

Vitamins

Vitamins are organic molecules that are essential for normal health and growth.¹ Since they are required in trace amounts vitamins are categorized as micronutrients, and they must be obtained from the diet because they are not synthesized in the body (which makes them essential nutrients too). Vitamins are classified into two groups by solubility: water-soluble and fat-soluble.

The water-soluble vitamins are required by many enzymes as cofactors to carry out certain aspects of the catalytic action - coenzymes do not remain bonded to a particular enzyme, but are used over and over again by different enzymes; thus, only small amounts are required in the cell. Since they are water soluble, they are not stored in the body, but excreted with urine if there is any excess (that is why we need water-soluble vitamins in our daily diets).

The fat-soluble vitamins are not involved as coenzymes², but they are important in processes such as vision, formation of bone, protection from oxidation, and proper blood clotting. These enzymes can be stored in the body so it is possible to take too much of them, which could be toxic.

Fat-Soluble Vitamins

<i>Vitamin</i>	<i>Function</i>	<i>RDA</i> ³	<i>Sources</i>	<i>Deficiency Symptoms</i>
A, retinol	Vision, synthesis of RNA.	3 mg	Yellow and green fruits and vegetables.	Night blindness, immune system repression, slowed growth rickets.
D, cholecalciferol	Regulation of absorption of P and Ca.	10 µg	Sunlight, cod liver oil, enriched milk, eggs.	Rickets, weak bone structure, osteomalacia.
E, tocopherol	Antioxidant, cell protection	10 mg	Meats, whole grains, vegetables.	Hemolysis, anemia.
K ₂ , menaquinone	Blood clotting	80 µg	Liver, spinach, cauliflower	Prolonged bleeding time, bruising.

Water-Soluble Vitamins

¹ Because the first of such compounds recognized to be essential in the diet was an amine, Casimir Funk incorrectly concluded that all of them were amines and called them vitamins ("life-amines"). The e was later dropped from the name.

² Vitamin K is the only fat-soluble vitamin currently known to function as a coenzyme (in carboxylation reactions).

³Recommended Daily Allowance (RDA) by the Committee on Food and Nutrition of the National Research Council.

<i>Vitamin</i>	<i>Reaction Catalyzed</i>	<i>RDA</i>	<i>Sources</i>	<i>Deficiency Symptoms</i>
B ₁ , thiamin	decarboxylation two-carbon transfer	2 mg	Liver, yeast, whole grain bread, cereals, milk.	Berberi: Fatigue, poor appetite, weigh loss, nerve degeneration, heart failure.
B ₂ , riboflavin	oxidation reduction electron transfer	1.7 mg	Beef liver, chicken, eggs, green leafy vegetables, dairy foods, peanuts, whole grains.	Dermatitis, dry skin, tongue inflammation, cataracts.
B ₃ , niacin	oxidation reduction	13-18 mg	Brewer's yeast, chicken, beef, fish, liver, brown rice, whole grains.	Pellagra: dermatitis, muscle fatigue, loss of appetite, diarrhea, mouth sores, mental disorders.
B ₅ , panthotenic acid	acyl transfer	10 mg	Salmon, beef, liver, eggs, brewer's yeast, whole grains, fresh vegetables.	Fatigue, retarded growth, muscle cramps, anemia.
B ₆ , pyridoxine	transamination decarboxilation	1 mg	Meat, liver, fish, nuts, whole grains, spinach.	Dermatitis, fatigue, anemia, retarded growth.
B ₁₂ , cobalamine	methyl transfer isomerization	3 µg	Liver, beef, kidney, chicken, fish, milk products.	Pernicious anemia, malformed red blood cells, nerve damage.
C, ascorbic acid	collagen synthesis healing of wounds	60 mg	Blueberries, oranges, strawberries, cantaloupe, tomatoes, peppers, broccoli, cabbage, spinach,	Scurvy: bleeding gums, weakened connective tissues, slow-healing wounds, anemia.
H, biotin	carboxylation	0.3 mg	Liver, yeast nuts, eggs.	Dermatitis, loss of hair, fatigue, anemia, nausea, depression.
Folic acid (folate)	methyl transfer	0.4 mg	Green leafy vegetables, beans, meat, seafood, yeast, asparagus, enriched whole grains.	Abnormal red blood cells, anemia, intestinal-tract disturbances, loss of hair, depression, spina bifida.