

Vitamins.

In addition to air, water, carbohydrates, proteins, fats and mineral salts, certain organic substances required for regulating some of the body processes and preventing certain diseases are called **vitamins**. These compounds cannot be synthesized by an organism. These vitamins are required in small amounts and deficiency of any one causes one disease or the other. Thus, vitamins are essential constituents of our diet. Several of these vitamins are known and are designated as A, B, C, D, E and so on. Many of these are now synthesized on commercial scale. On the basis of solubility, the vitamins are divided into two groups.

(1) Fat soluble; Vitamin A, D, E and K.

(2) Water soluble; Vitamin B and C.

Name	Sources	Functions	Effects of deficiency
Water soluble vitamins			
B ₁ (Thiamine or Aneurin) (C ₁₂ H ₁₈ N ₄ SOCl ₂)	Rice polishings, wheat flour, oat meal, eggs, yeast, meat, liver, etc.	Major component of co-enzyme co-carboxylase required for carbohydrate and amino acid metabolism.	Beri-beri , loss of appetite and vigour, constipation, weak heartbeat, muscle atrophy, even paralysis.
B ₂ or G (Riboflavin or Lactoflavin) (C ₁₇ H ₂₀ N ₄ O ₆)	Cheese, eggs, yeast, tomatoes, green vegetables, liver, meat, cereals, etc.	Combines with phosphoric acid to form coenzyme FAD essential for oxidative metabolism.	Cheilosis , digestive disorders, burning sensations in skin and eyes, headache, mental depression, scaly dermatitis at angles of nares, corneal opacity, etc.
B ₃ (Pantothenic acid) (C ₉ H ₁₇ O ₅ N)	All food; more in yeast, liver, kidneys, eggs, meat, milk, sugarcane, groundnut, tomatoes.	Important component of Co-A required for oxidative metabolism.	Dermatitis , in cocks; greying of hairs, retarded body and mental growth, reproductive debility.
B ₅ or P-P (Nicotinic acid or Niacin)	Fresh meat, liver, fish, cereals, milk, pulses, yeast, etc.	Active group in coenzyme NAD required for oxidative metabolism.	Pellagra , dermatitis, diarrhoea, dementia, muscle atrophy,

$C_6H_5NO_2$ ($C_5H_4N-COOH$)			inflammation of mucous membrane of gut.
B_6 (Pyridoxine or Adermin) ($C_8H_{11}O_3N$)	Milk, cereals, fish, meat, liver, yeast synthesised by intestinal bacteria.	Important coenzyme required in protein and amino acid metabolism.	Dermatitis, anaemia , convulsions, nausea, insomnia, vomiting, mental disorders, depressed appetite.
Vit. H (Biotin) ($C_{10}H_{16}N_2O_3S$)	Yeast, vegetables, fruits, wheat, chocolate, eggs, groundnut synthesised by intestinal bacteria.	Essential for fat synthesis and energy production.	Skin lesions , loss of appetite, weakness, hairfall, paralysis.
Folic acid group	Green vegetables, soyabean, yeast, kidneys, liver, synthesised by intestinal bacteria.	Essential for synthesis of DNA and maturation of blood corpuscles.	Retarded growth, anaemia .
B_{12} (Cyanocobalamine) ($C_{63}H_{88}O_{14}N_{14}PCo$)	Meat, fish, liver, eggs, milk synthesised by intestinal bacteria.	Required for chromosome duplication and formation of blood corpuscles.	Retarded growth, pernicious anaemia
Vit. C (Ascorbic acid) (CH_8O_6)	Lemon, orange and other citrus fruits, tomatoes, green vegetables, potatoes, carrots, pepper, etc.	Essential for formation of collagen, cartilage, bone, teeth, connective tissue and RBCs and for iron metabolism.	Wound-healing and growth retarded, scurvy , breakdown of immune defence system , spongy and bleeding gums , fragile blood vessels and bones , exhaustion, nervous breakdown, high fever.
Fat soluble vitamins			
Vit. A (Retinol or Axerophthol) ($C_{20}H_{30}O$)	Synthesised in cells of liver and intestinal mucous membrane from carotenoid pigments found in milk, butter, kidneys, egg yolk, liver, fish oil, etc.	Essential for synthesis of visual pigments; growth and division of epithelial cells.	Xerophthalmia-keratinized conjunctive and opaque and soft cornea. Stratification and keratinization in epithelia of skin, respiratory passages, urinary bladder, ureters and intestinal mucosa, night-blindness ,

			impaired growth, glandular secretion and reproduction.
Vit. D (Ergocalciferol), (Sun shine vitamin) $C_{28}H_{44}O$ and cholecalciferol	Synthesised in skin cells in sunlight from 7-dehydro-cholesterol also found in butter, liver, kidneys, egg yolk, fish oil, etc.	Regulates absorption of calcium and phosphorus in intestine, mineral deposition in bones and teeth.	Rickets with osteomalacia; soft and fragile teeth.
Vit. E group Tocopherols (α , β , γ) ($C_{29}H_{50}O_2$)	Green vegetables, oil, egg yolk, wheat, animal tissues.	Essential for proper spermatogenesis, pregnancy, lactation and muscular function.	Sterility (impotency) and muscular atrophy.
Vit. K (Phylloquinone) ($C_{31}H_{46}O_2$)	Carrots, lettuce, cabbage, tomatoes, liver, egg yolk, cheese; synthesized by colon bacteria.	Essential for synthesis of prothrombin in liver, which is required for blood clotting.	Haemorrhages , excessive bleeding in injury, poor coagulation of blood.