CONDITIONALLY ESSENTIAL VITAMINS

These are nutrients that the body can make from other nutritional substances, but under some circumstances, may be unable to make in quantities sufficient for optimum health. This category also includes substances whose vitamin status has not been clearly established or substances which are not officially considered vitamins, but that appear to have benefits according to the testimonials of those who use them.

INOSITOL

General: water-soluble; muscle sugar;

- Exists in 9 different, natural, optically inactive or active forms; only one optically active form, myo-inositol (muscle sugar), possesses biological activity;
- In plant cells, inositol occurs in the hexaphosphate form, phytic acid, that binds calcium, iron & zinc, preventing their absorption from the digestive tract;
- Inositol is a lipotropic factor — promotes the metabolism of fats in the liver; along with choline, it occurs in high concentrations in lecithin preparations;
- History: recognized as growth-promoting factor for yeast in 1928; recognized as cure for hair loss in mice in 1941;

Nutrition

- Sources: heart, meats, fruit, milk, nuts, vegetables, whole grains; made in the body from glucose; present as phytate (hexa-phosphate inositol) in plants;
- Supplements: lipotropic, B-complex, multi-vitamin & multi-mineral-vitamin formulations;
- Absorption: from small intestine; can also be synthesized from glucose by the body; can be synthesized by intestinal bacteria;
- Antagonized by: coffee (which can deplete stored inositol), mineral oil & antibiotics;
- Storage: in heart, brain, nerves, liver & muscle;
- Excretion: through urine;
- Metabolism: part of membrane phospholipids (phosphatidyl inositol); diabetics excrete much higher quantities of inositol & their needs for it are higher;
- Interactions: sulphonamides increase need;

Functions of inositol

- Functions primarily at membrane level; as phosphatidyl inositol, has special response functions in various cells to external stimuli, e.g. hormones & neurotransmitters;
- Has close relationship with choline, biotin, B-6, folic acid, B-5 & PABA;
- May be involved in membrane permeability to Ca++;
- May have special functions in nerve & secretory cells;
- May be involved in mobilizing fats from liver;
- May help control blood & tissue levels of cholesterol;
- May prevent fatty deposits in the heart, liver & blood vessels;
- May be involved in carbohydrate metabolism;
- Essential for growth of liver & bone marrow cells;
- May have beneficial effects on nerves, alleviating anxiety & insomnia;
- May have role in sperm productions;
- Important in lecithin formation;
Quantities

- **Measurement**: in milligrams;
- **Optimum**: (SONA) averages not yet established;
- **Individual** optimum must be determined on an individual basis;
- **Minimum**: (DRI) has not been set; inositol is not an essential nutrient, because it can be made within the body;
- **Deficiency** of inositol may result from inadequate diet, inadequate absorption, inadequate endogenous production, abnormal bowel flora;
- **At risk**: people with diabetes mellitus; chronic renal failure; galactosemia; multiple sclerosis;
- **Symptoms** may include: atherosclerotic plaques; high blood cholesterol & fat deposition in intestinal mucosa cells (gerbils); fatty degeneration of liver; nerve damage; irregularities in fat metabolism; dermatitis, weight loss & death (in gerbils);
- **Sub clinical deficiency** symptoms may include alopecia (hair loss); constipation; eczema; saturated fats more detrimental than unsaturated in inositol deficiency; transport of lipoproteins from liver to blood may be impeded;
- **Toxicity**: none associated even with high intake of inositol;

**Therapy with inositol**

- 100 to 1,000 mg/day commonly used;
- Lowers serum cholesterol, stops hair loss & controls allergic reactions in the brain that result in abnormal behaviour;
- Part of lipotropic formula, for preventing fatty degeneration of liver & other inner organs;
- Improves peripheral neuropathy & sensory nerve function in diabetics;
- Stimulates contractions of intestinal tract, alleviating constipation;
- Has sedative-like effect that may be beneficial in insomnia;
- May help to lower high blood pressure;
- May be helpful in schizophrenia, hypoglycaemia, high copper & low zinc;

**CHOLINE**

**General** water-soluble;

- Choline can be produced in the body if diet contains sufficient protein;
- Choline precursor is the essential amino acid methionine;
- A key component of lecithin;
- **History**: synthesized in 1866; identified as factor preventing fat accumulation in liver of dogs in 1937; biosynthesis pathway identified in 1941; route for incorporation into lecithin identified in 1956;

**Nutrition**

- **Sources**: lecithin, egg yolks, soy beans, liver, fish, whole grains, legumes, fatty natural foods, cauliflower, cabbage;
- **Supplements**: lipotropics, B-complex, multi-vitamin, multi-mineral-vitamin formulations;
- **Absorption**: from duodenum & along entire small intestine;
- **Storage**: higher quantities found in liver; distributed throughout body in cell membranes;
- **Metabolism**: choline forms 10% of lecithin; synthesized from methionine, with help of B-12 & folic acid; carbohydrate loading increases liver triglyceride synthesis & increases need for choline-containing lipoprotein envelopes; increased choline necessary during periods of rapid growth (infancy);
• **Interactions:** tricyclic anti-depressants, anti-histamines & anti-spasmodics interfere with acetylcholine function & short-term memory;

**Functions of choline**

- Main function is probably to make methyl groups available for biological reactions;
- Part of lecithin (phosphatidylcholine) molecule, important component of all membranes & main emulsifier (mixing oil & water) in body;
- Part of the acetylcholine molecule, an important neurotransmitter;
- Participates primarily in the metabolism of fats & nerve tissue;
- Prevents deposition of fats in liver; essential for liver & kidney function;
- Involved in: digestion, synthesis & transport of fats to cell membranes in all tissues; metabolism of fats in bloodstream & kidneys;
- Probably releases carnitine (required for fat metabolism) from tissue storage; other methyl donors (betaine, methionine, sarcosine) cannot do this;
- Provides methyl groups for carnitine synthesis (made from trimethyl-lysine);
- Keeps gall bladder cholesterol in solution, preventing formation of gall stones;
- Vital for synthesis of neurotransmitter acetylcholine; maintains integrity of myelin sheath surrounding nerves;
- Donates methyl groups (CH3) to make methionine from (toxic) homocysteine, betaine (that stores methyl groups), dimethylglycine (B-15) a metabolic intermediate & other biological reactions;
- May aid in hormone production;

**Quantities**

- **Measurement:** in milligrams;
- **Optimum:** (SONA) average not yet established
- **Individual** optimum needs to be individually determined;
- **Minimum:** (RDI) 500 mg/day; choline is beneficial, but not an essential nutrient; can be made from amino acid serine (B-6 required);
- **Deficiency** from lack of dietary lecithin, choline or precursor amino acid methionine;
- **Symptoms include:** fatty infiltration of liver (steatosis) & damage to liver cells (cirrhosis), nephritis, kidney damage, atherosclerosis, arteriosclerosis & stomach ulcerations; loss of short-term memory;
- **Toxicity:** “fishy” smell from choline ingestion results from bacteria in gut; choline may cause depression in a few people;

**Therapy with choline**

- 500 to 2,000 mg/day may be used
- Fat-solubilizing;
- Patients on intravenous (i.v.) may require choline as part of i.v. nutrient formulation;
- Oral administration of choline reduces high blood pressure slightly (may increase vagal tone, dilating arterioles); intravenous choline lowers blood pressure slightly;
- May help improve kidney function
- May help prevent (but not reverse) Alzheimer’s disease;
- Improves short-term memory in some people;
- Helpful in treating tardive dyskinesia, a side effect of anti-psychotic medications;
- May help in Parkinson’s disease, Huntington’s disease, Tourette’s syndrome; Friedreich’s ataxia;
- 1,000 - 1,500 mg/day controls manic symptoms in lithium-resistant manic-depressive disorder;
- Reduces heart palpitations, dizziness, headaches, ear noises, constipation within 10 days
(anecdotal); improves insomnia, visual disturbances, blood flow to eyes (anecdotal);
• More than doubled 3-year survival rate of patients hospitalized for atherosclerosis;

**PARA-AMINOBENZOIC ACID (PABA)**

**General** water-soluble;

• An, integral part of folic acid & procaine (Gerovital) molecule;
• Essential for some bacteria, that make folic acid from it, but not for man;

**Nutrition**

• **Sources:** liver, kidney, whole grains, bran; made by bacteria in healthy intestines;
• **Supplements:** B-complex, multi-vitamin & multi-mineral-vitamin supplements;
• **Absorption** from small intestine;
• **Metabolism:** nutritional benefit has not been confirmed;
• **Interactions:** PABA antagonizes actions of sulpha drugs;

**Functions of PABA**

• Necessary for synthesis of folic acid by bacteria in gut, that in turn stimulate synthesis of B-5;
• Co-enzyme in amino acid metabolism & in formation of red blood cells;
• Together with pantothenic acid, PABA maintains pigmentation of hair;
• Externally, PABA prevents sunburn & skin cancer from UV light;

**Quantities**

• **Measurement:** milligrams;
• **Optimum:** (SONA) average ranges not set;
• **Individual** optimum must be determined for each individual case;
• **Minimum:** (DRI) not yet established; essential nutrient for bacteria, but not for humans;
• **Deficiency** of PABA can only be achieved by oral administration of sulpha drugs;
• **Symptoms include:** hypertension, anxiety, depression, digestive disorders including constipation; fatigue, nervousness, headache;
• **Toxicity symptoms:** nausea, vomiting; long-term ingestion of high doses (more than 30 g./day) can be toxic to liver, heart & kidneys;
**Therapy with PABA**

- Constituent of folic acid;
- Helps utilization of pantothenic acid (B-5);
- Topical application protects against skin cancer;
- Topically applied sunscreen — prevents & soothes pain & damage of sunburn;
- Said to soothe pain of burns even better than vitamin E;
- Useful for treating some parasitic diseases, including Rocky Mountain spotted fever;
- Treatment of vitiligo, depigmentation of skin;
- Certain schizophrenia-like behaviours discontinued on administration of 2 g of PABA/day;
- May prevent amines from forming hallucinogens; used in schizophrenia (2,000 mg/day);
- With folic acid, B-5 & biotin, PABA restores colour to grey & greying hair (animals);
- Used to treat Peyronie’s disease, a fibrous penis condition in post-middle aged men;
- Used in lupus, apparently with some success;

**PANGAMIC ACID (DMG)**

**General:** water-soluble; dimethyl glycine (DMG)

- Need in human nutrition has not been established; dimethyl glycine is an intermediate in normal metabolism;
- Despite ambiguity of its nutritional status, pangamic acid is accepted as a valuable dietary factor; France, Japan, Germany, Spain & Russia use pangamic acid as an essential nutrient, with adult recommended allowances ranging from 25 - 50 mg/day;
- **History:** patented in 1949; introduced to natural foods trade in 1978;

**Nutrition**

- **Sources:** apricot pit; brewer’s yeast, brown rice, whole grain, pumpkin & sesame seeds; made in body by normal metabolism;
- **Supplement:** calcium pangamate;
- **Absorption** from small intestine; circulates freely in the body;
- **Storage:** minute amounts in liver & kidneys;
- **Excretion:** through kidneys, bowels, sweat;

**Functions of DMG**

- Can be converted into sarcosine & glycine by donating methyl groups;
- May have function in donating methyl groups for biological reactions;
- Poorly understood, but claimed to increase blood tissue oxygenation, improve performance & prevent insufficiency of tissue oxygen (hypoxia), that produces lactic acid build-up & fatigue;
- Reports claim that pangamic acid is involved in regulation of lipid & carbohydrate metabolism & in nervous system functions;
**Quantities**

- **Measurement:** milligrams;
- **Optimum:** (SONA) average ranges not yet established;
- **Individual** optimum must be established for each individual;
- **Minimum:** (DRI) not set; not an essential nutrient for humans;
- **Deficiency:** not noted;
- **Toxicity:** not observed; doses 50,000x greater than the recommended 25 to 50 mg/day produce no ill effects; contaminants found in some preparations may be mutagenic;

**Therapy with pangamic acid**

- Role of pangamic acid in human physiology still under investigation;
- Empirical observations from the USSR indicate that pangamic acid can be useful to treat alcoholism, senility, diabetes, heart disease, high blood pressure, allergies, neuritis, hepatitis, autism, schizophrenia & mild brain damage;
- 50 mg, twice/day of B-15 has helped chronic alcoholics lose their craving for alcohol;
- Pangamic acid has been researched for treating autism & learning disorders in U.S. children, with positive results; Dr. Bernard Rimland (Institute for Child Behaviour Research) in San Diego claims that it helps correct a wide range of behaviour disturbances;
- Athletes taking pangamic acid claim greater endurance; research finds lower lactic acid levels in skeletal & cardiac muscles (elevated lactic acid results from anaerobic respiration & produces fatigue);
- May help hyper-cholesterolemia, asthma, atherosclerosis, emphysema, angina, circulatory problems &; according to Nobel Laureate Dr. Otto Warburg, may help prevent cancer by avoiding anaerobic fermentation in cells.