COMPARATIVE STUDY OF B_{12} VITAMIN DISTRIBUTION AND ASSIMILATION

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Abstract

Vitamin B_{12} is found in most animal derived foods, including fish and shellfish, meat (especially liver), poultry, eggs, milk, and milk products. However, the binding capacity of egg yolks and egg whites is markedly diminished after heat treatment. Vitamin B12 is a nutrient that helps keep the body's nerve and blood cells healthy and helps make DNA, the genetic material in all cells. Vitamin B12 also helps prevent a type of anemia called megaloblastic anemia that makes people tired and weak. Two steps are required for the body to absorb vitamin B12 from food. First, hydrochloric acid in the stomach separates vitamin B12 from the protein to which vitamin B12 is attached in food. After this, vitamin B12 combines with a protein made by the stomach called intrinsic factor and is absorbed by the body. Some people have pernicious anemia, a condition where they cannot make intrinsic factor. As a result, they have trouble absorbing vitamin B12 from all foods and dietary supplements.

Keywords: *vitamin B_{12}, cobalamin, nutrient, DNA, anemia, nutrition, supplement, health, dietary.*

INTRODUCTION

Vitamin B12 is the only vitamin that has a metal molecule and a cobalt atom. Vitamin B_{12}, also called cobalamin, is a water-soluble vitamin with a key role in the normal functioning of the brain and nervous system, and for the formation of blood. It is one of the eight B vitamins. It is normally involved in the metabolism of every cell of the human body, especially affecting DNA synthesis and regulation, but also fatty acid synthesis and energy production. Neither fungi, plants, nor animals are capable of producing vitamin B_{12}.. Only bacteria and archaea have the enzymes required for its synthesis, although many foods are a natural source of B_{12} because of bacterial symbiosis. The vitamin is the largest and most structurally complicated vitamin and can be produced industrially only through bacterial fermentation-synthesis.

Vitamin B_{12} is vital for the formation of red blood cells, as well as for the proper functioning and health of nerve tissue. If left untreated, vitamin B_{12} deficiency, also known as B_{12} deficiency, can lead to anemia, as well as nerve and brain damage, which may eventually become irreversible.

People with B_{12} deficiency may eventually develop *pernicious anemia*, a type of blood disorder. Patients with pernicious anemia cannot produce enough *IF (intrinsic factor)* in their stomach. IF is needed so that the body can absorb vitamin B_{12}. People with this blood disorder need to have vitamin B_{12} injections which go straight into their bloodstream, bypassing the stomach. Vitamin B_{12} also helps our bodies absorb folic acid, which facilitates the release of energy.

MATERIAL AND METHODS

Vitamin B_{12} is used to treat vitamin B_{12} deficiency, cyanide poisoning, and hereditary deficiency of transcobalamin II. It is given as part of the Schilling test for detecting pernicious anemia. For cyanide poisoning, a large amount may be given intravenously and sometimes in combination with sodium thiosulfate. The mechanism of action is straightforward: the hydroxycobalamin hydroxide ligand is displaced by the toxic cyanide ion, and the resulting harmless B_{12} complex is excreted in urine.

High vitamin B_{12} level in elderly individuals may protect against brain atrophy or shrinkage associated with Alzheimer's disease and impaired cognitive function. http://en.wikipedia.org/wiki/Vitamin_B12_-_cite_note-12 High-dose administration of Vitamin B_{12} has been additionally validated to stimulate the activity of the body's TH1 suppressor T-Cells, which then down-regulates the over-production of the allergen antibody IgE in allergic individuals.

Vitamin B12 is naturally found in animal products, including fish, meat, poultry, eggs, milk, and milk products. Vitamin B12 is generally not present in plant foods, but fortified breakfast cereals are a readily available source of vitamin B12 with high bioavailability for vegetarians. Some nutritional yeast products also contain vitamin B12. Fortified foods vary in formulation, so it is important to read product labels to determine which added nutrients they contain.

Table1.

Several food sources of vitamin B12

Food	**Micrograms (mcg) per serving**	**Percent DV***
Clams, cooked, 3 ounces	84.1	1,402
Liver, beef, cooked, 3 ounces	70.7	1,178
Breakfast cereals, fortified with 100% of the DV for vitamin B12, 1 serving	6.0	100
Trout, rainbow, wild, cooked, 3 ounces	5.4	90
Salmon, sockeye, cooked, 3 ounces	4.8	80
Trout, rainbow, farmed, cooked, 3 ounces	3.5	58
Tuna fish, light, canned in water, 3 ounces	2.5	42
Cheeseburger, double patty and bun, 1 sandwich	2.1	35
Haddock, cooked, 3 ounces	1.8	30
Breakfast cereals, fortified with 25% of the DV for vitamin B12, 1 serving	1.5	25
Beef, top sirloin, broiled, 3 ounces	1.4	23
Milk, low-fat, 1 cup	1.2	18
Yogurt, fruit, low-fat, 8 ounces	1.1	18
Cheese, Swiss, 1 ounce	0.9	15
Beef taco, 1 soft taco	0.9	15
Ham, cured, roasted, 3 ounces	0.6	10
Egg, whole, hard boiled, 1 large	0.6	10

In dietary supplements, vitamin B12 is usually present as cyanocobalamin, a form that the body readily converts to the active forms methylcobalamin and 5-deoxyadenosylcobalamin. Dietary supplements can also contain methylcobalamin and other forms of vitamin B12.

Vitamin B12, in the form of cyanocobalamin and occasionally hydroxocobalamin, can be administered parenterally as a prescription medication, usually by intramuscular injection. Parenteral administration is typically used to treat vitamin B12 deficiency caused by pernicious anemia and other conditions that result in vitamin B12 malabsorption and severe vitamin B12 deficiency.

Vitamin B12 deficiency causes tiredness, weakness, constipation, loss of appetite, weight loss, and megaloblastic anemia. Nerve problems, such as numbness and tingling in the hands and feet, can also occur. Other symptoms of vitamin B12 deficiency include problems with balance, depression, confusion, dementia, poor memory, and soreness of the mouth or tongue.

Vitamin B12 deficiency can damage the nervous system even in people who don't have anemia, so it is important to treat a deficiency as soon as possible.

In infants, signs of a vitamin B12 deficiency include failure to thrive, problems with movement, delays in reaching the typical developmental milestones, and megaloblastic anemia.

Large amounts of folic acid can hide a vitamin B12 deficiency by correcting megaloblastic anemia, a hallmark of vitamin B12 deficiency. But folic acid does not correct the progressive damage to the nervous system that vitamin B12 deficiency also causes. For this reason, healthy adults should not get more than 1,000 mcg of folic acid a day.

Scientists are studying vitamin B12 to understand how it affects health. Here are several examples of what this research has shown:

- ***Heart disease***
  Vitamin B12 supplements (along with folic acid and vitamin B6) do not reduce the risk of getting heart disease. Scientists had thought that these vitamins might be helpful because they reduce blood levels of homocysteine, a compound linked to an increased risk of having a heart attack or stroke.
- ***Dementia***
  As they get older, some people develop dementia. These people often have high levels of homocysteine in the blood. Vitamin B12 (with folic acid and vitamin B6) can lower homocysteine levels, but scientists don't know yet whether these vitamins actually help prevent or treat dementia.
- ***Energy and athletic performance***
  Advertisements often promote vitamin B12 supplements as a way to increase energy or endurance. Except in people with a vitamin B12 deficiency, no evidence shows that vitamin B12 supplements increase energy or improve athletic performance.

RESULTS AND DISCUSSION

Vegans and some vegetarians - vegetarians who do not eat eggs, as well as vegans should make sure their B_{12} intake is adequate. There are various breakfast cereals which are fortified with vitamin B_{12}. Some brands of nutritional yeast are also good sources of B_{12}. Some types of soy milk are fortified with B_{12}.

According to Patrick J. Skerrett, Executive Editor, *Harvard Health*, a standard multivitamin contains 6 micrograms of vitamin B_{12}, which is more than enough to cover an average person's daily requirement.

It is important for vegans, whose food provides few sources of B_{12}, and anyone else wishing to obtain B_{12} from food sources other than animals, to consume foods that contain little or no pseudovitamin-B_{12} and are high in biologically active B_{12}. However, there have been no significant human trials of sufficient size to demonstrate enzymatic activity of B_{12} from nonbacterial sources, such as *Chlorella* and edible sea algae (seaweeds, such as lavers), although chemically some of these sources have been reported to contain B_{12} that seems chemically identical to active vitamin. However, among these sources, only fresh sea algae such as Susabi-nori (*Porphyra yezoensis*) have been reported to demonstrate vitamin B_{12} activity in B_{12} deficient rats. This has yet to be demonstrated for *Chlorella*, and no study in rats of any algal B_{12} source has yet to be confirmed by a second independent study..

People who eat meat and/or fish - a balanced diet containing fish, meat and dairy foods should have enough B_{12} for human requirements.

A number of reliable vegan food sources for vitamin B12 are known. One brand of nutritional yeast, Red Star T-6635+, has been tested and shown to contain active vitamin B12. This brand of yeast is often labeled as Vegetarian Support Formula with or without T-6635+ in parentheses following this name. It is a reliable source of vitamin B12. Nutritional yeast, Saccharomyces cerevisiae, is a food yeast, grown on a molasses solution, which comes as yellow flakes or powder. It has a cheesy taste. Nutritional yeast is different from brewer's yeast or torula yeast. Those sensitive to other yeasts can often use it.

Other sources of vitamin B_{12} are vitamin B_{12} fortified soy milk, vitamin B12 fortified meat analogues (food made from wheat gluten or soybeans to resemble meat, poultry, or fish), vitamin B12-fortified energy bars, and vitamin B12 supplements.

CONCLUSION

The dietary reference intake for an adult ranges from 2 to 3 µg per day. Vitamin B_{12} is believed to be safe when used orally in amounts that do not exceed the recommended dietary allowance (RDA). There have been studies that showed no adverse consequences of doses above the RDA. The RDA for vitamin B_{12} in pregnant women is 2.6 µg per day and 2.8 µg during lactation periods.

The Institute of Medicine states that because 10 to 30% of older people may be unable to absorb naturally occurring vitamin B_{12} in foods, it is advisable for those 51 years old and older to consume B_{12}-fortified foods or B_{12} supplements to meet the recommended intake.

BIBLIOGRAPHY

1. CARMEL R. How I treat cobalamin (vitamin B12) deficiency. Blood.2008
2. CLARKE R. B-vitamins and prevention of dementia. Proc Nutr Soc 2008;
3. Lesaffre Yeast Corporation. Vegetarian Support Formula. http://www.lesaffre-yeast.com/red-star/vsf.html. Accessed April 10, 2012.
4. MANGELS, REED. "Vitamin B12 in the Vegan Diet". Vegetarian Resource Group. Retrieved 2008-01-17
5. NORRIS J. Vitamin B12: Are you getting it? http://veganhealth.org/articles/vitaminb12. Accessed April 3, 2012.
6. "Vitamin B12". *The American Society of Health-System Pharmacists*. Retrieved 3 April 2011.

7. "Vitamins and minerals – B vitamins and folic acid". *NHS*. National Health Service (NHS). 2012-11-26. Retrieved 2013-07-10.
8. WALSH, STEPHEN. "What every vegan should know about vitamin B12". Vegan Society. Archived from the original on 2007-07-17. Retrieved 2007-12-03.