

Vitamin B₆

Physiological Functions

Vitamin B₆ or pyridoxine is a coenzyme for enzymes involved in amino acid metabolism. Deamination, transamination, and decarboxylation of amino acids are required for synthesis, oxidation, and degradation of critical amino acid derived molecules that participate in hematological, neurological, humoral, and inflammatory processes. As a result, activities sensitive to pyridoxine status include neurotransmitter function, heme synthesis, conversion of tryptophan to niacin, immunoglobulin synthesis, and hormone production.

Vitamin B₆ supplements in pharmacologic doses have been used to treat carpal tunnel syndrome, premenstrual syndrome, and depression.

Factors Affecting Availability

Vitamin B₆ is easily destroyed in processing of foods. More than half of the vitamin may be lost with use of the flash-frozen method for freezing fruits and vegetables, during milling of grains, and production of processed meats. Vitamin B₆ is not included as part of the enrichment mixture that is added to processed grains to compensate for milling losses so whole grains are a richer source of the vitamin. Fresh meats and raw produce also provide greater levels of Vitamin B₆ than their processed counterparts.

The bioavailability of Vitamin B₆ from meats is greater than from fruits, vegetables and whole grains. Approximately 75% of vitamin B₆ is absorbed from foods consumed in a typical American diet. Alcohol and several drugs adversely affect the bioavailability of Vitamin B₆ through interfering with absorption and synthesis of the coenzyme form. Examples of these drugs are isonicotinic acid hydrazide (INH), isoniazid, hydralazine, and penicillamine.

Deficiency

Epithelial and neurologic changes are characteristic of a vitamin B₆ deficiency. Epithelial tissue changes associated with vitamin B₆ deficiency include cheilosis, glossitis, stomatitis, and skin disorders. Neurological changes include weakness, tingling and pain in the extremities, as well as depression, headaches and nausea. Microcytic hypochromic anemia is observed in a deficiency of pyridoxine because the coenzyme is involved in heme synthesis. A pyridoxine deficiency is likely responsible when these hematologic changes occur with normal serum ferritin and ceruloplasmin levels

Elevated serum homocysteine levels (associated with increased risk of heart disease) are also a clinical manifestation of vitamin B₆ deficiency when it is accompanied by folate and vitamin B₁₂ deficiencies.

Toxicity

Vitamin B6 is stored primarily in skeletal muscle. Although this vitamin is water soluble, megadoses of vitamin B6 may be toxic. Symptoms of toxicity are mainly neurological and include weakness and numbness and tingling of peripheral nerves. These symptoms are thought to be related to excess levels of the vitamin coenzyme, pyridoxal phosphate, which inhibits neurotransmitter synthesis by negative feedback inhibition.

- ❖ *The upper limit of safety for vitamin B6 established by the Food and Nutrition Board of the Institute of Medicine is 100 mg daily for adults. Age-specific safety levels appear in the table below.*

Vitamin B6 Tolerable Upper Intake Levels	
Life Stage	Vitamin B6 (mg)
Infants	
0-6 mo	N/A
7-12 mo	N/A
Children	
1-3 y	30
4-8 y	40
Males, Females	
9-13 y	60
14-18 y	80
19-70 y	100
70 y	100
Pregnancy	
≤ 18 y	80
19-50 y	100
Lactation	
≤ 18 y	80
19-50 y	100

Daily Requirements

The Daily Reference Intakes (DRI) for Vitamin B6 are shown in the table below.

Life Stage	Vitamin B ₆ (mg)
Infants	
0-6 mo	.1
7-12 mo	.3
Children	
1-3 y	.5
4-8 y	.6
Males	

9-13 y	1.0
14-18 y	1.3
19-30 y	1.3
31-50 y	1.3
51-70 y	1.7
70 y	1.7
Females	
9-13 y	1.0
14-18 y	1.2
19-30 y	1.3
31-50 y	1.3
51-70 y	1.5
70	1.5
Pregnancy	
18 y	1.9
19-30 y	1.9
31-50 y	1.9
Lactation	
18 y	2.0
19-30 y	2.0
31-50 y	2.0

Dietary Sources

Vitamin B₆ is widely available in foods of both plant and animal origin. Fish, poultry, meat, nuts, fruits, and whole grains such as oatmeal are excellent sources of Vitamin B₆.

FOOD	Vitamin B₆ (mg)
Liver, beef, 3.5 oz cooked	1.4
Oatmeal, 1 cup cooked	.74
Banana, 1	.70
Salmon, 3.5 oz cooked	.65
Chicken, light meat, 3.5 oz cooked	.63
Turkey, light meat, 3.5 oz cooked	.50
Potatoes, mashed, 1 cup	.48
Avocado, California, 1	.48
Halibut, baked, 3.5 oz cooked	.40
Tomato juice, 1 cup cooked	.34
Sweet potatoes, _ cup canned	.30
Blackstrap molasses, 2 Tbl	.29
Mango, 1	.28
Wheat germ, toasted, _ cup	.28

Rice, brown, cooked, 1 cup	.28
Sunflower seeds, kernels, _ cup	.26
Brussels sprouts, _ cooked	.23
Prunes, dried, 10	.22
Watermelon, 1 cup cubed	.22
Cantelope, 1 cup cubed	.18
Lentils, _ cup cooked	.18
Carrots, _ cup cooked	.18
Peanuts, _ cup	.18
Peanut butter, 2 T	.15
Cauliflower, cooked, _ cup	.11
Orange juice, 1 cup	.10
Milk, 2%, 1 cup	.10
Tomato, raw, 1	.10