MICRONUTRIENTS

Summary Sheet on types, sources, physiological functions and daily requirements

Vitamin	**Best Sources**	**Physiological Functions**	**Daily Requirements**	**Deficiency symptoms**
Thiamin (Vit. B1)	Pork (excellent source), Meat, liver, fish, poultry, whole-grain and enriched breads, cereals, pasta, nuts, legumes, wheat germ, oats.	Co-enzyme in energy release from carbohydrates and some amino acids (leucine isoleucine and valine); supports normal appetite and nervous system function. Involved in control of fluids in the body	Adult man: 1.2 mg Woman: 0.8-1.1 mg Children: 0.3mg	Beriberi, anorexia, weight loss, weakness (dry beri-beri), peripheral neuropathy, and wernicke-korsakoff syndrome (in alcoholics); Pitting edema (**wet beriberi)**
Riboflavin (Vit. B2)	Milk (excellent source), dark green vegetables, yogurt, cheese, liver, meat, whole-grain or enriched breads and cereals.	Helps enzymes release energy from carbohydrate, fat, and protein; promotes healthy skin and normal vision.	Adults: 1.1 to 1.3 milligrams/day Children: 0.4 mg	Inflammation of tongue (glossitis); cracking of tissues around corners of mouth (cheilosis); seborrheic dermatitis (disease of sebaceous glands of skin), inflamation of the mouth (stomatitis), eye & nervous system disorders
Niacin (Vit. B3)	All protein foods (excellent source), tryptophan conversion, whole grain cereals.	Co-enzyme in energy release from energy nutrients (nicotinamide adenine dinucleotide – NAD^+ and nicotinamide adenine dinucleotide phosphate ($NADP^+$; promotes health of skin, nerves, and digestive system.	Men= 16 mg Women= 14 mg	Pellagra with its associated effects- dementia, diarrhea, dermatitis and sometimes death. Early symptoms are anorexia, weight loss and weakness

Pantothenic acid (Vit. B5)	Widespread in foods, but mainly in liver, eggs, peanuts, milk, broccoli, yeast and meat.	As Coenzyme A (CoA) in energy metabolism (formation of ATP) from energy rich foods and fatty acid synthesis. - Also known as *anti-stress vitamin* because the CoA is closely involved in adrenal cortex function to produce stress hormones.	5-10 milligrams /day	Weakness, fatigue, impaired muscle function, GI tract disturbance
Vitamin B_6 (pyridoxine)	Meat, poultry, fish, shellfish, legumes, whole-grain products, green leafy vegetables, bananas.	Its phosphorylated form (PLP) is a co-enzyme in many enzymatic reactions:-. 1) Protein metabolism to form nonessential amino acids; 2) carbohydrate metabolism (maintains blood glucose during glycogen breakdown); 3) formation of antibodies and red blood cells; 4) helps convert amino acid tryptophan to niacin (Vitamin B3); 5) synthesis of neurotransmitters from amino acids e.g. serotonin from tryptophan; histamine from histadin) .	Adults: 1.3-2mg	Deficiency is rare, but symptoms include seborrheic dermatitis: mycrocytic hypochromic anaemia, convulsion, depression and confusion, muscle pain, fatigue.
Biotin (Vit. B7 or H)	Widespread in foods, especially whole grains, eggs, legumes and nuts. Intestinal synthesis of biotin by bacteria also supplies part of biotin needs.	Coenzyme in metabolism of carbohydrates, amino acids and fats; glycogen formation and cell growth.	30 microgram/day	Nervous disorders, skin rash, muscle weakness, anaemia, convulsion, kidney stones
Folate (Vit. B9)	Green leafy vegetables, liver, legumes, seeds.	Red blood cell formation; protein metabolism; new cell division. In pregnancy, helps regulate embryonic & fetal nerve cell formation	Adults: 200 microgram (µg) Pregnancy: 400 µg Lactation: 300 µg Children: 50-100 µg	Anaemia, smooth tongue, fatigue, nerve degeneration progressing to paralysis.

Vitamin B_{12} (cobalamin)	Animal products: meat, fish, poultry, shellfish, milk, cheese, eggs; nutritional yeast.	Helps maintain nerve cells; red blood cell formation; synthesis of genetic material. Vit. B-1 co-enzymes also help recycle folate coenzymes	Adults:2 micrograms Pregnancy: 3 µg Lactation: 2.5 µg	Pernicious anemia; nerve degeneration causing paresthesia(tingling and numbness in legs). In infants, can cause diminished brain growth, degeneration of spinal cord, poor intellectual development
Vitamin C (ascorbic acid)	Citrus fruits, cabbage-type vegetables, tomatoes, potatoes, dark green vegetables, peppers, lettuce, canta-loupe, strawberries, mangos, papayas.	Synthesis of collagen (wound healing), maintains bone & teeth, strengthens blood vessels); anti-oxidant; strengthens resistance to infection; helps body absorb iron.	50-90 mg; for the elderly, use of fortified foods and supplements is recommended.	Scurvy(painful joints, swollen & bleeding gums, & slow healing or re-opening of old wounds).
Vitamin A	*Retinal:* fortified milk & margarine, cream, cheese, butter, eggs, liver. *Beta-carotene:* Spinach & *other dark leafy* greens, broccoli, deep orange fruits (apricots, peaches, cantaloupe), & vegetables (carrots, sweet potatoes, pumpkin).	Vision; growth & repair of body tissues; reproduction bone & tooth formation; immunity; hormone *synthesis; antioxidant* (in the form of beta-carotene only).	Adults: 5,000 IU; Children: 7,500 IU	Poor growth, night blindness, dry skin, **Xeropthalmia**, including **Bitot's spots** and corneal ulceration and night blindness. Vitamin A deficiency also weakens the immune system and hence increases the severity, complications and risk of death from measles, maternal mortality, etc
Vitamin D (cholecalciferol)	Self-synthesis with sunlight; fortified milk, fortified margarine, eggs, liver, fish.	Calcium and phosphorus metabolism (bone and tooth formation); aids body's absorption of calcium.	Adults: 100-400 IU; Children: 300 IU	Rickets which affects bone development resulting in pelvis malformation when severe.
Vitamin E (Tocopherol)	Vegetable oils, green leafy vegetables, wheat germ, whole-grain products, butter, liver, egg yolk, milk fat, nuts, seeds.	Protects red blood cells; antioxidant (protects fat-soluble vitamins); stabilization of cell membranes. Relieves coronary thrombosis	15 IU	Hemolysis of red blood cells, degeneration of sensory neurons

Vitamin K	Bacterial synthesis in digestive tract, liver, green leafy and cabbage-type vegetables, milk.	Synthesis of blood-clotting proteins (prothrombin) & a blood protein that regulates blood calcium (prevention of osteoporosis) Aids in converting glucose into glycogen. Promotes healthy liver function	- Daily requirements not known, but about 90-120 micrograms; Is manufactured by bacteria in the intestine	Hymorrhage nd fractures

MINERALS AND TRACE ELEMENTS

Mineral	Best Sources	Physiological Functions	Daily Requirements	Deficiency symptoms
Calcium	Milk/milk products, small fish, some green vegetables(spider herb)	√ Principle mineral of bones & teeth √ Aids in function of muscles √ Nerve functions, √ Blood clotting, blood pressure	Adults: 0.8-1.0g Pregnancy: 1.5 g Lactation: 1.5 g	Osteoporosis (bone loss) in adults and stunted growth in children
Phosphorus	Both animal and plant sources of food	√ Part of every cell √ Formation of bones & teeth	Adults: 0.8 g Children: 1.0 g	Poor bone maintennce
Magnesium	Nuts, Legumes, Whole grains, Dark green vegetables	- Interacts with Mg & Ca to strengthen bones & teeth. - Regulates functions of nerves & muscles	Adults: 200-300mg Children:120-230 mg	Weakness, musle pain, poor heart function
Sodium and Chloride	Salt and processed food	Helps maintain normal fluid & acid-base balance. - Normal fluid balance - Aids in digestion - Part of stomach acid	5-20 g	Convulsions and Growth failure in children, muscle cramps mental apathy, loss of appetite
Potassium	All whole foods: - meat, milk, fruits, veges, grains, legumes	√ Needed for all cellular functions √ In normal functioning of heart √ Generally, facilitates many reactions in the body, e.g protein synthesis, nerve transmission, etc.	0.8-1.3g	Irregular heartbeat, loss of appetite, Muscle weakness, paralysis, confusion, can cause death, accompanies dehydration

Iodine	Iodised salt, sea food	- Needed for normal physical & mental growth - Needed by thyroid glands for production of thyroxine which regulates metabolic rate	Adults: 0.014-.45mg Children: 0.1mg	Iodine deficiency disorders (cretinism & goiter) Cretinism: severe mental & physical disability Goitre: swelling of thyroid gland in the neck;
Iron	Animal protein sources, legumes, dried fruits	- Haemoglobin formation. - Transportation of oxygen - Utilization of energy Immune function; -Cognitive development	Adult Men: 8-10 mg Adult Women: 10-18mg Pregnant & lactating women: 20mg	Anaemia - Fatigue, small pale red blood cells, low blood hemoglobin value, poor immune function
Zinc	Protein rich food	√ Part of many enzymes √ Immunity √ Vit. A transportation √ Wound healing √ Maintenance of normal taste √ Growth & Stabilizes cell membranes	5-11 mg	Skin rash, diarrhea, reduced appetite and sense of taste, hair loss, poor growth and development in children
Copper	Meat, Drinking water	√ Absorption of iron √ Part of may enzymes		Anemia, low white blood cell count, poor growth
Flouride	Drinking water, Sea food(small fish)	Formation of bones & teeth Prevention of dental carriers	Adults: 1 part per million Children:0.5 p.p.m	Dental cariers
Selenium	Meat, grains, seafood	Protects body compounds from oxidation		Muscle pain, muscle weakness, form of heart disease
Chromium	Meat, fats, unrefined food	Associated with insulin & needed for release of energy from glucose	Not Known	High blood glucose after a meal

References:

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