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 & nitrates), 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;