

VITAMIN B-1 (Thiamine)

General - water-soluble; anti-beriberi factor; anti-neuritic factor;

- First member of the B-complex to be isolated & structurally identified;
- Imparts characteristic smell to the B-complex; contains sulphur & nitrogen;
- Adult body contains about 30 to 70 mg of thiamine;
- **History:** beriberi described in 7th century in China; rice bran found to prevent beriberi produced by eating polished rice in 1897; isolated in 1912, called “vitamin”, identified in 1936; widespread B-1 deficiency in U.S. documented in 1943;

Nutrition

- **Sources:** all whole foods contain B-1; best: brewer’s yeast; pork, lamb, beef, poultry; sea foods, whole grains, brown rice; fair: walnuts, pecans, lentils, beans; worst: processed & refined foods;
- **Supplements:** B-1, B-complex, multi-vitamin, multi-mineral-vitamin formulations;
- **Absorption:** absorbed very rapidly from duodenum & small intestine; circulates freely in bloodstream; must be replenished daily;
- **Improved by:** other B-complex vitamins; anti-oxidant vitamin C; garlic & onions;
- **Antagonized by:** preparation losses in cooking are very high (25% or more); alcohol; gastritis & liver disease interfere with absorption;
- **Stability:** destroyed by heat, alkali, oxygen; destroyed by baking soda, light, irradiation, meat preservatives;
- **Storage:** throughout the body in endoplasmic reticula of all cells; 50% found in muscle; high concentrations in liver, heart, kidneys & brain; leukocytes, red blood cells;
- **Excretion:** rapidly through urine;
- **Metabolism:** limited stores can be depleted & clinical symptoms appear within 2 weeks or less; need for B-1 increases with alcohol, stress & sugar consumption; need increased for older people; less thiamine needed if fats are burned for energy;
- **Interactions:** some antibiotics & sulphonamides increase need for B-1; tea (8 cups/day) can result in higher B-1 requirement; oral contraceptives decrease body content of B-1;

Functions of vitamin B-1

- Predominant role of B-1 is as co-enzyme (TPP — thiamine pyrophosphate or co-carboxylase) to “extract” energy from carbohydrates; required for carbohydrate metabolism, along with B-2, B-3 & B-5;
- Necessary to synthesize neurotransmitter (acetylcholine), which allows nerve impulses to travel from one nerve cell to another; has role in maintaining nerve cell membranes;
- Involved in synthesis of RNA, fat & niacin (from tryptophan);

- A principal co-enzyme in liver chemistry; metabolizes acetaldehyde made from alcohol;
- Required for health of nerve, heart, muscle & digestive tissues;
- Promotes growth & repair of all tissues;
- Essential for production of stomach acid (HCl), required for digestion of proteins;
- Assisted by: other B-complex vitamins; anti-oxidant vitamin C

Quantities

- **Measurement:** milligrams;
- **Optimum:** (SONA) average ranges from 3.3 to 9.2 mg/day; diets high in refined carbohydrates (sugar, sucrose, glucose, sweets, refined unfortified flours) require more;
- **Individual** optimum must be individually determined; proportional to body weight, caloric intake, food habits, life style factors; minimum is 0.5 grams/1,000 calories;
- **Minimum:** (DRI) set at 1 .2 mg/day;
- **Less than RDA:** 46% of population, according to a U.S. government survey;
- **Deficiency:** can result from inadequate intake, poor absorption, stress, food additives (especially sulphites & nitrites), smoking, heavy drinking (leading cause); high carbohydrate consumption; exposure to air pollutants; use of prescription antibiotics; diarrhoea, sprue, ulcerative colitis, cancer, dysentery, biliary disease, lack of HCl; tea, coffee, betel nut; refined & unfortified foods; increased inborn requirement; endemic in areas of the world that eats polished rice as a staple;
- **Symptoms** include: beriberi: severe neurological disorder marked by mental confusion, muscle wasting (dry beriberi) & motor dysfunction, tissue swelling (wet beriberi oedema), anorexia, severe gastric distress, cardiac irregularities, heart failure;
- **Infant beriberi:** sudden vomiting, convulsions, abdominal distension, very fast heartbeat (tachycardia), followed by death from heart failure; cyanosis; weak, almost inaudible cry;
- **Alcohol abuse** (Wernicke-Korsakoff): confusion, depression, psychosis, coma;
- **Sub clinical beriberi:** fatigue, weight loss, slow nerve reflexes, loss of memory, irritability, stomach upset, generalized weakness, even in areas of adequate diet;
- **Mild deficiency** can produce apathy, mood changes, mental confusion, depression, disorderly thinking, vague fears; indigestion, poor appetite, insomnia; loss of intestinal muscle tone, colon distension, constipation; paraesthesia (numbness or burning of extremities); elevated blood pyruvic & lactic acid levels, producing oxygen deficiency probably accounts for most symptoms; possible neurological damage from deficiency during pregnancy; possible role in Alzheimer's disease;
- **Toxicity:** not recorded; excess B-1 excreted in urine; 100 times RDA completely safe;

Therapy with thiamine

- Usual therapeutic doses range from 1.5 - 100 mg/day;
- Rapidly reverses B-1 deficiency symptoms;
- Used to treat alcohol-induced psychosis;
- May restore injured nerve function (neuropathy), neuritis, neuralgia & pains of various origins; used to treat diseases of central nervous system;
- Used in treatment of cardiovascular symptoms;
- Treats multiple sclerosis, in conjunction with vitamin B-3;
- Improves muscle tone of digestive tract, eliminating a major cause of constipation;