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## REPORT

## Vitamin B12: Surprising New Findings

by: Terri Mitchell

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For years, vitamin B12 languished as the vitamin that cures anemia. Hardly any research was done into what this vitamin could do for non-anemic people. It turns out that it may do a lot. New studies show that the right amount of B12 can protect against dementia, boost immune function, maintain nerves, regenerate cells and more. B12 is in the news because it lowers homocysteine and protects against atherosclerosis. It's also vital for maintaining methylation reactions that repair DNA and prevent cancer. One of the crucial areas for B12 is the brain.

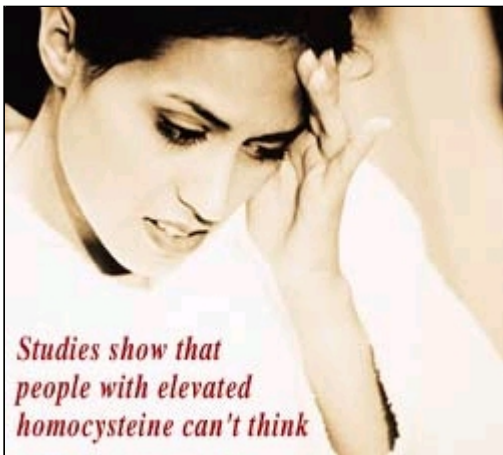


It's not surprising that people with B12 deficiency develop mental disorders. The vitamin is crucial for the synthesis or utilization of important neuro-factors including monoamines, melatonin and serotonin. In addition, B12 is absolutely critical for the function and maintenance of nerves themselves. B12 is needed for methylation reactions that maintain these cells, and enable them to function. For this reason, the methylated form of B12, methylcobalamin, may be superior to other forms of the vitamin. Methylcobalamin is considered "bioactive", which means that it doesn't have to undergo any chemical reactions in the body before it starts working.

B12 contributes to brain function by lowering homocysteine. Homocysteine is a toxic by-product of methionine metabolism that can damage neurons. Importantly, homocysteine interferes with the methylation reactions critical for brain function. Studies show that people with elevated homocysteine can't think.

I can't remember

B12-deficiency can cause a dementia that looks exactly like Alzheimer's disease. And Alzheimer's disease itself is characterized by brain deficiencies of both vitamin B12 and the methylating factor, S-adenosylmethionine (SAME). A new study from Germany correlates B12 deficiency in Alzheimer's patients with two personality changes—irritability and disturbed behavior.



The connection between B12 deficiency and mental illness has been documented repeatedly. According to the latest research, as much as 30% of hospitalized mental patients may be deficient in the vitamin. And what's disturbing is that studies repeatedly show that the deficiency is frequently missed by standard blood tests. For example, a recent study from Germany shows that out of 67 hemodialysis patients who were B12-deficient by the measurement of methylmalonic acid (it goes up when B12 goes down), only two of them were deficient by a standard blood test. Looking at the data, one can't help but wonder how many people with B12 deficiency get treated for mental illness when what they should get is a vitamin!

### B12 and folate

Folate deficiency can also produce mental symptoms, although it is less common. Folate and vitamin B12 are both required for biochemical reactions that occur in the brain. One won't work without the other: a deficiency in one produces a deficiency in

the other.

Should a folate deficiency be suspected, both folate and vitamin B12 should be taken. This is because the deficiencies look so

similar. If the deficiency is, in fact, B12 instead of folate, folate will appear to correct it in blood cells (where deficiencies are measured). But folate will not correct a B12 deficiency in the brain. Permanent brain damage can result if B12 deficiency is treated with folate. For years, this problem has caused the government to resist supplementing the food supply with significant amounts of folate. Be aware, also, that high amounts of folate in the absence of adequate B12 can provoke or worsen neurological conditions. It's important to get adequate amounts of both of these vitamins simultaneously.

## Aging

Many studies have been done on the issue of whether B12 deficiency relates to age-related cognitive decline in normal people. Results have been mixed. One of the problems is getting an accurate reading on B12 levels. Blood levels don't necessarily reflect tissue levels. Another problem is that folate deficiency can complicate the picture. A study in people 65+ found that folate levels significantly correlate with cognitive function, but B12 did not. Another study published at the same time (but using a different kind of evaluation) found that supplemental B12 improves cognition, notably, a person's ability to remember words.

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### Protect your nerves

Methylcobalamin is terrific for protecting neurons. It saves the brain from the damaging effects of glutamate, nitric oxide, low blood sugar and low oxygen. Low oxygen occurs during stroke or heart attack. Low blood sugar is a chronic problem in diabetes. Glutamate and nitric oxide toxicity are features of Alzheimer's and Parkinson's diseases.

Taking methylcobalamin everyday may provide immediate protection should a person be suddenly injured or have a stroke. Researchers in Japan demonstrated that chronic application of methylcobalamin to neurons protects them, but in order for the vitamin to work, it has to be ready and available before the injury occurs.

Myelin sheath, the "insulation" around nerve cells, is critical for nerve conduction. Degeneration of this protein causes serious neurological diseases. Myelin is created and maintained by methylation reactions that depend on vitamin B12.

Recently, researchers in France succeeded in creating for the first time a model of vitamin B12 deficiency in oligodendrocytes, the cells that produce myelin sheath. This will enable the in-depth study of the effects of vitamin B12 on the synthesis of myelin for the first time. Data from this new model could lead to new insight into muscular dystrophy, amyotrophic lateral sclerosis, subacute combined degeneration of the spinal cord, multiple sclerosis and other neuro-degenerative diseases.

Methylcobalamin has been used in animal studies on neurodegenerative diseases. The methyl form of vitamin B12 clearly promotes nerve regeneration and slows the progression of neurodegenerative diseases.

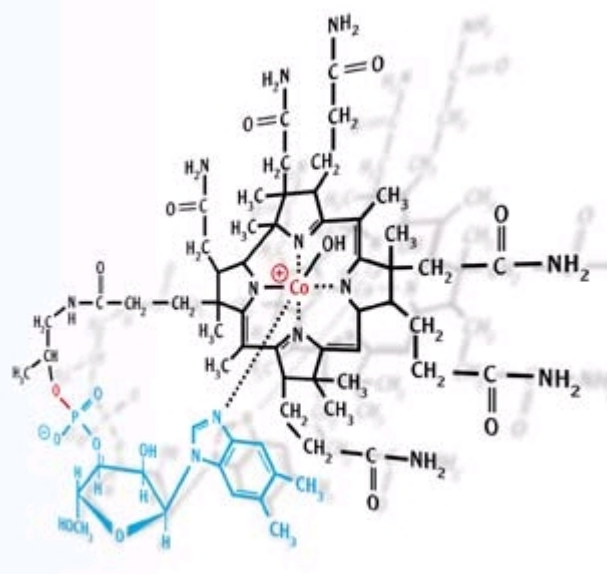
Neuropathies are strange and sometimes painful sensations caused by degeneration of nerves. Methylcobalamin is effective for this condition. In a study on diabetic rats, methylcobalamin reduced demyelination. In a study on humans undergoing hemodialysis, 500 micrograms of methylcobalamin by injection three times a week, lessened neuropathies.

### Heart attack and stroke

Vitamin B12 has an important role in reducing levels of homocysteine to prevent heart attack and stroke. Homocysteine is a by-product of methionine metabolism that can damage blood vessels. B12 and folate are critical for the production of the tongue-twisting enzyme, methylenetetrahydrofolatereductase, which helps convert homocysteine to methionine. Dozens of studies show that the most common cause of elevated homocysteine is inadequate folate or vitamin B12. Supplementation with these vitamins lowers homocysteine levels, but vitamin B6 and trimethylglycine (TMG) are usually also required to lower homocysteine to a healthy range.

Vitamin B12 deficiency has another effect on the heart as well. Turkish researchers recently reported that people with megaloblastic anemia have abnormal electrical conductivity of the heart. The problem originates in the nerves that control heart rate. When the anemic volunteers took supplemental B12, heart rate returned to normal.

### The supplement-of-choice



Vitamin B12 is the only vitamin that is part mineral. The scientific name for B12 is cobalamin. Cobalamin contains cobalt, a mineral that stimulates the production of red blood cells. The most common forms of supplemental B12 are cyanocobalamin or hydroxycobalamin. The natural form of B12 found in food is methylcobalamin (or a similar form, adenosylcobalamin). The structure of B12 is very complex, with numerous methyl groups attached. Methyl groups (CH<sub>3</sub>) are used in beneficial methylation reactions, such as those that reduce homocysteine.

Methylcobalamin is the supplement-of-choice in Japan where it's approved to treat anemia. This form may have advantages over the cyano form. In a study on sleep patterns,

Elevated homocysteine is rightfully considered a risk factor for cancer. High levels of homocysteine are consistently linked with DNA damage. The connection was shown recently in a study from Australia where the micro-nucleus index (a measure of DNA damage) increased as levels of homocysteine increased. This held true for both younger (18-32) and older (50-70) people.

Fifty-six percent of the men in the older bracket either tested below par for B12 or folate, or abnormally high for homocysteine. Men with homocysteine levels greater than 10 micromoles per liter had significantly more DNA damage than those with lower homocysteine, even if they had normal levels of B12 and folate. Despite no folate deficiency, supplementation with 3.5 times the recommended allowance of folate and B12 still significantly reduced the micronucleus index in people where it was initially elevated above the 50th percentile. (Note: in this study, taking 10 times the recommended amount of folate and B12 did not have any added benefit).

One of the implications of this study is that "normal" levels of these vitamins—standard blood levels—are probably not adequate to prevent DNA damage. It also indicates that high homocysteine levels are a red flag that DNA damage is occurring whether or not homocysteine-lowering vitamins are adequate by blood

measurements. Men with low, but still "normal", levels of B12 had significantly more damage. According to Dr. Michael Fenech, author of the study, "the accepted standard for vitamin B12 sufficiency (i.e., plasma concentration <150 pmol/L) may not be adequate to minimize chromosome damage rates."

### Methylcobalamin (B12) and Bell's Palsy

Bell's palsy is a temporary paralysis of the facial nerve. A person with Bell's palsy may not be able to open their eye or close one side of their mouth. Since this condition involves nerves, and vitamin B12 is critical for nerves, the vitamin was tested as a treatment for this nerve condition. Sixty people with Bell's palsy were divided into three groups. The first group was given standard steroid therapy. The second group was given methylcobalamin plus steroid. The third group was given methylcobalamin alone. It took 2-9 weeks for the drug group to recover. The groups given methylcobalamin recovered much quicker, some within days. The group given methylcobalamin alone recovered the quickest.

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#### H. Pylori and vitamin B12 deficiency

Researchers have discovered a connection between anemia, B12 deficiency, and infection with H. Pylori, the organism that causes stomach ulcers. The study enrolled 138 people with B12 deficiency and anemia. Fifty-six percent of them tested positive for H. Pylori. Many had no symptoms; others had "heartburn" or other stomach problems.

When the bacteria were eradicated with antibiotics, vitamin B12 levels returned to normal without supplementation. It took a month for this to occur, and three to six months more for full improvement. In people where the antibiotic treatment didn't work, anemia and B12 levels didn't improve. The difference in B12 levels before and after treatment is striking: after treatment, levels were approximately four times higher. H. Pylori may partly explain mysterious studies showing that elderly people are taking in enough B12, but turning up deficient anyway. Older people are prone to atrophic gastritis, a condition where there is not enough acid and pepsin in the stomach to properly digest food. This creates a friendly climate for unfriendly bacteria such as H. Pylori. It also impairs the stomach's ability to acquire vitamin B12 from food.

People with stomach pain or "heartburn" often take antacids, including drugs such as Prolisec or Prevacid. While these types of drugs temporarily ease the pain, they further suppress acid necessary to maintain B12 levels and proper stomach bacteria. If the stomach is infected with H. Pylori or other pathogenic bacteria (overgrowth of bacteria in the small intestine can cause similar symptoms), the answer is to kill the bug, allow the ulcers to heal, then augment (not suppress) stomach acid with supplements designed to maintain acidity and discourage bacterial growth.

#### Oral B12 works

Despite what it says on the package insert of injectable B12, oral B12 works. For example, gastrointestinal surgery usually causes B12 depletion and anemia. Japanese researchers used 500-1500 mcg/day of oral B12 to treat B12 deficiency after total gastrectomy. This amount reversed the deficiency quickly and efficiently. B12 blood levels of patients receiving 750+mcg were comparable to patients receiving 500 mcg by injection every two months. Japan has long recognized the benefits of using the methylated form of B12, methylcobalamin. Despite strong evidence that oral B12 is effective, physicians are slow to recommend this form to their patients. A study published in 1998 reports that 71% of the internists surveyed don't believe that oral B12 works as well as injections.

#### Widespread deficiency

A new study from Tufts University reports that B12 supplements are the most important source of vitamin B12 for Americans. Those taking supplements or eating cereal supplemented with B12, are half as likely to be B12 deficient than those who don't. Meat, the primary source of B12 for Americans, is not as good a source. This is probably due to problems in digestion and prescription drugs that interfere with the absorption of B12 when it's attached to proteins such as meat. Cooking may also affect the vitamin B12 content of meat.

B12 deficiency has gotten so bad in America that the RDA has been increased from 2.0 micrograms a day to 2.4. It's not only older people who are deficient these days. The Tufts study looked at the children of people who took part in the original Framingham heart study. They were stunned to see that in one generation, B12 deficiency in kids had caught up to the generation before. Pizza, one of the foods evaluated, is apparently not a good source of vitamin B12.

Vegetarians continue to be at risk. The only non-animal sources of B12 presently known are some types of seaweed and fermented foods such as tempeh. Forty percent of participants in one study and almost 50% in another (vegan) study were B12 (and iron) deficient. This may have consequences for immunity. In a study from Japan, B12 deficiency caused serious changes in immunity, including lower natural killer cell activity and skewed T-cell balance. Natural killer cells are important for destroying viruses and cancer. Abnormal T-cell balances show up in autoimmune diseases and HIV infection.

#### Symptoms of deficiency

Other than anemia, the symptoms of B12 deficiency are rarely documented. Researchers involved in the gastrectomy study above

took the uncommon step of doing an in-depth analysis of the symptoms of B12 deficiency. They found that lassitude (exhaustion), fatigability (tiring easily), chills (cold hands and feet), numbness in the extremities (no feeling in arm, leg, foot), dizziness, glossitis (painful tongue), leukoplakia (white spots on the tongue) and erectile dysfunction were symptoms of B12 deficiency.

Although the body needs minute amounts of vitamin B12, Americans are not getting enough for general health, let alone optimal DNA and heart protection. H. Pylori infection, drugs, over-cooking meat, increased demand and other factors may be robbing us of this highly crucial vitamin. The mistaken belief that B12 has to be given by injection may be keeping people from getting the extra B12 they need. High amounts of the vitamin are not toxic; and may in fact be more beneficial than we currently know. Evidence is stacking up that amounts of vitamin B12 above and beyond the current recommended daily allowance may help protect nerves and protect us from cancer, infections and a host of other adverse conditions.

### Methylcobalamin (B12) and immunity



Methylcobalamin enhances the activity of natural killer and T-cells. These immune cells are important for killing cancer and viruses. Japanese researchers have discovered that ratio of T-helper cells to T-suppressor cells is abnormal in people with anemia. Methylcobalamin corrects this defect. Vegans with B12 deficiency have lowered numbers of immune cells. People infected with HIV are more likely to get AIDS if their B12 levels are low, irrespective of whether they take antiviral drugs. Methylcobalamin is required for both the synthesis and function of immune cells. In a study on people with low tissue levels of B12, methionine synthetase activity was very low, indicating that very few immune cells were being synthesized. Treatment with methylcobalamin restored immunity almost immediately.

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