

What is vitamin B12?

Vitamin B12 is one of the most controversial members of the vitamin family collectively referred to as the "B-complex" vitamins. Although the full chemical structure of B12 was not identified until the 1960s, two Nobel Prizes have already been awarded for research involving this vitamin.

Vitamin B12 is unusual with respect to its origins. While most vitamins can be made by a wide variety of plants and specific animals, no plant or animal has been shown capable of producing B12, and the exclusive source of this vitamin appears to be tiny microorganisms like bacteria, yeasts, molds, and algae.

Like most vitamins, B12 can occur in a variety of forms and can take on a variety of names. Names for B12 include: cobrynamide, cobinamide, cobamide, cobalamin, hydroxycobalamin, aquocobalamin, nitrotocobalamin, and cyanocobalamin.

Without intrinsic factor, which is a unique protein made in the stomach, vitamin B12 cannot gain access to the rest of the body where it is needed.

What high-vitamin B12 foods can do for you:

- support production of red blood cells and prevent anemia
- allow nerve cells to develop properly
- help your cells metabolize protein, carbohydrate, and fat

Deficiency Symptoms

What are deficiency symptoms for vitamin B12?

Although B12 is not the only nutrient deficiency that can contribute to occurrence of the following symptoms, B12 deficiency should be considered as a possible underlying factor whenever any of the symptoms listed below are present.

Symptoms potentially associated with vitamin B12 deficiency:

| | |
|--------------------------|------------------|
| dandruff | nervousness |
| decreased blood clotting | numbness in feet |
| decreased reflexes | paleness |
| depression | red tongue |
| difficulty swallowing | sore tongue |
| fatigue | tingling in feet |
| heart palpitations | weakness |
| memory problems | weak pulse |
| menstrual problems | Eye Twitching |

What are toxicity symptoms for vitamin B12?

No toxicity levels have been reported for vitamin B12, and no toxicity symptoms have been identified in scientific research studies.

Impact of Cooking, Storage and Processing

How do cooking, storage, or processing affect vitamin B12?

When derived from animal foods, vitamin B12 is fairly well preserved under most cooking conditions. About 70% of B12 is still present after cow's milk is boiled for 2-5 minutes. Retention of vitamin B12 in plant-based foods like tempeh, a fermented food made from soy, has not been well researched.

Factors that Affect Function

What factors might contribute to a deficiency of B12?

B-12 and the stomach

Stomach problems can contribute to a B12 deficiency in two ways.

First, irritation and inflammation of the stomach can prevent the stomach cells from functioning properly. When functioning improperly, the cells may stop producing a substance required for B12 absorption called *intrinsic factor* (IF). Without IF, B12 cannot be absorbed from the gastrointestinal tract into the body's cells.

A **second** way for stomach problems to create B12 deficiency is through inadequate secretion of stomach acids. Lack of stomach acids (a condition called *hypochlorhydria*) gets in the way of B12 absorption since most B12 in food is attached to proteins in the food, and stomach acids are necessary to release the B12 from these proteins.

The above stomach problems that can contribute to B12 deficiency have a wide variety of causes. These **causes** include abuse of **over-the-counter antacids**, abuse of **prescription medicines used to control stomach acidity**, and **stomach ulcers** (also called **gastric ulcers**), which may themselves be due to infection with the bacteria, *helicobacter pylori*.

B12 and vegetarianism

The ability of a **strict vegetarian diet to supply adequate amounts of B12 remains controversial**, despite increasing evidence in support of vegetarianism and its nutritional adequacy. The controversy is fueled by **two somewhat divergent schools of thought**.

One school emphasizes the fact that most animals, including humans, are capable of storing long-term supplies of B12.

In humans, these stores may last for twenty years or longer. Given this potential for storage, a daily requirement for B12 is regarded as highly unlikely.

A second school of thought, however, points to the unreliability of plants as sources of B12. For strict vegetarians who eat no animal products whatsoever, this unreliability may pose a problem. Since no plant is capable of making B-12, the amount of B12 in plant food depends upon the relationship of the plant to soil and root-level microorganisms (bacteria, yeasts, molds, and fungi) which make the vitamin. Cultured and fermented bean products like tofu, tempeh, miso, tamari and shoyu may or may not contain significant amounts of B12, depending upon the bacteria, molds, and fungi used to produce them. **The B12 content of sea vegetables also varies according to the distribution of microorganisms in the surrounding sea environment.**

Unfortunately, reliable nutrient analyses are often unavailable for consumers of these products, and labeling for B12 content is not required. In general, tofus, tempehs, and sea vegetables tend to be more consistent sources of B12 than misos, tamaris, and shoyus.

Depending upon the medium in which they are grown, brewer's and nutritional yeast can also be significant sources of B12 in a strict vegetarian diet.

Drug-Nutrient Interactions

What medications affect vitamin B12?

Categories of drugs that can diminish the body's supply of vitamin B12 include antibiotics, anticancer medications, anticonvulsants, anti-gout medications, antihypertensives, antiParkinson's medications, antipsychotics, antituberculosis medications, birth control pills, cholesterol-lowering drugs, and potassium replacements.

How do other nutrients interact with vitamin B12?

Vitamin B6 is required for proper absorption of vitamin B12, and deficiency of vitamin B6 has been shown to impair B12 absorption in animal studies.

Conversion of vitamin B12 from its non-active into its biologically active form requires the presence of vitamin E. Individuals at risk for **vitamin E deficiency may show signs of vitamin B12 deficiency as well.**

Excessive intake of folic acid can mask B-12 deficiencies and individuals at risk for vitamin B12 deficiency who are also taking folic acid in supplement form should consult with their healthcare practitioner.

Health Conditions

What health conditions require special emphasis on vitamin B12?

Vitamin B12 may help in the prevention and/or treatment of the following health conditions:

- Alcoholism
- Anemia (Pernicious)
- Arthritis (Rheumatoid)
- Asthma (Bronchial)
- Atherosclerosis
- Cancer
- Celiac Disease
- Crohn's Disease
- Dermatitis (Seborrheic)
- Epstein-Barr Virus
- Fatigue
- Leukemia
- Lupus
- Multiple Sclerosis
- Neuropathies/Neuromuscular degeneration

Form in Dietary Supplements

What forms of vitamin B12 are found in dietary supplements?

Cyanocobalamin is the form of B12 most commonly found in vitamin supplements. However, this form of the vitamin is only found in the laboratory, where a cyanide molecule is added to the vitamin to help stabilize it in tablet or capsule form.

Since the **cobalamin forms** of the vitamin are the only ones known with certainty to play an active role in the body, alternative forms of B12 like cobamamide may be less preferable for supplementation.

On a drop-for-drop basis, **sublingual (under-the-tongue) forms of B12 deliver more of the vitamin** into your bloodstream than tablet or intranasal (inhaled through the nose) versions.

Food Sources

What foods provide vitamin B12?

Since vitamin B12 cannot be made by any animals or plants, the B12 content of animals and plants depends on their ability to store the vitamin and their relationship to microorganisms (like bacteria in the soil). **Because of their greater ability to store vitamin B12, animals contain more of the vitamin than plants.**

Public Health Recommendations

What are current public health recommendations for vitamin B12?

The most recent Recommended Dietary Allowances (RDAs) for vitamin B12 were set in 1998 by the National Academy of Sciences. The RDAs were established for all persons 1

year of age and older. For infants under the age of 1 year, Adequate Intake (AI) levels were set. **These AI and RDA guidelines are as follows:**

- **0-6 months: 400 nanograms**
- **6-12 months: 500 nanograms**
- **1-3 years: 900 nanograms**
- **4-8 years: 1.2 micrograms**
- **males 9-13 years: 1.8 micrograms**
- **males 14 years and older: 2.4 micrograms**
- **females 9-13 years: 1.8 micrograms**
- **females 14 years and older: 2.4 micrograms**
- **Pregnant females of any age: 2.6 micrograms**
- **Lactating females of any age: 2.8 micrograms**

(Source: <http://www.whfoods.com>)

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