

Editorial

Vitamin B12 – Need of the Body

Mohsin Masud Jan

Editor

What is Vitamin B12?

Vitamin B12 is a water-soluble vitamin that contains the mineral cobalt, so is sometimes called cobalamin. It is naturally found in some foods like tuna, beef and dairy, is added to fortified foods like breakfast cereals, and is available as a dietary supplement or prescription. B12 is a necessary nutrient for the development of the brain and nerve cells, red blood cells and DNA synthesis. Since it is not primarily found in plant foods (though some, like seaweed and mushrooms, can contain small amounts), it is essential for people who follow a vegan and vegetarian diet to supplement or consume foods fortified with B12. Methylcobalamin and 5-deoxyadenosylcobalamin are the metabolically active forms of vitamin B12. However, two others forms, hydroxycobalamin and cyanocobalamin, become biologically active after they are converted to methylcobalamin or 5-deoxyadenosylcobalamin¹⁻².

Vitamin B12 Deficiency

Causes of vitamin B12 deficiency include difficulty absorbing vitamin B12 from food, lack of intrinsic factor (e.g., because of pernicious anemia), surgery in the gastrointestinal tract, prolonged use of certain medications (e.g., metformin or proton pump inhibitors, discussed in more detail below in the section on interactions with medications), and dietary deficiency^{3,4}. Because people who have difficulty in absorbing vitamin B12 from food absorb free vitamin B12 normally, their vitamin B12 deficiency tends to be less severe than that of individuals with pernicious anemia, who cannot absorb either food-bound or free vitamin B12. Certain congenital conditions, such as hereditary intrinsic factor defects and congenital vitamin B12 malabsorption (Imerslund-Gräsbeck disease), can also cause severe vitamin B12 deficiency³. The effects of vitamin B12 deficiency can include the hallmark megaloblastic anemia (characterized by large, abnormally nucleated red blood cells) as well as low counts of white and red blood cells, platelets, or a combination; glossitis of the tongue; fatigue; palpitations; pale skin; dementia; weight loss; and infertility^{3,4}. Neurological changes, such as numbness and tingling in the hands and feet, can also occur. These neurological symptoms can occur without anemia, so early diagnosis and intervention is important to avoid irreversible damage⁵. In addition, some studies have found associations between vitamin B12 deficiency or low vitamin B12 intakes and depression⁶⁻⁷. In pregnant and breastfeeding women, vitamin B12 deficiency might cause neural tube defects, developmental delays, failure to thrive, and anemia in offspring.

Because the body stores about 1 to 5 mg vitamin B12 (or about 1,000 to 2,000 times as much as the amount

typically consumed in a day), the symptoms of vitamin B12 deficiency can take several years to appear.

Vitamin B12 deficiency with the classic hematologic and neurologic signs and symptoms is uncommon. However, low or marginal vitamin B12 status (200–300 pg/mL [148–221 pmol/L]) without these symptoms is much more common, at up to 40% in Western populations, especially in those with low intakes of vitamin B12-rich foods. The prevalence of vitamin B12 deficiency varies by cutoff level and biomarker used.

Typically, vitamin B12 deficiency is treated with vitamin B12 injections because this method bypasses any barriers to absorption. However, high doses of oral vitamin B12 might also be effective. A 2018 Cochrane Review included three randomized controlled trials (RCTs) that compared very high doses (1,000–2,000 mcg) of oral with intramuscular vitamin B12 for vitamin B12 deficiency in a total of 153 participants. The evidence from these studies, although of low quality, showed that the ability of high oral doses of vitamin B12 supplements to normalize serum vitamin B12 was similar to that of intramuscular vitamin B12.

However, because most people do consume enough through food and the body stores a significant amount of vitamin B12 in the liver, symptoms of B12 deficiency can sometimes take years to appear. The infants of Vegetarians women also have B12 deficiency. The deficiency involves in different disease persons like different types of cancer, cardiovascular disease, stroke, dementia and diabetes also have shown the deficiency of Vitamin B12.

Health Benefits of Vitamin B12

Research has shown that vitamin B12 plays several essential roles in our health. Some benefits include the following.

Red Blood Cell Production

Sufficient vitamin B12 is necessary for producing healthy red blood cells and preventing megaloblastic anemia, a type of anemia that causes large, underdeveloped cells. Symptoms of megaloblastic anemia can include fatigue, pale skin, heart palpitations, loss of appetite, weight loss or infertility.

Brain and Nervous System Health

B12 is required for neurological function and maintaining healthy nerve cells.⁸ Therefore, B12 deficiency can interfere with maintaining healthy function of the nervous system and could even lead to permanent nerve damage over time.

Development for Infants

As an infant's brain develops rapidly, adequate B12 is needed to support healthy brain development and produce red blood cells.⁹ B12 is readily found in breast milk and is fortified into formulas, so infants' needs can

be easily met from consuming these foods regularly. While rare, B12 deficiency can cause failure to thrive and delays in developmental milestones for infants. If left untreated, vitamin B12 deficiency could lead to permanent brain damage over time. If you have concerns about your child, be sure to talk to your doctor and health care team.

Healthy Energy Metabolism

Vitamin B12 plays an important role in energy metabolism. For this reason, if you have a vitamin B12 deficiency, you may feel tired or weak. The good news is that B12 deficiency is generally easy to treat, through increasing food sources, taking a supplement or, in cases of malabsorption, via high-dose injection or nasal spray. Oftentimes, treatments can work very quickly, within 48 to 72 hours. Talk to your doctor to identify an individualized plan for you.

While scientists are studying the effects of B12 supplementation on cancer, heart disease, stroke, dementia or adjunct therapy for viral infections, more evidence is needed to clarify its influence on long-term health.¹⁰

Food Sources of Vitamin B12

Since vitamin B12 is bound to protein, B12-rich food sources include: fish, meat, poultry, eggs, dairy, clams, oysters, beef liver, Fortified breakfast cereals, nutritional yeast and plant-based milk alternatives. If you want to start adding more vitamin B12 food sources to your diet, find food sources that you actually enjoy. You are much more likely to continue eating them if they're foods that can easily be added to your daily diet.

If you follow a vegan diet, use fortified nutritional yeast as well as fortified foods to supplement your diet. You can sprinkle it over pasta, pizza and salads for a cheesy flavor, or mix it into soups or stews. When a product is fortified with B12, a percent Daily Value will be listed on the food label in the vitamins and minerals section. Naturally occurring B12 is not listed on the food label.

Who Could Benefit from Vitamin B12 Supplementation?

While most people get enough from food sources in their diets, people with vitamin B12 deficiency or the following circumstances should consider taking a supplement:

Those following a vegan or vegetarian diet: Since B12 is only naturally found in animal foods, studies have shown that those following vegetarian and vegan diets tend to have low B12 stores. This is especially important for those who are pregnant, since it is necessary for proper fetal brain and nerve system development.

Those with a lack of intrinsic factor: Pernicious anemia is an autoimmune disease that impairs the gut's ability to produce intrinsic factor, which is a protein that is necessary for the absorption of B12.

Those with low stomach acid or medications that decrease stomach acid: Lack of sufficient stomach

acid is the most common cause of B12 deficiency, especially for older adults. And vitamin B12 deficiency affects between 3% and 43% of older adults. Certain medications that reduce or suppress stomach acid taken regularly, such as medications and antacids for gastroesophageal reflux disease (GERD) or peptic ulcer disease, can cause difficulty absorbing vitamin B12 from food. However, fortified foods or supplements do not require stomach acid and can be an excellent choice for people who take these medications.

Those who've had intestinal surgery or digestive disorders: Surgery that impacts parts of the stomach or small intestine, or diseases including Crohn's and celiac disease, can cause impaired absorption of B12. Talk to your doctor about the best care plan for you.

Those using other medications that interfere with absorption: Metformin, a commonly prescribed drug for prediabetes and diabetes, can block absorption of B12 and is strongly associated with B12 deficiency.

Recommended Intakes

Intake recommendations for vitamin B12 and other nutrients are provided in the Dietary Reference Intakes (DRIs) developed by the Food and Nutrition Board (FNB) at the National Academies of Sciences, Engineering, and Medicine. DRI is the general term for a set of reference values used for planning and assessing nutrient intakes of healthy people. These values, which vary by age and sex, include the following:

- **Recommended Dietary Allowance (RDA):** Average daily level of intake sufficient to meet the nutrient requirements of nearly all (97%–98%) healthy individuals; often used to plan nutritionally adequate diets for individuals
- **Adequate Intake (AI):** Intake at this level is assumed to ensure nutritional adequacy; established when evidence is insufficient to develop an RDA
- **Estimated Average Requirement (EAR):** Average daily level of intake estimated to meet the requirements of 50% of healthy individuals; usually used to assess the nutrient intakes of groups of people and to plan nutritionally adequate diets for them; can also be used to assess the nutrient intakes of individuals
- **Tolerable Upper Intake Level (UL):** Maximum daily intake unlikely to cause adverse health effects

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