

The B Vitamins - A Clinically Oriented Fact Sheet

The B-complex vitamins are a group of substances which are considered “essential” because they must be obtained from the diet. They serve as cofactors for numerous enzymatic pathways in the body.

Vitamin B1 (thiamin)

Deficiency: In the 3rd world, results in beriberi (neuromuscular, GI, cardiovascular collapse). In the US, deficiencies are seen in severely malnourished infants, the elderly, adults who diet chronically, and those who suffer alcoholism.

Pharmacology: to be metabolically active, thiamin combines with two molecules of phosphoric acid to form the co-enzyme thiamine pyrophosphate (TPP). Alcohol interferes with the absorption of thiamin, yet it is depleted by the metabolism of alcohol. Severe deficiency may require parenteral replacement.

Food Sources: All plant and animal foods contain vitamin B1.

Widely Accepted Uses

- Treatment of Wernicke-Korsakoff syndrome in malnourished alcoholics.
- Supplementation in GI malabsorption conditions such as celiac sprue.

CAM Clinical Use

- Adjunctive therapy in the treatment of depression – evidence is scant.

Adverse Effects/Toxicity: none

Vitamin B2 (riboflavin)

Food Sources: dairy products, meats, dark green vegetables, eggs, avocados, oysters, mushrooms, fish (e.g., salmon and tuna), and enriched breakfast cereals.

Pharmacology: Combines with phosphoric acid to become part of flavin adenine dinucleotide (FAD). FAD binds more than 100 flavoprotein enzymes, which catalyze oxidation-reduction reactions in cells, playing a critical role in the conversion of carbohydrates to ATP.

CAM Clinical Uses

- To prevent migraine headaches – evidence is scant.

Adverse Effects/Toxicity: none

Vitamin B3 (niacin)

Deficiency: known as pellagra: dermatitis, dementia, and diarrhea. Pellagra is limited to areas where nutrition is severely limited and based on corn.

Food Sources: meats, poultry, fish, peanuts, organ meats, brewer's yeast, milk, legumes, and some cereals, especially enriched grains and flours

Pharmacology: Vitamin B3 functions as a component of nicotinamide adenine dinucleotide (NAD) and nicotinamide adenine dinucleotide phosphate (NADP) which are involved in more than 200 oxidation-reduction reactions in the Krebs cycle involving the production of energy from carbohydrates, and are critical for the step-wise transfer of electrons in mitochondria.

Widely Accepted Use: Dyslipidemia: lowers LDL, increases HDL, lowers triglycerides.

Adverse Effects/Toxicity: Large doses may cause transient side effects (e.g., tingling sensations, flushing of the skin, and head throbbing), which subside within 20-30 minutes and usually disappear entirely with continued use.

Vitamin B5 (pantothenic acid)

Vitamin B5 is converted into co-enzyme A (CoA). Vitamin B5 is present in nearly all foods so deficiency in humans is virtually unknown.

Food Sources: present in all plant and animal tissues.

Pharmacology: CoA is involved in the release of energy from carbohydrates in the Krebs cycle and is necessary for the synthesis of acetylcholine, phospholipids, and porphyrin in the hemoglobin of red blood cells.

CAM Clinical Uses

- To boost energy and athletic ability – evidence is scant.
- To detoxify alcohol – evidence is scant.
- To improve the stress reactions of well-nourished individuals – evidence is scant.

Vitamin B6 (pyridoxine)

Pharmacology: Vitamin B6 is phosphorylated to its active form, pyridoxal phosphate (PLP) which is involved in amino acid metabolism.

Widely Accepted Use: Prevention of isoniazid-induced peripheral neuropathy.

CAM Clinical Uses

- To treat premenstrual syndrome – suggestive data that should be confirmed.
- To treat nausea + vomiting of pregnancy – suggestive data that should be confirmed.
- To treat depression – evidence is scant.
- To prevent atherosclerosis by metabolizing homocysteine – evidence is scant.
- To prevent and treat carpal tunnel syndrome – evidence is scant.

Adverse Effects/Toxicity

- Large doses (1-6 g/d) can be neurotoxic. Limited and inconsistent evidence of toxicity with chronic doses of 500 mg/d. No toxicity has been reported with 100-300 mg/d; a safe upper limit is considered 100 mg/d.

Folate (sometimes referred to as “B9”)

Folic acid plays an essential role in numerous metabolic pathways, strikingly similar to that of “the other” B-vitamins, and is present in most commercial “B-complex” formulations. Deficiency is extremely rare but can result in anemia or dementia.

Food Sources: Large amounts are found in green leafy vegetables and fruits.

Widely Accepted Uses

- Maternal use early in gestation has been shown to prevent neural tube defects. Since 1998, the US government requires folic acid fortification of all cold cereals and baking flour, which extends to breads, pastas, bakery items, cookies, crackers.
- Prevention of methotrexate toxicity.

CAM Clinical Use

- To prevent atherosclerosis by metabolizing homocysteine – evidence is scant.
- To treat depression – evidence is scant.
- To prevent cancer – evidence is scant.

Vitamin B12 (cobalamin)

- Vitamin B12 is needed for DNA synthesis. Deficiencies manifest primarily as anemia and neurologic disorders. Symptoms include: fatigue, peripheral neuropathy, tongue and mouth irregularities, macrocytic anemia, depression, confusion, and memory loss.
- Strict vegetarians, the elderly, and those with Crohn’s disease that involves the terminal ileum, are at increased risk of deficiency.

Food Sources: beef, eggs, milk, chicken, and cheese. Trace amounts in legumes, soy.

Pharmacology: Vitamin B12 absorption is facilitated by intrinsic factor, a protein in gastric secretions, without which absorption drops to less than 1%. Vitamin B12 is required for nerve growth and maintenance and red blood cell maturation.