

Section 5

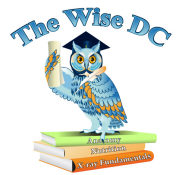
Vitamins

Vitamins, found in small amounts in most foods, represent a class of complex organic compounds that are essential for the optimal functioning of a great number of physiological processes. Some vitamins, particularly the B vitamins, function as coenzymes; they are needed to activate or control the activity of enzymes, those protein compounds that regulate almost all physiological processes in the body, such as digestion, muscle contraction, and the release of energy from foods. Some vitamins, such as C, E, and beta-carotene (a precursor of vitamin A) serve as antioxidants; they prevent undesired oxidative processes in the body. Vitamin D functions as a hormone.

Health Implications of Vitamins

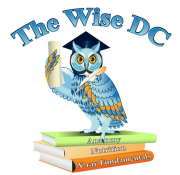
The key to adequate vitamin nutrition is to consume a balanced diet of natural foods high in nutrient density. Epidemiological evidence has suggested that consumption of certain vegetables containing beta-carotene, such as carrots, sweet potatoes, and squash, and cruciferous vegetables, such as broccoli, cauliflower, cabbage, and brussel sprouts, may be helpful in the prevention of cancer. These foods contain sulforaphane (a natural anticarcinogen). Another hypothesis is that the antioxidant effect exerted by beta-carotene or other antioxidants naturally occurring in plants, such as phytic acid and vitamins C and E, may block the possible carcinogenic action of free radicals (especially reactive particles produced in the body that are thought to damage cell membranes) in the body on the cell membrane or DNA.

Megadoses of vitamins should be avoided. A megadose is defined as an amount which is ten times the RDA (lower for vitamin A [only 5 times] and vitamin D [only 2 times]). If the vitamin content of the body is adequate, excess vitamin intake does not serve any useful purpose and may function as a drug and be harmful to organs such as the liver. There are more than 4,000 cases of vitamin/mineral overdoses in the United States each year, resulting in about thirty fatalities, particularly among young children.



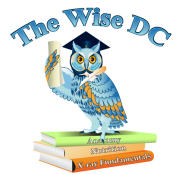
13 Essential Vitamins

Vitamin Name (Other Terms)	RDA or ESADDI for Adults and Children over Four	Major Sources
Fat-Soluble Vitamins		
Vitamin A (retinal; provitamin Carotenoids)	5000 IU or ♂ 1,000 RE ♂ 4000 IU or 800 RE ♀	Retinol in animal foods; liver, whole milk, fortified milk, cheese, Carotenoids in plant foods; carrots, green leafy vegetables, sweet potatoes, fortified margarine from vegetable oils.
Vitamin D (calciferol)	400 IU or 10 micrograms	Vitamin D fortified foods like dairy products, margarine, and fish oils. Action of sunlight on the skin.
Vitamin E (tocopherol)	10 mg ♂ 8mg ♀ alpha- TE	Vegetable oils, margarine, green leafy vegetables, wheat germ, whole grain products, egg yolks.
Vitamin K (antihemorrhagic vitamin)	80 micrograms ♂ 65 micrograms ♀	Pork and beef liver, eggs, spinach, cauliflower. Formation in the human intestines by bacteria.
Water-Soluble Vitamins		
Thiamin (vitamin B ₁)	1.5 mg ♂ 1.3 mg ♀	Ham, pork, lean meat, liver, whole grain products, fortified breads and cereals, legumes.
Riboflavin (vitamin B ₂)	1.7 mg ♂ 1.3 mg ♀	Milk and dairy products, meat, fortified grain products, green leafy vegetables, beans.
Niacin (nicotinamide, nicotinic acid)	19 mg ♂ 15 mg ♀	Lean meats, fish, poultry, whole grain products, beans. May be formed in the body from tryptophan, an essential amino acid.
Vitamin B ₆ (pyridoxal, pyridoxine, pyridoxamine)	2 mg ♂ 1.6 mg ♀	Protein foods, liver, lean meats, fish poultry, legumes, green leafy vegetables.
Vitamin B ₁₂ (cobalamin; cyanocobalamin)	2 micrograms	Animal foods only, meat, fish, poultry, milk, eggs.
Folic acid (folacin)	200 micrograms ♂ 180 micrograms ♀	Liver, green leafy vegetables, legumes, nuts.
Biotin	30-100 micrograms	Meats, legumes, milk, egg yolk, whole grain products, most vegetables.
Pantothenic acid	4-7 mg	Beef and pork liver, lean meats, milk, eggs, legumes, whole grain products, most vegetables.
Vitamin C (ascorbic acid)	60 mg	Citrus fruits, green leafy vegetables, broccoli, peppers, strawberries, potatoes.



Vitamin	Major Functions in the Body	Deficiency Symptoms	Symptoms of Excess Consumption
Fat-Soluble Vitamins			
A	Maintenance of epithelial tissue in skin and mucous membranes, formation of visual purple for night vision, bone development.	Night blindness, intestinal infections, impaired growth, xerophthalmia.	Nausea, headache fatigue, liver and spleen damage, skin peeling, pain in the joints
D	Acts as a hormone to increase intestinal absorption of calcium and promote bone and tooth formation	Rare, Rickets in children and osteomalacia in adults.	Loss of appetite, nausea, irritability, joint pains, calcium deposits in soft tissues such as the kidney.
E	Functions as an antioxidant to protect cell membranes from destruction by oxidation.	Extremely rare, Disruption of red blood cell membranes, anemia.	General lack of toxicity with doses up to 600 IU.
K	Essential for blood coagulation processes.	Increased bleeding and hemorrhaging.	Possible clot formation (thrombus), vomiting.

Vitamin	Major Functions in the Body	Deficiency Symptoms	Symptoms of Excess Consumption
Water-Soluble Vitamins			
B1	Serves as a coenzyme for energy production from carbohydrate; essential for normal functioning of the central nervous system.	Poor appetite, apathy, mental depression, pain in calf muscles, beriberi.	General lack of toxicity.
B2	Functions as a coenzyme involved in energy production from carbohydrates and fats; maintains healthy skin.	Dermatitis, cracks at the corners of the mouth, sores on the tongue, damage to the cornea.	General lack of toxicity.
Niacin	Functions as a coenzyme for the aerobic and anaerobic production of energy from carbohydrate; helps synthesize fat needed for healthy skin.	Loss of appetite, weakness, skin lesions, gastrointestinal problems, pellagra.	Nicotinic acid causes headache, nausea, burning and itching skin, flushing of face..
B6	Functions as a coenzyme in protein metabolism; necessary for formation of hemoglobin and red blood cells; needed for glycogenolysis and gluconeogenesis.	Nervous irritability, convulsions, dermatitis, sores on tongue, anemia.	Loss of nerve sensation, impaired gait.
B12	Functions as a coenzyme for formation of DNA, development of RBC, and maintenance of nerve tissue.	Pernicious anemia, nerve damage resulting in paralysis.	General lack of toxicity.
Folic Acid	Functions as a coenzyme for DNA formation and RBC development.	Fatigue, gastrointestinal disorders, diarrhea, anemia.	May prevent detection of pernicious anemia caused by B12 deficiency.
Biotin	Functions as a coenzyme in the metabolism of carbohydrates, fats,	Rare. May be caused by excessive intake of raw egg	General lack of toxicity.



	and protein.	whites. Fatigue, nausea, skin rashes.	
Pantothenic Acid	Functions as part of coenzyme A in energy metabolism.	Rare. Only produced clinically Fatigue, nausea, loss of appetite, mental depression.	General lack of toxicity.
C	Forms collagen essential for connective tissue development; aids in absorption of iron; helps form epinephrine; serves as antioxidant.	Weakness, rough skin, slow wound healing, bleeding gums, scurvy.	Diarrhea, possible kidney stones, rebound scurvy.

Minerals

There are 106 known elements, 78 of them occurring naturally and the remainder man-made. A number of the natural elements are essential to human body structure and function.

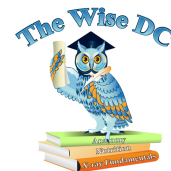
Minerals are inorganic elements that are essential to life processes. Twenty-five minerals are known to be essential in human nutrition, and they perform a wide variety of functions in the body. Seven elements and minerals (carbon, oxygen, hydrogen, nitrogen, sulfur, calcium, and phosphorous, are used as building blocks for body tissues. Physiological processes influenced by minerals include muscle contraction, conduction of nerve impulses, acid - base balance of blood, blood clotting, and normal heart rhythm.

Mineral Health Implications

A deficiency or excess of any mineral may lead to serious health problems. Calcium, iron, and sodium are three minerals that appear to have significant health implications in the typical American diet.

Essential Minerals in Human Nutrition

Mineral (Symbol)	Major Body Function
Calcium (Ca)	Muscle contraction; nerve impulse transmission; blood clotting; fat digestion; formation of bone and teeth
Chlorine (Cl)	Water and electrolyte balance; formation of stomach acids



Chromium (Cr)	Glucose metabolism in cells; related to insulin action
Cobalt (Co)	Component of vitamin B ₁₂ ; development of red blood cells
Copper (Cu)	Formation (with iron) of hemoglobin and iron enzymes
Fluorine (F)	Formation of bones and teeth
Iodine (I)	Formation of thyroxine (a thyroid hormone)
Iron (Fe)	Formation of compounds (such as hemoglobin) for the transportation of oxygen.
Magnesium (Mg)	Activates a number involved in the regulation of protein synthesis and muscle contraction.
Manganese (Mn)	Many enzyme functions; bone formation; fat synthesis
Molybdenum (Mo)	Required in several enzymes
Phosphorus (P)	Acts with calcium to form bone tissue; part of high-energy compounds in body cells
Potassium (K)	Maintains acid-base balance; nerve impulse conduction; muscle contraction; many other functions in the body cells
Selenium (Se)	Functions with vitamin E; liver function
Silicon (Si)	Formation of connective tissue
Sodium (Na)	Maintenance of normal body fluid volume; nerve impulse transmission and muscle contraction; acid-base balance
Sulfur (S)	Formation of body tissues and enzymes
Zinc (Zn)	Component of many enzymes



Calcium

Calcium intake among adults is often below the recommended level. Because calcium is the primary constituent of bone tissue, calcium deficiency, particularly in older women, may lead to osteoporosis, a decrease in bone mass that increases susceptibility to fractures in the hip, wrist, and spine. Foods high in calcium, such as dairy foods, should be consumed in the diet throughout life, particularly during the growth years to maximize bone mass.

Iron

National surveys suggest that over 90 percent of women are receiving less than the RDA for iron. Inadequate dietary intake or excessive losses of iron may lead to iron deficiency anemia, a condition that may lead to constant weakness and fatigue.

Sodium

A primary function of sodium is the maintenance of a normal blood pressure. Excessive intake of sodium has been linked with the development of high blood pressure in individuals who are salt or sodium sensitive. These individuals do not effectively regulate sodium balance. Since there may be 15 to 20 million Americans who may be sodium sensitive, it is recommended that the amount of sodium and salt in the diet be decreased.

General Overview of Mineral Consumption

Excessive intake of one mineral, usually through supplements, may impair the absorption of other essential minerals. For example, excessive intake of zinc will impair the absorption of copper. Many minerals may be toxic to the body if consumed in excess. It is very difficult to consume excessive amounts of minerals through natural foods, but mega doses provided by excessive intake of mineral supplements may seriously impair normal physiological functions. Excessive intake of potassium may disturb the normal electrical activity in the heart and may lead to arrhythmias and possible death. As with vitamins, mega doses of minerals, which may be only 3 to 5 times the RDA, are to be avoided.