

VITAMIN B-6 (Pyridoxine)

General - water-soluble; anti-dermatitis factor;

- Natural B-6 contains 3 equally effective forms: pyridoxine, pyridoxal & pyridoxamine;
- Liver converts vitamin B-6 to metabolically active pyridoxal phosphate;
- Adult body contains about 25 mg of B-6;
- **History:** suspected in 1926, confirmed in 1935; isolated in 1938; structure identified in 1939; other forms identified in 1945; deficiency in infants due to over-processed formulas identified in 1951; requirement in humans established in 1957;

Nutrition

- **Sources:** best: brewer's yeast, liver, chicken; good: ham, fish, nuts, whole grains, cauliflower, beans, bananas, raisins; poor: most vegetables & fruits, refined & processed, starchy foods;
- **Supplements:** B-6, B-complex, multi-vitamin & multi-mineral-vitamin formulations;
- **Absorption** occurs in the small intestine; 70% absorbed;
- **Improved by:** other B-complex vitamins & antioxidant vitamin C;
- **Stability:** relatively stable to heat; destroyed by light, UV, oxidation, alkaline conditions; freezing loses 15-70%; cooking loses up to 40%; milling grains loses 50-90%;
- **Storage:** throughout the body; slightly elevated concentrations in liver, nerve tissue, muscles & lymphatic system; bound to proteins (albumin & haemoglobin) in blood; body retains small amounts of pyridoxine; adequate daily consumption needed to maintain healthy levels;
- **Excretion:** through urine;
- **Metabolism:** converted to active form, pyridoxal-5-phosphate (PLP) in liver & blood cells, catalyzed by magnesium & zinc; circulates in blood attached to albumin protein; requirement increased with high protein & high fat diets;
- **Interactions:** oral contraceptives, estrogens, anti-depressants interfere with B-6 activity & increase need;
- High doses of B-6 may interfere with levodopa treatment of Parkinson's disease;

Functions of vitamin B-6

- Required for normal growth; necessary for functions of more than 60 enzymes;
- Helps in B-12 absorption;
- Necessary for immune function & cancer protection; improves immune function in elderly;
- Role in heart & artery health; converts toxic, atherogenic homocysteine into methionine;
- Main function of B-6 is transamination & deamination reactions (move amine {NH₂} groups between molecules; B-6 links amino acid {protein} & energy metabolism); also involved in decarboxylation reactions;

- PLP is a co-enzyme in the metabolism of carbohydrates, proteins & fats;
- Co-factor in the physiology of muscle, lymph & nerve tissues;
- Regulates energy production in cells; necessary for glucose tolerance; involved in breakdown of glycogen for energy;
- Converts essential fatty acids into prostaglandins (linoleic acid to arachidonic acid);
- Regulates water retention/excretion; maintains proper sodium/potassium ratios;
- Co-enzyme in synthesis of lipids from fatty acids & proteins from amino acids;
- Necessary for formation of vitamin B-3 from tryptophan;
- Improves oral health by maintaining integrity of teeth & facial bones;
- Vital for forming red blood cell pigment (heme), nucleic acids, bile salts, hormones, brain chemicals & immune antibodies;
- Necessary to produce neurotransmitters (epinephrine, serotonin, histamine) from amino acids; low B-6 during brain development results in permanent impairment;
- Plays part in thyroid hormone metabolism & in insulin & growth hormone synthesis;
- Plays part in DNA, RNA & elastin (connective tissue) synthesis;
- Synergized by: B-2, B-3 & biotin, that help convert B-6 into its active form;
- Antagonized by: increased intake of lipids or proteins; stress; pregnancy; aging; more than 40 drugs, including some antibiotics (cycloserine), oral contraceptives (estrogens), tuberculosis drug isoniazid, penicillamine, blood pressure lowering drugs (hydrallazine), anti-metabolites (desoxyypyri-doxine) & others;

Quantities

- Measurement: in milligrams;
- Optimum: (SONA) averages range from 2 to 25 mg/day;
- Individual optimum must be determined by each individual; determined by body weight & diet; 2 mg/100 grams of protein is necessary for positive nitrogen balance & amino acid metabolism; to prevent imbalance, B-6 should be at least equal to B-1 & B-2 consumption;
- Minimum: (DRI) set at 1 .3/1 .5 mg/day; (2 mg for pregnancy)
- Less than RDA: 80% of population, according to a U.S. government survey; almost 50% of population obtains less than 70% of RDA;
- Deficiency from inadequate diet, oestrogen birth control pills, pharmaceutical drugs; pregnancy & lactation; chronic alcohol use; high protein diet; poor absorption; higher requirement; unsupplemented fasting & reducing diets; increased need during pregnancy, lactation, exposure to radiation, cardiac failure, ageing;
- Symptoms include: headache; dizziness; generalized weakness & fatigue; irritability; unable to concentrate; insomnia; depression; water retention; skin lesions: sores on lips, skin & tongue; white blood cell dysfunctions; dandruff & oily scales on scalp & eye-brows (seborrhoeic dermatitis); iron-resistant anaemia; disorders of nerves, heart & joints; poor wound healing; abdominal

distress, vomiting; poor growth; erratic blood glucose levels; abnormal decrease in haemoglobin level (hypo chromic anaemia); inability to convert tryptophan into vitamin B-3; kidney stones; brain wave (EEG) abnormalities; nerve degeneration; low blood sugar, glucose intolerance, insensitivity to insulin; numbness & cramps in arms & legs; visual disturbances, neuritis, arthritis, limb paralysis, heart disorders involving nerves; increased urination;

- Infants: convulsive seizures of cerebral origin;
- Prenatal deficiency: may result in blood disorders & mental retardation of infants;
- Severe deficiency may result in stillbirth;
- Toxicity: low; 50 times RDA is safe over long term; at levels approaching 500 mg/day, may develop sensory neuropathy after several years; 2 to 10 grams/day develop sensory neuropathy within a few months;
- Reversed by cessation of supplement;

Therapy with pyridoxine

- Usual therapeutic dose from 2 to 200 mg/day;
- Useful in treatment of homocysteine-related heart & artery disease;
- Improves immune function in immune deficiency (cancer, AIDS);
- Prevent oxalate kidney stones; mild diuretic;
- Treat depression due to inability to convert tryptophan to neurotransmitter serotonin;
- Helpful in treating allergies, arthritis, asthma, carpal tunnel syndrome;
- Reverses deficiency conditions, certain kinds of anaemia, abnormalities of amino acid metabolism;
- 40 mg/day used to treat morning sickness (nausea & vomiting) during early pregnancy; vital during pregnancy & lactation; may relieve depression from oral contraceptives;
- Improves fertility in some cases of unexplained infertility;
- 50 - 200 mg/day may relieve premenstrual syndrome (PMS);
- Arthritic conditions may be alleviated by high doses of B-6 + cider vinegar & lecithin;
- May improve glucose tolerance in some cases of diabetes mellitus or gestational diabetes;
- May lessen frequency & severity of asthma attacks (wheezing, coughing, breathing difficulties);
- 25 - 200 mg/day may have beneficial effects in treatment of radiation sickness;
- 500 mg/day used to treat carpal tunnel syndrome, instead of penicillamine;
- 250 to 1,000 mg of pyridoxine increase dream recall without disturbing sleep patterns;
- "Mauve factor" (kryptopyrrole) schizophrenics may require 250 - 3,000 mg/day of B-6 to function normally; kryptopyrrole binds B-6, producing deficiency;
- B-6 + magnesium oxide prevent the recurrence of kidney stones;
- Large doses of B-6 + magnesium help treat childhood "autism";