

Vitamin B₁₂

Physiological Functions

Vitamin B₁₂ is required for folate absorption, storage and activation to its coenzyme forms. Thus vitamin B₁₂ works in tandem with folate to support cellular replication and a deficiency in either vitamin can adversely affect the functions of both. The only unique role identified for the vitamin is the synthesis of myelin a constituent of the sheaths that protect nerve fibers. Neurological damage associated with a vitamin B₁₂ deficiency can occur in spite of adequate folate intake.

Factors Affecting Availability

Vitamin B₁₂ is generally stable and is minimally destroyed with normal methods of cooking and processing. However, up to a third of this vitamin can be destroyed if cooking time is prolonged.

Vitamin B₁₂ is absorbed by both passive and facilitated diffusion. Only small amounts of the vitamin are passively absorbed so for optimal absorption, facilitated diffusion involving binding to intrinsic factor is required. Intrinsic factor, produced by gastric mucosa, promotes vitamin B₁₂ absorption in the ileum. Gastric acidity also promotes availability of vitamin B₁₂ by releasing it from the polypeptides to which it is bound in food sources. Decreased gastric acidity due to medications or age can significantly compromise vitamin B₁₂ status.

Deficiency

Vitamin B₁₂ deficiency is most commonly the result of inadequate absorption. Low intake can also contribute since vitamin B₁₂ is exclusively found in foods of animal origin.

Megaloblastic anemia is a clinical manifestation of vitamin B₁₂ deficiency which reflects the dependence between folic acid and vitamin B₁₂. Megaloblastic anemia caused by inadequate production of intrinsic factor is designated pernicious anemia. Neurologic symptoms associated with vitamin B₁₂ deficiency include progressive neuropathy with demyelination of the peripheral nerves advancing to the central nervous system. Numbness and tingling in the hands and feet, stiffness and weakness in the legs, and an unsteady gait are often observed. In the elderly, vitamin B₁₂ deficiency is characterized by mental disorientation, memory loss, and a yellowish tint to the skin due to concurrent anemia and jaundice.

The dependence of folate metabolism on vitamin B₁₂ can be bypassed by high dose folate supplements which will reverse the hematological changes, but not the neurological damage. To prevent the progressive irreversible neurological damage of undetected vitamin B₁₂ deficiency, nonprescription **folate supplements cannot exceed 400 µg**.

Toxicity

Vitamin B₁₂ is not toxic in oral doses up to 100 µg daily because absorptive efficiency decreases with increased dose.

- ❖ *The upper limit of safety for vitamin B₁₂ has not been determined due to lack of data substantiating adverse effects at high intakes. The Food and Nutrition Board of the Institute of Medicine recommends that vitamin B₁₂ should be consumed only from food sources to prevent intake of potentially toxic levels.*

Requirements

The Daily Reference Intakes (DRI) for vitamin B₁₂ are shown in the table below.

Life cycle	Vitamin B₁₂ (µg)
Infants	
0-6 mo	.4
7-12 mo	.5
Children	
1-3 y	.9
4-8 y	1.2
Males	
9-13 y	1.8
14-18 y	2.4
19-30 y	2.4
31-50 y	2.4
51-70 y	2.4
70 y	2.4
Females	
9-13 y	1.8
14-18 y	2.4
19-30 y	2.4
31-50 y	2.4
51-70 y	2.4
70	2.4
Pregnancy	
18 y	2.6
19-30 y	2.6
31-50 y	2.6
Lactation	
18 y	2.8
19-30 y	2.8
31-50 y	2.8

Dietary Sources

Vitamin B₁₂ is obtained mainly from foods of animal origin. Some grain products and nondairy products intended to replace dairy foods may be fortified with vitamin B₁₂ to provide dietary sources of this nutrient for vegetarians. See the table below for dietary sources of vitamin B₁₂.

Vitamin B₁₂ Content of Food	
FOOD	Vitamin B₁₂ (µg)
Liver, beef, 3.5 oz	112
Clams, steamed, 3.5 oz	99
Oysters, raw, Pacific, 3 oz	16
Crab, cooked, 3 oz	9
Trout, cooked, 3.5 oz	5
Tuna, light, canned, in water, 3.5 oz	1.8
Low fat yogurt, 1 cup	1.4
Milk, nonfat, 1 cup	.93
Frankfurters, beef, 1	.88
Pork chop, broiled, 3.5 oz	.6
Egg, one cooked	.50
Cheese, provolone, 1 oz	.41
Chicken, white meat, 3.5 oz cooked	.36
Chicken, dark meat, 3.5 oz cooked	.32
Cheddar cheese, 1 oz	.24