

This Deficiency Can Lead to Psychosis and Alzheimer's

Analysis by [Dr. Joseph Mercola](#)

✓ Fact Checked

April 19, 2022

STORY AT-A-GLANCE

- › B vitamin deficiencies are known to produce symptoms of psychiatric disorders, including depression and schizophrenia, and they play an important role in cognitive decline and the development of dementia
- › Vitamins B6, B9 (folate) and B12 may help prevent cognitive decline and protect against more serious dementia such as Alzheimer's disease
- › A primary mechanism of action is the suppression of homocysteine, which tends to be elevated when you have brain degeneration. Having a homocysteine level above 14 micromoles per liter is associated with a doubled risk of Alzheimer's
- › Research has shown taking high doses of folic acid, B6 and B12 lowers blood levels of homocysteine, decreasing brain shrinkage by as much as 90%
- › B vitamins also have a direct impact on the methylation cycle, and are required for the production and function of neurotransmitters, and for the maintenance of myelin, all of which are important for cognitive health

This article was previously published February 7, 2019, and has been updated with new information.

It should come as no surprise that nutrition is a foundational consideration to optimize and maintain cognitive function. It's well-established that healthy fats such as animal-based omega-3s – especially DHA – are vitally important for brain health, but certain

vitamins are also important, and a number of vitamin deficiencies have been linked to impaired cognition, neurological diseases and mental disorders.

Among the most important vitamins for brain health are vitamins B3 (niacin), B6 and B12. For example, two clinical manifestations of pellagra¹ – a condition caused by niacin deficiency – are delirium and dementia. Schizophrenia also shares some of the features of pellagra.

The disease originates in your gut and is associated with malnourishment and the "poor man's diet" consisting primarily of corn products. Other B vitamin deficiencies, including B1, B2, B6, B8 and B12,^{2,3} can also produce neuropsychiatric symptoms. As noted in a 2016 review of B vitamins and the brain:⁴

"The B-vitamins ... perform essential, closely interrelated roles in cellular functioning, acting as co-enzymes in a vast array of catabolic and anabolic enzymatic reactions. Their collective effects are particularly prevalent to numerous aspects of brain function, including energy production, DNA/RNA synthesis/repair, genomic and nongenomic methylation, and the synthesis of numerous neurochemicals and signaling molecules ...

[E]vidence from human research clearly shows both that a significant proportion of the populations of developed countries suffer from deficiencies or insufficiencies in one or more of this group of vitamins, and that, in the absence of an optimal diet, administration of the entire B-vitamin group, rather than a small sub-set, at doses greatly in excess of the current governmental recommendations, would be a rational approach for preserving brain health."

B Vitamins Support Cognitive Function

Vitamins B6, B9 (folate) and B12 may be particularly important for supporting cognitive function as you age, and have been shown to play a major role in the development of dementia, including Alzheimer's disease, which is the most serious (and lethal).

A primary mechanism of action here is the suppression of homocysteine,⁵ which tends to be elevated when you have brain degeneration. As noted by Dr. Michael Greger in the featured video, research has confirmed that elevated homocysteine "is a strong, independent risk factor for the development of dementia and Alzheimer's disease."

Having a serum (blood) level of homocysteine greater than 14 micromoles per liter is associated with a doubled risk of Alzheimer's. As noted in a 2010 paper:⁶

"Deficiencies of the vitamins folate, B12 and B6 are associated with neurological and psychological dysfunction ... In the elderly, cognitive impairment and incident dementia may be related to the high prevalence of inadequate B vitamin status and to elevations of plasma homocysteine.

Plausible mechanisms include homocysteine neurotoxicity, vasotoxicity and impaired S-adenosylmethionine-dependent methylation reactions vital to central nervous system function. In light of this, it is imperative to find safe ways of improving vitamin B status in the elderly ..."

The good news is your body can eliminate homocysteine naturally, provided you're getting enough B9 (folate), B6 and B12. One study confirming this was published in 2010.⁷ Participants received either a placebo or 800 micrograms (mcg) of folic acid (the synthetic form of B9), 500 mcg of B12 and 20 mg of B6.

The study was based on the presumption that by controlling homocysteine levels you might be able to reduce brain atrophy, thereby slowing the onset of Alzheimer's. Indeed, after two years those who received the vitamin-B regimen had significantly less brain shrinkage compared to the placebo group. Those who had the highest levels of homocysteine at the start of the trial experienced brain shrinkage at half the rate of those taking a placebo.

A 2013 study⁸ took this research a step further, showing that not only do B vitamins slow brain shrinkage, but they specifically slow shrinkage in brain regions known to be most severely impacted by Alzheimer's disease. Moreover, in those specific areas the shrinkage is decreased by as much as 700% which is rather remarkable.

As in the previous study, participants taking high doses of folic acid and vitamins B6 and B12 lowered their blood levels of homocysteine, decreasing brain shrinkage by as much as 90%. Earlier research⁹ has also pointed out that even subclinical deficiencies in B vitamins may have "a subtle influence on aspects of cognitive performance."

The Link Between Dietary Fiber and Folate Status

Importantly, though, findings such as these also suggest that since elevated homocysteine appears to significantly drive the atrophy process, and those with high homocysteine benefit the most from B-vitamin supplementation, (indicating they were deficient in these vitamins), it seems reasonable to conclude that by avoiding B-vitamin deficiency in the first place, you can minimize age-related brain atrophy.

This is such a simple and inexpensive preventive strategy, it would seem foolish to ignore it. Related to this, research¹⁰ also shows that your dietary fiber intake has an impact on your folate status. For each gram of fiber consumed, folate levels increased by nearly 2%. The researchers hypothesize that this boost in folate level is due to the fact that fiber nourishes bacteria that synthesize folate in your large intestine.

Yet another way to lower homocysteine is to lower methionine, found in animal protein. While I firmly believe animal protein is an important part of a healthy diet, most Americans eat far more protein than required for optimal health. The answer, however, is not necessarily a vegan diet.

Research¹¹ shows vegans actually have the worst homocysteine levels of all, when compared to omnivores and lactovegetarians. The reason for this is because they're not getting enough B12, which is primarily found in animal foods.

So, while eating lots of vegetables is important for folate and fiber, you also need healthy amounts of B12 — either from animal foods such as meat, fish, milk, cheese and eggs, or a supplement — in order to maintain healthy homocysteine levels and optimal brain function.

Also, keep in mind that advancing age can diminish your body's ability to absorb B12 from food,¹² so the need for supplementation may increase as you get older. Your body's ability to absorb B12 depends on three factors:

1. Adequate stomach acid – With age, stomach acid often diminishes. You may also have insufficient amounts of acid if you take acid blockers for heartburn
2. Gastric intrinsic factor – Many also lack gastric intrinsic factor
3. The enzyme pepsin

Conditions that inhibit absorption of B12 include pernicious anemia and atrophic gastritis type B, the latter of which is thought to affect as much as half of all people over the age of 60.¹³ Poor B12 absorption has also been implicated in depression, which is indeed common among the elderly.

B Vitamins Are Also Important for Psychiatric Conditions

Studies also show the importance of B vitamins for the prevention and treatment of psychiatric conditions. For example, in one meta-analysis,¹⁴ high doses of vitamins B6, B8 (inositol) and B12 significantly reduced symptoms of schizophrenia – more so than standard drug treatments alone. As reported by Science Daily:¹⁵

"Lead author Joseph Firth, based at the University's Division of Psychology and Mental Health, said, 'Looking at all of the data from clinical trials of vitamin and mineral supplements for schizophrenia to date, we can see that B vitamins effectively improve outcomes for patients.'"

Vitamin B3 (niacin) has also been successfully used to treat psychiatric disorders such as attention deficit disorder, anxiety, depression, general psychosis, obsessive-compulsive disorder and schizophrenia.

Why B Vitamins Have Such a Powerful Effect on Brain Health

Aside from regulating homocysteine (which takes a toll on your brain structure and function), another reason why B vitamins have such a powerful effect on a wide range of brain disorders and psychiatric conditions has to do with the fact that they:

- Have a direct impact on the methylation cycle
- Are required for the production and function of neurotransmitters
- Are required for the maintenance of myelin, the fatty sheath surrounding your nerve cells. Without this protective coating, nerve signals become slow and sporadic, which can lead to motor function problems, cognitive losses and changes in mood

What's more, B8 or inositol, specifically, aids cell communication, allowing your cells to properly interpret chemical messages and respond accordingly,¹⁶ while B6, folate and B12 (in combination with SAME) regulate the synthesis and breakdown of brain chemicals involved in mood control, including serotonin, melatonin and dopamine. This is why a deficiency in one or more of these B vitamins can trigger symptoms of depression.

How to Improve Your Vitamin B Status

Mood disorders, cognitive decline and psychiatric problems can have many underlying factors, but addressing your diet is often a good place to start. Not only can nutritional deficiencies wreak havoc with your brain function, your gut health also plays an important role, and toxic exposures from your diet or environment can also contribute.

Ideally, you'd want to address all of these issues. I've written extensively about all of them. As for nutritional deficiencies, B vitamins appear to be very important, as are animal-based omega-3, vitamin C and vitamin D.

As a general rule, I recommend getting most if not all of your nutrition from real food, ideally organic to avoid toxic pesticides, and locally grown. Depending on your situation and condition, however, you may need one or more supplements.

To start, review the following listing of foods that contain the B vitamins discussed in this article. If you find that you rarely or never eat foods rich in one or more of these nutrients, you may want to consider taking a high quality, ideally food-based supplement.

Also consider limiting sugar and eating fermented foods. The entire B group vitamin series is produced within your gut, assuming you have healthy gut flora. Eating real food, including plenty of leafy greens and fermented foods, will provide your microbiome with important fiber and beneficial bacteria to help optimize your internal vitamin B production.

Nutrient	Dietary Sources	Supplement Recommendations
Niacin (B3)	Liver, chicken, veal, peanuts, chili powder, bacon and sun-dried tomatoes have some of the highest amounts of niacin per gram. ¹⁷ Other niacin-rich foods include baker's yeast, paprika, espresso coffee, anchovies, spirulina, duck, shiitake mushrooms and soy sauce. ¹⁸	The dietary reference intake established by the Food and Nutrition Board ranges from 14 to 18 mg per day for adults. Higher amounts are recommended depending on your condition. For a list of recommended dosages, see the Mayo Clinic's website. ¹⁹ For pellagra, discussed above, doses range from 50 to 1,000 mg daily.

Nutrient

Dietary Sources

Supplement Recommendations

Vitamin B6

Turkey, beef, chicken, wild-caught salmon, sweet potatoes, potatoes, sunflower seeds, pistachios, avocado, spinach and banana.^{20,21}

Nutritional yeast is an excellent source of B vitamins, especially B6.²²

One serving (2 tablespoons) contains nearly 10 mg of vitamin B6.

Not to be confused with Brewer's yeast or other active yeasts, nutritional yeast is made from an organism grown on molasses, which is then harvested and dried to deactivate the yeast.

It has a pleasant cheesy flavor and can be added to a number of different dishes.

Nutrient	Dietary Sources	Supplement Recommendations
B8 (inositol/biotin)	Meat, egg yolks, fish, liver, poultry, wild-caught Alaskan salmon, avocado, nuts and legumes. ^{23,24}	<p>B8 is not recognized as an essential nutrient and no recommended daily intake has been set.</p> <p>That said, it's believed you need about 300 mcg per day. Vitamin B8 is sometimes listed as biotin on supplements.</p> <p>Brewer's yeast is a natural supplemental source.²⁵</p>
Folate (B9)	Fresh, raw, organic leafy green vegetables, especially broccoli, asparagus, spinach and turnip greens, and a wide variety of beans, especially lentils, but also pinto beans, garbanzo beans, kidney beans, navy and black beans. ²⁶	<p>Folic acid is a synthetic type of B vitamin used in supplements; folate is the natural form found in foods.</p> <p>(Think: Folate comes from foliage, edible leafy plants.)</p> <p>For folic acid to be of use, it must first be activated into its biologically active form (L-5-MTHF).</p>

Nutrient

Dietary Sources

Supplement Recommendations

This is the form able to cross the blood-brain barrier to give you the brain benefits noted.

Nearly half the population has difficulty converting folic acid into the bioactive form due to a genetic reduction in enzyme activity.

For this reason, if you take a B-vitamin supplement, make sure it contains natural folate rather than synthetic folic acid.

Nutritional yeast is an excellent source.²⁷

Nutrient	Dietary Sources	Supplement Recommendations
Vitamin B12	<p>Vitamin B12 is found almost exclusively in animal tissues, including foods like beef and beef liver, lamb, snapper, venison, salmon, shrimp, scallops, poultry, eggs and dairy products.</p> <p>The few plant foods that are sources of B12 are actually B12 analogs that block the uptake of true B12.</p>	<p>Nutritional yeast is also high in B12, and is highly recommended for vegetarians and vegans.</p> <p>One serving (2 tablespoons) provides nearly 8 mcg of natural vitamin B12.²⁸</p> <p>Sublingual (under-the-tongue) fine mist spray or vitamin B12 injections are also effective, as they allow the large B12 molecule to be absorbed directly into your bloodstream.</p>

Sources and References

- ¹ Medscape, Dermatologic Manifestations of Pellagra
- ² British Medical Journal 956 Dec 15; 2(5006): 1394–1398
- ³ British Medical Journal 956 Dec 15; 2(5006): 1394–1398 (Full article, PDF)
- ⁴ Nutrients 2016 Feb; 8(2): 68
- ⁵ Nutritionfacts.org January 18, 2019
- ⁶ Nutrition Reviews 2010 Dec;68 Suppl 2:S112-8
- ⁷ PLoS ONE 5(9): e12244
- ⁸ PNAS 2013 Jun 4;110(23):9523-8
- ⁹ J Gerontol B Psychol Sci Soc Sci. 2001 Nov;56(6):P327-39
- ¹⁰ American Journal of Clinical Nutrition 1997 Dec;66(6):1414-21

- ¹¹ [British Journal of Nutrition 2013 Mar 14;109\(5\):785-94](#)
- ¹² [New York Times September 6, 2016](#)
- ¹³ [Prim Care Companion J Clin Psychiatry 2009; 11\(5\): 269–270](#)
- ¹⁴ [Psychological Medicine February 16, 2017, DOI](#)
- ¹⁵ [Science Daily February 16, 2017](#)
- ¹⁶ [Healthy Eating, Vitamin B8](#)
- ^{17, 18} [Healthaliciousness.com, Top 10 High Niacin Foods](#)
- ¹⁹ [Mayo Clinic Niacin Dosing](#)
- ²⁰ [Worlds Healthiest Foods, Vitamin B6](#)
- ²¹ [Healthaliciousness.com, Top 10 Foods High in Vitamin B6](#)
- ^{22, 28} [Self Nutrition Data, Nutritional Yeast](#)
- ²³ [Explain-Health.com Food Sources High in Vitamin B8](#)
- ²⁴ [Oregonstate.edu, Biotin Food Sources](#)
- ²⁵ [Medical News Today December 4, 2017](#)
- ²⁶ [Worlds Healthiest Foods, Folate](#)
- ²⁷ [Chalkboard, Nutritional Yeast](#)