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B Vitamins May Protect Against Damaging Effects of Air Pollution

Analysis by Dr. Joseph Mercola | February 12, 2024

STORY AT-A-GLANCE

- A small-scale human trial found high doses of vitamins B6, B9 and B12 in combination completely offset damage caused by very fine particulate matter in air pollution
- Four weeks of high-dose supplementation reduced genetic damage in 10 gene locations by 28% to 76%, protected mitochondrial DNA from the harmful effects of pollution, and even helped repair some of the genetic damage
- Several vitamin B deficiencies have the ability to produce symptoms of neuropsychiatric disorders and can be a valuable adjunct in the treatment of attention deficit disorder, anxiety, schizophrenia, dementia and more

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B vitamins are important for cognition and mental health, but research suggests they may have other important functions as well. A small-scale human trial[1] found B vitamins may help protect against air pollution.[2,3]

At high doses, B vitamins were actually able to "completely offset" damage incurred by fine particulate matter.

According to a World Health Organization report released in 2016, only 8% of people worldwide are breathing air that meets WHO standards.[4] This means 92% of the world population are breathing polluted air, and toxic environments are responsible for at least 1 of every 4 deaths reported worldwide.[5]

Poor air quality can cause serious damage to your lungs, heart and other organ systems. One of the most dangerous air pollutants is very fine particulate matter known as PM2.5, particles smaller than 2.5 micrometers — about one-thirtieth the width of a human hair — in diameter.

B Vitamins Help Prevent Damage From Air Pollution

The featured trial,[6] the first of its kind, involved just 10 volunteers between the ages of 18 and 60. In the first round, they were exposed to clean air and given a placebo to establish a baseline. In the next round of tests, they inhaled concentrated smog for two hours. Blood samples were collected after each test.

In the next stage of the experiment the participants received a daily supplement of 2.5 milligrams (mg) of folic acid (B9), 50 mg of vitamin B6 and 1 mg of B12 for four weeks before inhaling "hazardous levels" of PM2.5 pollution (PM2.5 concentrated to more than 250 micrograms per cubic meter of air).

It's worth noting the dosages used in this study were very high. The Institute of Medicine recommends a daily intake of just 400 micrograms (mcg) of folate (B9), 1.3 to 1.7 mg of B6 and 2.4 mcg of B12.[7]

This isn't the first time much higher than normal doses of B vitamins have been shown to have distinct health benefits. Interestingly, four weeks of high-dose supplementation:

- Reduced the genetic damage incurred in 10 gene locations by 28% to 76%
- Protected mitochondrial DNA from the harmful effects of PM2.5
- Helped repair some of the genetic damage caused by pollution

According to lead researcher Jia Zhong:[8,9]

> *"Where we quantify the effect, it is almost close to a complete offset on the epigenome of the air pollution. On the mitochondrial DNA side, it also offset a big proportion of it ...*

Biologically, B vitamins in the diet are expected to have the same effect on the epigenome as pill-based supplements ... I would suggest maintaining a healthy, balanced diet with sufficient sources of B vitamins."

B Vitamins Are Also Important for Psychiatric Health

Several vitamin B deficiencies also have the ability to produce symptoms of neuropsychiatric disorders and can be a valuable adjunct in the treatment of everything from attention deficit disorder (ADD) and anxiety to schizophrenia and dementia. This includes vitamins B1, B2, B6, B8, B9 and B12.

For example, research[10,11] suggests high doses of vitamins B6, B8 and B12 in combination were very effective for improving schizophrenic symptoms — more so than standard drug treatments alone, and particularly when implemented early on. Low doses were ineffective.

Previous research and work by the late Dr. Abram Hoffer have linked psychiatric disorders such as schizophrenia with severe and chronic niacin (B3) deficiency or niacin dependency — a state that necessitates far more niacin on a regular basis than normal.

Aside from schizophrenia, researchers have found niacin can be successfully used in the treatment of ADD, general psychosis, anxiety, depression and obsessive-compulsive disorder. B12 deficiency can also trigger mania, psychosis and paranoid delusions.[12,13]

Why B Vitamins Are so Important for Mental Health and Well-Being

One of the reasons for B vitamins' effect on a wide range of mood disorders and neurological and psychiatric conditions relates to the fact that these vitamins have a direct impact on the methylation cycle, and are required for the production and function of neurotransmitters and 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. B8 also aids in cell communication, allowing your cells to properly interpret chemical messages and respond accordingly.[14]

Meanwhile, B6, folate and B12 support the synthesis of S-adenosylmethionine (SAMe), which plays a significant role on the methylation cycle.[15] Hence, a deficiency in one or more of these B vitamins may lead to depression, cognitive impairment and dementia.[16]

B Vitamins Also Protect Against Dementia

Vitamins B6, B9 (folate, or folic acid in its synthetic form) and B12 have also made headlines for their powerful role in preventing cognitive decline and more serious dementia such as Alzheimer's disease. In fact, mental fogginess and memory problems are two of the top warning signs of vitamin B12 deficiency.

One of the mechanisms of action here is the suppression of homocysteine, which tends to be elevated when you have brain degeneration. High homocysteine levels are associated with dementia and Alzheimer's. Vitamins B6, B9, and B12 help convert homocysteine into methionine — a building block for proteins.

If you don't get enough of these B vitamins, this conversion process is impaired, causing your homocysteine level to rise. Conversely, when you increase intake of folate, vitamin B6 and vitamin B12, your homocysteine levels decrease.

One study confirming this was published in 2010.[17] Participants received either a placebo or 800 mcg of folic acid, 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 shrinkage, 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 study[18] 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%! As in the previous study, participants taking high doses of folic acid and vitamins B6 and B12 lowered their blood levels of homocysteine, and brain shrinkage was decreased by as much as 90%.

Vitamin B-Rich Foods

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.

Ideally, select a high-quality food-based supplement containing a broad spectrum of B vitamins. As you can see, being deficient in one or more of them can trigger a range of problematic neurological effects.

Also, considering over 90% of people breathe polluted air, getting plenty of B vitamins could be a simple way to ameliorate the harmful effects. To start, review the following listing of foods high in B vitamins. 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 supplement.

Also consider eating fermented foods and limiting sugar. The entire B group vitamin series is produced within your gut provided you have a healthy gut microbiome. Eating real food, ideally organic, along with fermented foods will provide your microbiome with important fiber and beneficial bacteria to help optimize your internal vitamin B production as well.

Nutrient	Dietary Sources	Supplement Recommendations
Thiamine (B1)	Pork, dark leafy greens, wheat germ, green peas, lentils and nuts.[19]	Adult men and women need 1.2 and 1.1 mg respectively each day.
Riboflavin (B2)	Dairy products such as yogurt and cheese, ideally made from raw organic grassfed milk, are high in B2. Other sources include: asparagus, dark leafy greens like spinach, fish, chicken and eggs.[20]	Suggested daily intake is about 1.1 mg for women and 1.3 mg for men.
Niacin (B3)	Liver, chicken, veal, peanuts, chili powder, bacon and sun dried tomatoes have some of the highest amounts of niacin per gram.[21] Other niacin-rich foods include baker's yeast, paprika, espresso coffee, anchovies, spirulina, duck, shiitake mushrooms and soy sauce.[22]	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.[23] For pellagra, discussed

Nutrient	Dietary Sources	Supplement Recommendations
		above, doses range from 50 to 1,000 mg daily.
Vitamin B6	Poultry, beef, wild-caught salmon, tuna, sweet potatoes, fortified cereals, avocado, dark leafy greens, banana, papaya, oranges and cantaloupe.[24,25]	Nutritional yeast is an excellent source of B vitamins, especially B6.[26] One serving (2 tablespoons) contains nearly 10 mg of vitamin B6, and the daily recommended intake is only 1.3 mg. 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.
Biotin (B7)[27]	Beef liver, eggs (cooked), salmon, avocados, pork,	Biotin is sometimes listed as vitamin B7 on

Nutrient	Dietary Sources	Supplement Recommendations
	sweet potato, nuts and seeds.	supplements. A deficiency in B7 can cause thinning hair, skin rashes and brittle nails. There is no RDA for B7; the AI (adequate intake) is 30 mcg daily for adults over age 19; there is no UL (tolerable upper limit; 10 to 300 mcg are usually found in supplements. Note: Raw eggs contain a protein that prevents biotin absorption.
Inositol (B8)[28]	Meat, fruits, corn, beans, grains, legumes and brewer's yeast.	While it's often listed as vitamin B8, inositol is actually a sugar that is important for cell development and function. Because it's not a recognized nutrient, there is no dietary RDA, UL or AI for it. However, according to

Nutrient	Dietary Sources	Supplement Recommendations
		Cleveland Clinic, there may be benefits to supplementing with it, as it helps fight metabolic syndrome, high blood sugar, high blood pressure, gestational diabetes and symptoms of polycystic ovary syndrome.
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.[29]	Folic acid is a synthetic type of B vitamin used in supplements; folate is the natural form found in foods. (Think: folate comes from foliage, edible leafy plants.) For folic acid to be of use, it must first be activated into its biologically active form (L-5-MTHF). This is the form able to cross the blood-brain barrier to give you the brain benefits noted.

Nutrient	Dietary Sources	Supplement Recommendations
		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.[30] Adults need about 400 mcg of folate per day.
Vitamin B12	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. The few plant foods that	Nutritional yeast is also high in B12, and is highly recommended for vegetarians and vegans. One serving (2 tbsp.) provides nearly 8 mcg of natural vitamin B12.[31] Sublingual (under-the-

Nutrient	Dietary Sources	Supplement Recommendations
	are sources of B12 are actually B12 analogs that block the uptake of true B12.	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.

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