facilitates the manufacture of brain neurotransmitters [33, 34].

As consumption of omega-3 fatty acids from fish and other sources has declined in most populations, the incidence of major depression has increased [8]. Several mechanisms of action may explain how eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), the two omega-3s found in fish oil, cause antidepressant effects in humans. Most of the proposed mechanisms affect neurotransmitters and, of course, some have more supporting data than others. For example, effects may be due to EPA that is converted to prostaglandins, leukotrienes, and other needed brain chemicals. Other theories state that EPA and DHA affect signal transduction in brain cells by activating peroxisomal proliferator-activated receptors (PPARs), inhibiting G-proteins and protein kinase C, and affecting calcium, sodium, and potassium ion channels. No matter which mechanism(s) prove to be true, epidemiological data and clinical studies already show that omega-3s can effectively treat depression [35]. Supplementing with omega-3 fatty acids containing 1.5 to 4 g of EPA per day should be sufficient for mood elevation in depressed patients. High doses of omega-3 supplements, however, may not be suitable for some patients, such as those on anti-clotting drugs [36].

Other nutritional deficiencies can contribute to depression. Notably, vitamin B (e.g., folate) and magnesium deficiencies have been linked to depression [7, 11, 12]. It has been reported that rapid recovery from major depression is possible in less than seven days by treating patients with 125 to 300 mg of magnesium (as glycinate and taurinate) with each meal and at bedtime [12].

Bipolar Disorder

Some biochemical abnormalities in people with bipolar disorder include oversensitivity to acetylcholine, excess vanadium, a taurine deficiency, vitamin B deficiencies, anemia, omega-3 fatty acids deficiencies, and vitamin C deficiency. Bipolar patients tend to have excess acetylcholine receptors, which is a major cause of depression and mania [37, 38]. Vanadium is a mineral needed by the human body in tiny amounts. Bipolar patients have significantly elevated levels of vanadium, causing mania, depression, and melancholy [39, 40]. Taurine is made in the liver from the amino acid cysteine and is known to have a role in the brain with a calming effect. Eighty percent of bipolar sufferers have some vitamin B deficiencies (often accompanied by anemia) [41]. These vitamins are needed to work together with the body's natural lithium to reduce the depression and mania of bipolar disorder [42]. Omega-3 oils are needed in brain cells to transmit signals for proper thinking, moods, and emotions and are often present at very low levels in most Americans and bipolar sufferers [43]. In bipolar disorder, vitamin C is needed to protect the body from the damage caused by excess vanadium.

Prescription lithium is in the form of lithium carbonate, and doses can be as high as 180 mg. It is these high doses that are responsible for the many side effects of prescription lithium. Some of the more common side effects include a dulled personality, reduced emotions, memory loss, tremors, or weight gain [3, 4]. Another form of lithium—lithium orotate—is preferred because the orotate ion crosses into the brain more easily than the carbonate ion of prescription lithium carbonate. Therefore, lithium orotate can be used in much lower doses (5 mg) with excellent results and no side effects [44, 45]. It is available without a prescription, unlike lithium carbonate, which is considered a drug by the FDA. In addition or as

an alternative to lithium, the amino acid-derivative, taurine, also blocks the effects of excess acetylcholine that contributes to bipolar disorder [46].

Schizophrenia

Disturbances in amino acid metabolism have been implicated in the pathophysiology of schizophrenia. Specifically, an impaired synthesis of serotonin in the central nervous system has been found in schizophrenic patients [47]. High doses (30 g) of glycine have been shown to reduce the more subtle symptoms of schizophrenia, such as social withdrawal, emotional flatness, and apathy, which do not respond to most existing medications [48-50]. The most consistent correlation found in one study on schizophrenia and diet was that an increased consumption of refined sugar results in an overall worse outcome for schizophrenia, as measured both by the number of days spent in the hospital and poor social functioning [51]. That study concluded that the dietary predictors of the outcome of schizophrenia and prevalence of depression are similar to those that predict illnesses such as coronary heart disease and diabetes. A Danish study showed that good outcomes for schizophrenic patients strongly correlate with living in a country with a high consumption of omega-3 fatty acids [52].

Anxiety Disorders

Post-traumatic Stress Disorder

A possible explanation for post-traumatic stress disorder is that, like other mental illnesses, it shares a common metabolic disorder of insulin resistance (hypoglycemia), which can fully explain the psychopathology of PTSD [53]. The following general nutritional guideline may be helpful for those with PTSD: maintain balanced blood sugar levels to help stabilize mood. For example, eat small frequent meals that include a small amount of protein, and avoid processed, refined, and simple sugars.

Certain nutritional supplements, such as zinc, vitamin C, fish oil with omega-3 fatty acids, and B-complex, are essential, because mental health patients have often been found to have specific nutritional deficiencies and requirements [7, 9, 12, 54]. Inositol, considered to be part of the vitamin B complex and found in citrus fruits, vegetables, cereal grains, meats, and supplement form, may help reduce anxiety associated with PTSD [55].

Obsessive-Compulsive Disorder

It is well documented that serotonin uptake inhibitors help patients with obsessive-compulsive disorder (OCD) [56]. Therefore, it is clear that nutrients that increase serotonin levels will reduce the symptoms of OCD. As discussed earlier, the amino acid tryptophan is a precursor to serotonin, and supplementation with tryptophan (which is better than 5-HTP) will increase serotonin levels as a treatment for OCD [57].

Eating Disorders

Anorexia Nervosa

A few years ago, the renowned researcher of natural and botanical medicine, Alexander Schauss, presented a paper about a number of patients who were suffering from anorexia nervosa (AN) and found to be zinc deficient. Many previous studies showed this phenomenon [58]. A low zinc intake, which is very common in AN patients, adversely affects neurotransmitters in various parts of the brain, including gamma-aminobutyric acid (GABA). For diagnosing zinc deficiencies, a simple test (the zinc tally test—or ZTT) can be used. Patients are given a zinc sulfate solution to drink; if they can't taste the solution or if it tastes like water, they may have a zinc deficiency, even if their blood levels are normal (documented by the same group reporting on Parkinson's disease) [59]. Schauss found he had trouble correcting the zinc abnormalities using zinc tablets or capsules and needed to use liquid zinc for better absorption. Zinc supplementation corrects the abnormalities in neurotransmitter concentrations, and therefore an oral administration of 14 mg of elemental zinc daily for two months in AN patients is recommended [60].

Bulimia Nervosa and Binge-Eating Disorder

It is well known that binge eating leads to dopamine release, and this sets up the addiction. In order to keep getting the happy feeling from dopamine, binge eaters continue to binge. Some amino acids, such as tyrosine and phenylalanine, can cause dopamine release without any binge eating [61]. It is recommended that mental health professionals order an amino acid analysis for their patients who chronically overeat or are bulimic. This analysis reveals which amino acids are low; these should be increased with supplements to get the neurotransmitters back into balance. It is clear that dieting can cause vitamin deficiencies such as vitamin B1 (thiamin), B2 (riboflavin), and B6 (pyridoxine), as well as a zinc deficiency [58, 62].

Thiamin is easily depleted by under-eating and is one of the nutrients the body cannot make itself; we must obtain B1 from food, primarily the whole foods that chronic dieters and people with eating disorders rarely eat enough of: beans, whole grains, seeds, meats, and vegetables. In addition, simply supplementing with a multivitamin may help stop the cravings of binge eaters and bulimics, as well as the appetite loss of anorexics.

Attention Deficit Disorder/Attention Deficit Hyperactivity Disorder

For a relatively long time it has been known that, to some extent, the human diet affects behavior [63]. Therefore, it is no surprise that many researchers have hypothesized dietary links to attention deficit disorder/attention deficit hyperactivity disorder [64]. Studies reveal that the same glycemic-index dietary practices that are good for weight loss can have a major positive effect on ADD/ADHD [65]. A disruption of acetylcholine activity may play a part in ADD/ADHD. Iron, zinc, and magnesium deficiencies have been linked to the symptoms of these conditions [50, 66-69]. General poor nutrition, such as a Western diet with high sugar, high saturated fats, and food additives and without omega-3 fatty acids, seems to aggravate the symptoms of ADD/ADHD. Symptoms of attention deficit closely resemble those of omega-3 fatty acid deficiency, and further research has shown that, in some cases, omega-3 supplementation (specifically with EPA and DHA) may be helpful for ADD/ADHD patients [70-73].

Chemical Addiction

Addictions such as alcoholism and drug abuse have been shown to respond positively to nutritional therapies. First, chemicals such as alcohol, drugs, nicotine, caffeine, and sugar need to be eliminated, and then neurotransmitters need to be replenished. As discussed earlier, supplementing tryptophan increases serotonin levels, while tyrosine and phenylalanine are precursors of dopamine. Depleted serotonin, dopamine, and GABA levels are often found in alcoholics and other drug addicts [74-76]. Lithium orotate, discussed in the section on bipolar disorder, is also effective for treating alcoholism and drug addictions [45]. Other suggested supplements for use with recovering alcoholics or drug addicts include omega-3 fatty acids, glutamine, and magnesium [77-79].

Autism

Vitamin B12 shots have been used for autism, usually at a dose of 1000 micrograms (1 cc) intramuscularly per treatment. Amounts above 1000 mcg may be excreted in urine, because this is a water-soluble vitamin. There are no reported cases of B12 toxicity, even at high doses. It is also recommended to supplement autistic patients with vitamins and minerals such as calcium (30 mg twice a day), magnesium (50 mg twice a day), vitamin C (50 mg twice a day), and vitamin B5 (pantothenic acid) (500 mg twice a day) [80].

Conclusion

Here we have shown just a few of the many documented nutritional therapies effective for mental disorders. Many of these studies were done in the 1970s and 1980s, but were soon discontinued because they were underfunded. Nutritional therapies have now become a long-forgotten mode of treatment, because they were of no interest to pharmaceutical companies that could not patent or own them. Instead, these companies—that fund most clinical research—spend their dollars investigating synthetic drugs they can patent and sell. More recently, with consumers interested in natural and holistic therapies, nutritional therapies have been well received, and some studies are again underway in these areas. Those with

influence in this field should speak up to increase the available grant money for this type of research, while researchers should submit more proposals for grants to do work on nutrition for mental health.

Psychiatrists treating patients with mental health disorders should be aware of available nutritional therapies, appropriate doses, and possible side effects in order to provide alternative and complementary treatments for their patients. This may reduce the noncompliance of mental health patients with their prescription medications. Of course, like prescription drugs, nutritional therapies may need to have substance choices and doses adjusted to achieve optimal results.

Abbreviations

ADD: attention deficit disorder

ADHD: attention deficit hyperactivity disorder

AN: anorexia nervosa

DHA: docosahexaenoic acid

EPA: eicosapentaenoic acid

GABA: gamma-aminobutyric acid

OCD: obsessive-compulsive disorder

PPARs: peroxisomal proliferator-activated receptors

PTSD: post-traumatic stress disorder

SAM: S-adenosylmethionine

Competing Interests

The authors declare they have no competing interests.

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Table 1 Summary of proposed causes and treatments for common mental health disorders.

Mental Disorder	Proposed Cause	Treatment	References	
Major Depression	Serotonin deficiency	Tryptophan	[13, 20, 21, 29]	
	Dopamine deficiency	Tyrosine	[32, 81]	
	Noradrenaline deficiency	Tyrosine	[24, 32]	
	GABA deficiency	GABA	[25]	
	Omega-3 deficiency	Omega-3s	[8, 35]	
	Folate deficiency	Folate	[7, 11]	
	Magnesium deficiency	Magnesium	[12]	
Bipolar Disorder	Excess acetylcholine receptors	Lithium orotate & taurine	[37, 38, 44, 45]	
	Excess vanadium	Vitamin C	[39, 40]	
	B vitamin deficiencies	B complex vitamins	[41, 42]	
	Omega-3 deficiencies	Omega-3s	[43]	
Schizophrenia	Impaired serotonin synthesis	Tryptophan	[82]	
	Glycine deficiency	Glycine	[83-85]	
	Omega-3 deficiencies	Omega-3s	[86]	
PTSD	Insulin resistance	Stabilize blood sugar	[53]	
	Inositol deficiency	Inositol	[55]	
OCD	Serotonin deficiency	Tryptophan	[57]	
Anorexia Nervosa	Zinc deficiency	Zinc	[58, 60, 87]	
	GABA deficiency	Zinc, GABA	[58, 60, 87]	
Bulimia Nervosa and Binge-Eating Disorder	Amino acid deficiencies	Amino acids (tyrosine)	[61]	
	Vitamin deficiencies	Thiamin, riboflavin, pyridoxine	[62]	
	Zinc deficiency	Zinc	[58, 87]	
ADD/ADHD	Mineral deficiencies	Iron, zinc, magnesium	[67-69, 80]	
	Omega-3 deficiency	Omega-3s	[88]	
Chemical Addiction	Serotonin deficiency	Tryptophan	[74]	
	Dopamine deficiency	Tyrosine	[75]	
	GABA deficiency	GABA	[76]	
	Omega-3 deficiency	Omega-3s	[78, 79]	
	Magnesium deficiency	Magnesium	[77]	
	Autism	Magnesium deficiency	Magnesium	[80]