Facts About Dietary Supplements

Clinical Nutrition Service, Warren Grant Magnuson Clinical Center • Office of Dietary Supplements • National Institutes of Health

Vitamin B_6

As a consumer, you need information you can trust to help you make thoughtful decisions about eating a healthful diet and using vitamin and mineral supplements. Registered dietitians at the Warren Grant Magnuson Clinical Center, the clinical research hospital at the National Institutes of Health (NIH) in Bethesda, MD, developed this series of Fact Sheets in conjunction with the Office of Dietary Supplements in the Office of the Director of NIH to provide responsible information about the role of vitamins and minerals in health and disease and to help guide your decisions on the use of vitamin and mineral supplements. Each fact sheet in this series received extensive scientific review by recognized experts from the academic and research communities. The information is not intended to be a substitute for professional medical advice. It is important that you seek the advice of a physician about any medical condition or symptom. It is also important to seek the advice of a physician, registered dietitian, pharmacist, or other qualified health care professional about the appropriateness of taking dietary supplements and their potential interactions with medications.

Vitamin B_6: What is it?

Vitamin B_6 is a water-soluble vitamin that exists in three major chemical forms: pyridoxine, pyridoxal, and pyridoxamine (1, 2). It performs a wide variety of functions in your body and is essential for your good health. For example, vitamin B_6 is needed for more than 100 enzymes involved in protein metabolism. It is also essential for red blood cell metabolism. The nervous and immune systems need vitamin B6 to function efficiently, (3-6) and it is also needed for the conversion of tryptophan (an amino acid) to niacin (a vitamin) (1, 7).

Hemoglobin within red blood cells carries oxygen to tissues. Your body needs vitamin B_6 to make hemoglobin. Vitamin B_6 also helps increase the amount of oxygen carried by hemoglobin. A vitamin B6 deficiency can result in a form of anemia (1) that is similar to iron deficiency anemia.

An immune response is a broad term that describes a variety of biochemical changes that occur in an effort to fight off infections. Calories, protein, vitamins, and minerals are important to your immune defenses because they promote the growth of white blood cells that directly fight infections. Vitamin B6, through its involvement in protein metabolism and cellular growth, is important to the immune system. It helps maintain the health of lymphoid organs (thymus, spleen, and lymph nodes) that make your white blood cells. Animal studies show that a vitamin B_6 deficiency can decrease your antibody production and suppress your immune response (1, 5).

Vitamin B_6 also helps maintain your blood glucose (sugar) within a normal range. When caloric intake is low your body needs vitamin $B_6$to help convert stored carbohydrate or other nutrients to glucose to maintain normal blood sugar levels. While a shortage of vitamin B_6 will limit these functions, supplements of this vitamin do not enhance them in well-nourished individuals (1, 8-10).

What foods provide vitamin B_6?

Vitamin B_6 is found in a wide variety of foods including fortified cereals, beans, meat, poultry, fish, and some fruits and vegetables (1, 11). The table of selected food sources of vitamin B_6 suggests many dietary sources of B6.

What is the Recommended Dietary Allowance for vitamin B_6 for adults?

The Recommended Dietary Allowance (RDA) is the average daily dietary intake level that is sufficient to meet the nutrient requirements of nearly all (97 to 98%) healthy individuals in each life-stage and gender group (12).

Below are the 1998 RDAs for vitamin B_6 (12) for adults, in milligrams:

Life Stage	Men	Women	Pregnancy	Lactation
Ages 19-50	1.3 mg	1.3 mg		
Ages 51+	1.7 mg	1.5 mg		
All Ages			1.9 mg	2.0 mg

Results of two national surveys, the National Health and Nutrition Examination Survey (NHANES III1988-94) (12, 13) and the Continuing Survey of Food Intakes by Individuals (1994-96 CSFII) (12), indicated that diets of most Americans meet current intake recommendations for vitamin B_6. (12).

When can a vitamin B_6 deficiency occur?

Clinical signs of vitamin B_6 deficiency are rarely seen in the United States. Many older Americans, however, have low blood levels of vitamin B_6, which may suggest a marginal or sub-optimal vitamin B6 nutritional status. Vitamin B6 deficiency can occur in individuals with poor quality diets that are deficient in many nutrients. Symptoms occur during later stages of deficiency, when intake has been very low for an extended time. Signs of vitamin B_6 deficiency include dermatitis (skin inflammation), glossitis (a sore tongue), depression, confusion, and convulsions (1, 12). Vitamin B_6 deficiency also can cause anemia (1, 12, 14). Some of these symptoms can also result from a variety of medical conditions other than vitamin B_6 deficiency. It is important to have a physician evaluate these symptoms so that appropriate medical care can be given.

Who may need extra vitamin B_6 to prevent a deficiency?

Individuals with a poor quality diet or an inadequate B_6 intake for an extended period may benefit from taking a vitamin B6 supplement if they are unable to increase their dietary intake of vitamin B_6 (1, 15). Alcoholics and older adults are more likely to have inadequate vitamin B_6 intakes than other segments of the population because they may have limited variety in their diet. Alcohol also promotes the destruction and loss of vitamin B_6 from the body

Asthmatic children treated with the medicine theophylline may need to take a vitamin B_6 supplement (16). Theophylline decreases body stores of vitamin B_6 (17), and theophylline-induced seizures have been linked to low body stores of the vitamin. A physician should be consulted about the need for a vitamin B6 supplement when theophylline is prescribed.

What are some current issues and controversies about vitamin B_6?

Vitamin B_6 and the nervous system

Vitamin B_6 is needed for the synthesis of neurotransmitters such as serotonin and dopamine (1). These neurotransmitters are required for normal nerve cell communication. Researchers have been investigating the relationship between vitamin B6 status and a wide variety of neurologic conditions such as seizures, chronic pain, depression, headache, and Parkinson's disease (18).

Lower levels of serotonin have been found in individuals suffering from depression and migraine headaches. So far, however, vitamin B6 supplements have not proved effective for relieving these symptoms. One study found that a sugar pill was just as likely as vitamin B_6 to relieve headaches and depression associated with low dose oral contraceptives (19).

Alcohol abuse can result in neuropathy, abnormal nerve sensations in the arms and legs (20). A poor dietary intake contributes to this neuropathy and dietary supplements that include vitamin B_6 may prevent or decrease its incidence (18).

Vitamin B_6 and carpal tunnel syndrome

Vitamin B_6 was first recommended for carpal tunnel syndrome almost 30 years ago (21). Several popular books still recommend taking 100 to 200 milligrams (mg) of vitamin B_6 daily to treat carpal tunnel syndrome, even though scientific studies do not indicate it is effective. Anyone taking large doses of vitamin B_6 supplements for carpal tunnel syndrome needs to be aware that the Institute of Medicine recently established an upper tolerable limit of 100 mg per day for adults (12). There are documented cases in the literature of neuropathy caused by excessive vitamin B6 taken for treatment of carpal tunnel syndrome (22).

Vitamin B6 and premenstrual syndrome
Vitamin B_6 has become a popular remedy for treating the discomforts associated with premenstrual syndrome (PMS). Unfortunately, clinical trials have failed to support any significant benefit (23). One recent study indicated that a sugar pill was as likely to relieve symptoms of PMS as vitamin B_6 (24). In addition, vitamin B6 toxicity has been seen in increasing numbers of women taking vitamin B_6 supplements for PMS. One review indicated that neuropathy was present in 23 of 58 women taking daily vitamin B_6 supplements for PMS whose blood levels of B_6 were above normal (25). There is no convincing scientific evidence to support recommending vitamin B_6supplements for PMS.

Vitamin B_6 and interactions with medication
There are many drugs that interfere with the metabolism of vitamin B_6. Isoniazid, which is used to treat tuberculosis, and L-DOPA, which is used to treat a variety of neurologic problems such as Parkinson's disease, alter the activity of vitamin B_6. There is disagreement about the need for routine vitamin B_6 supplementation when taking isoniazid (26, 27). Acute isoniazid toxicity can result in coma and seizures that are reversed by vitamin B_6 but in a group of children receiving isoniazid, no cases of neurological or neuropsychiatric problems were observed regardless of whether or not they took a vitamin B6 supplement. Some doctors recommend taking a supplement that provides 100 percent of the RDA for B6 when isoniazid is prescribed, which is usually enough to prevent symptoms of vitamin B6 deficiency. It is important to consult with a physician about the need for a vitamin B_6 supplement when taking isoniazid.

What is the relationship between vitamin B_6, homocysteine, and heart disease?
A deficiency of vitamin B_6, folic acid, or vitamin B_{12} may increase your level of homocysteine, an amino acid normally found in your blood (28). There is evidence that an elevated homocysteine level is an independent risk factor for heart disease and stroke (29-37). The evidence suggests that high levels of homocysteine may damage coronary arteries or make it easier for blood clotting cells called platelets to clump together and form a clot. However, there is currently no evidence available to suggest that lowering homocysteine level with vitamins will reduce your risk of heart disease. Clinical intervention trials are needed to determine whether supplementation with vitamin B_6, folic acid, or vitamin B12 can help protect you against developing coronary heart disease.

What is the health risk of too much vitamin B_6?
Too much vitamin B_6 can result in nerve damage to the arms and legs. This neuropathy is usually related to high intake of vitamin B_6 from supplements, (28) and is reversible when supplementation is stopped. According to the Institute of Medicine, "Several reports show sensory neuropathy at doses lower than 500 mg per day" (12). As previously mentioned, the Food and Nutrition Board of the Institute of Medicine has established an upper tolerable intake level (UL)

for vitamin B_6 of 100 mg per day for all adults (12). "As intake increases above the UL, the risk of adverse effects increases (12)."

Selected Food Sources of vitamin B_6(11)

As the 2000 Dietary Guidelines for Americans state, "Different foods contain different nutrients and other healthful substances. No single food can supply all the nutrients in the amounts you need" (38). As the following table indicates, vitamin B_6 is found in a wide variety of foods. Foods such as fortified breakfast cereals, fish including salmon and tuna fish, meats such as pork and chicken, bananas, beans and peanut butter, and many vegetables will contribute to your vitamin B_6 intake. If you want more information about building a healthful diet, refer to the Dietary Guidelines for Americans and the Food Guide Pyramid.

Table of Selected Food Sources of vitamin B_6

Food	*Milligrams*	*% DV**
Ready-to-eat cereal, 100% fortified, 3/4 c	2.00	100
Potato, Baked, flesh and skin, 1 medium	0.70	35
Banana, raw, 1 medium	0.68	34
Garbanzo beans, canned, 1/2 c	0.57	30
Chicken breast, meat only, cooked, 1/2 breast	0.52	25
Ready-to-eat cereal, 25% fortified, 3/4 c	0.50	25
Oatmeal, instant, fortified, 1 packet	0.42	20
Pork loin, lean only, cooked, 3 oz	0.42	20
Roast Beef, eye of round, lean only, cooked, 3 oz	0.32	15

Table of Selected Food Sources of vitamin B_6

Food	*Milligrams*	*% DV**
Trout, Rainbow, cooked, 3 oz	0.29	15
Sunflower seeds, kernels, dry roasted, 1 oz	0.23	10
Spinach, frozen, cooked, 1/2 c	0.14	8
Tomato juice, canned, 6 oz	0.20	10
Avocado, raw, sliced, 1/2cup	0.20	10
Salmon, Sockeye, cooked, 3 oz	0.19	10
Tuna, canned in water, drained solids, 3 oz	0.18	10
Wheat bran, crude or unprocessed, 1/4 c	0.18	10
Peanut butter, smooth, 2 Tbs.	0.15	8
Walnuts, English/Persian, 1 oz	0.15	8
Soybeans, green, boiled, drained, 1/2 c	0.05	2
Lima beans, frozen, cooked, drained, 1/2c	0.10	6

** DV = Daily Value. DVs are reference numbers based on the Recommended Dietary Allowance (RDA). They were developed to help consumers determine if a food contains a lot or a little of a specific nutrient. The DV for vitamin B6 is 2.0 milligrams (mg). The percent DV (%DV) listed on the nutrition facts panel of food labels tells you what percentage of the DV is provided in one serving. Percent DVs are based on a 2,000 calorie diet. Your Daily Values may be higher or lower depending on your calorie needs. Foods that provide lower percenages of the DV also contribute to a healthful diet.*

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