

UNIT 5

VITAMINS

Vitamins are organic molecules that are essential for normal health and growth. They are required in trace amounts and must be obtained from the diet because they are not synthesized in the body.

- Organic molecules with a wide variety of functions.
- Cofactors for enzymatic reactions

Before vitamins were discovered, it was known that lime juice prevented the disease scurvy in sailors and that cod liver oil could prevent rickets. In 1912, scientists found that, in addition to carbohydrates, fats, and proteins, certain other factors called vitamins must be obtained from the diet.

Why are they good for us?

- Greater need due to worse environment
- Improve immunity
- Prevent illnesses
- Slower aging

Types of Vitamin

Two distinct

types:

Water-soluble

water-soluble vitamin is one that dissolves in water and as a result, is easily absorbed into the tissues of the body and metabolized more quickly than fat-soluble vitamins.

Fat-soluble

The fat-soluble vitamins are soluble in lipids (fats). These vitamins are usually absorbed in fat globules that travel through the lymphatic system of the small intestines and into the general blood circulation within the body.

Water Soluble Vitamins

- Soluble in aqueous solutions
- Water soluble vitamins Used as cofactors by many enzymes
- Not stored in the body

Thiamine (vitamin B1)

- Function: It helps to convert food into energy. Needed for healthy skin, hair, muscles, and brain and is critical for nerve function.
- Food Sources: Pork chops, brown rice, ham, soymilk, watermelons, acorn squash
- Deficiency: Deficiency of thiamine results in beriberi and its symptoms are fatigue, weight loss, and nerve degeneration.

Riboflavin (vitamin B2)

- Function: It helps to convert food into energy. Needed for healthy skin, hair, blood, and brain.
- Food Sources: Milk, eggs, yogurt, cheese, meats, green leafy vegetables, whole, and enriched grains and cereals
- Deficiency: riboflavin deficiency also known as ariboflavinosis, include skin disorders, hyperaemia (excess blood) and edema of the mouth and throat, angular stomatitis (lesions at the corners of the mouth), cheilosis (swollen, cracked lips), hair loss, reproductive problems, sore throat, itchy and red eyes, and degeneration of the liver and nervous system.

Niacin (vitamin B3, nicotinic acid)

- Function: It helps to convert food into energy. Essential for healthy skin, blood cells, brain, and nervous system.
- Food Sources: Meat, poultry, fish, fortified and whole grains, mushrooms, potatoes, peanut butter
- Deficiency: Deficiency of niacin can result in dermatitis, muscle fatigue and loss of appetite.

Pantothenic Acid (vitamin B5)

- Function: It helps to convert food into energy. It helps in making lipids (fats), neurotransmitters, steroid hormones, and haemoglobin.
- Food Sources: Wide variety of nutritious foods, including chicken, egg yolk, whole grains, broccoli, mushrooms, avocados, tomato products.
- Deficiency: Its deficiency may cause fatigue, retarded growth, insomnia, depression.

Pyridoxine (vitamin B6)

- Function: Aids in lowering homocysteine levels and may reduce the risk of heart disease. It helps in converting tryptophan to niacin and serotonin, a neurotransmitter that plays key roles in sleep, appetite, and moods. Helps in making red blood cells Influence cognitive abilities and immune function.
- Food Sources: Meat, fish, poultry, legumes, tofu and other soy products, potatoes, noncitrus fruits such as bananas and watermelons
- Deficiency: Vitamin B6 deficiency can result in microcytic anaemia, electroencephalographic abnormalities, dermatitis with cheilosis (scaling on the lips and cracks at the corners of the mouth) and glossitis (swollen tongue).

Cobalamin (vitamin B12)

- Function: Aids in lowering homocysteine levels and may lower the risk of heart disease. Assists in making new cells and breaking down some fatty acids and amino acids. Protects nerve cells and encourages their normal growth Helps make red blood cells and DNA.

- Food Sources: Meat, poultry, fish, milk, cheese, eggs, fortified cereals, fortified soymilk
- Deficiency: The deficiency of cobalamin leads to pernicious anaemia and nerve damage.

Biotin

- Function: It helps to convert food into energy and synthesize glucose. It helps in making and breaking down some fatty acids. Needed for healthy bones and hair.
- Food Sources: Many foods, including whole grains, organ meats, egg yolks, soybeans, and fish
- Deficiency: Biotin deficiency includes hair loss (alopecia) and a scaly red rash around the eyes, nose, mouth, and genital area. Neurologic symptoms in adults have included depression, lethargy, hallucinations, numbness, and tingling of the extremities, ataxia, and seizures.

Ascorbic Acid (vitamin C)

- Function: Foods rich in vitamin C may lower the risk for some cancers, including those of the mouth, oesophagus, stomach, and breast. Long-term use of supplemental vitamin C may protect against cataracts. It helps to make collagen, a connective tissue that knits together wounds and supports blood vessel walls. It also helps to make the neurotransmitters serotonin and norepinephrine. Acts as an antioxidant, neutralizing unstable molecules that can damage cells. Bolsters the immune system.
- Food Sources: Fruits and fruit juices (especially citrus), potatoes, broccoli, bell peppers, spinach, strawberries, tomatoes, Brussels sprouts
- Deficiency: Vitamin C deficiency called Scurvy.

Excess of Vitamin C can cause Diarrhoea, Nausea, Vomiting.

Folic Acid (vitamin B9)

- Function: It is vital for new cell creation, helps to prevent brain and spine birth defects when taken early in pregnancy; it should be taken regularly by all women of child-bearing age since women may not know they are pregnant in the first weeks of pregnancy. Can lower levels of homocysteine and may reduce heart disease risk May reduce the risk for colon cancer. Offsets breast cancer risk among women who consume alcohol.
- Food Sources: Fortified grains and cereals, asparagus, okra, spinach, turnip greens, broccoli, legumes like black-eyed peas and chickpeas, orange juice, tomato juice
- Deficiency: It causes Folate-deficiency anaemia. Folate- deficiency anaemia is the lack of folic acid in the blood.

Fat-Soluble Vitamins

- Soluble in lipids, but not in aqueous solutions
- Important in vision, bone formation, antioxidants, and blood clotting
- Stored in the body

Vitamin A

vitamin A; includes retinol, retinal, retinyl esters, and retinoic acid and is also referred to as “preformed” vitamin A. Beta carotene can easily be converted to vitamin A as needed.

- Function: Essential for vision Lycopene may lower prostate cancer risk. Keeps tissues and skin healthy. Plays an important role in bone growth and the immune system. Diets rich in the carotenoid’s alpha-carotene and lycopene seem to lower lung cancer risk. Carotenoids act as antioxidants. Foods rich in the carotenoids lutein and zeaxanthin may protect against cataracts.
- Food Sources: Sources of retinoids: beef liver, eggs, shrimp, fish, fortified milk, butter, cheddar cheese, Swiss cheese
- Sources of beta carotene: sweet potatoes, carrots, pumpkins, squash, spinach, mangoes, turnip greens, and almost all green vegetables.
- Deficiency: Deficiency of Vitamin A called Night Blindness.

Calciferol (vitamin D)

- Function: It helps to maintain normal blood levels of calcium and phosphorus, which strengthens bones. It helps in the formation of teeth and bones. Supplements can reduce the number of non-spinal fractures.
- Food Sources: Fortified milk or margarine, fortified cereals, fatty fish
- Deficiency: Deficiency can result in weakened bones.

Alpha-Tocopherol (vitamin E)

- Function: Acts as an antioxidant, neutralizing unstable molecule that can damage cells. Protects vitamin A and certain lipids from

damage. Diets rich in vitamin E may help prevent Alzheimer's disease. Cures muscle, heart and skin diseases, burns.

- Food Sources: Wide variety of foods, including vegetable oils, salad dressings, and margarine made with vegetable oils, wheat germ, leafy green vegetables, whole grains, nuts
- Deficiency: Muscle weakness, Coordination, and walking difficulties, Vision deterioration

Phylloquinone, Menadione (vitamin K)

- Function: Activates proteins and calcium essential to blood clotting. May help prevent hip fractures. Vitamin K1 in plants has a saturated side chain. Vitamin K2 in animals has a long unsaturated side chain. Vitamin K2 is needed for the synthesis of zymogens for blood clotting. Higher need by new-borns, people with liver diseases, or fat malabsorption.
- Food Sources: Cabbage, liver, eggs, milk, spinach, broccoli, sprouts, kale, collards, and other green vegetables
- Deficiency: Vitamin K deficiency is much more common in infants. In infants, the condition is called VKDB, for vitamin K deficiency bleeding.

Vitamins and Its Recommended Daily Values

Humans need a certain daily intake of vitamins. This table summarizes recommended daily values of some water- & fat-soluble vitamins.

Vitamin	Daily values [mg]
A (retinol)	1-3
B1 (thiamine)	30 – 200
B2 (riboflavin)	25 – 200
B3 (niacin)	30 – 100
B5 (Pantothenic acid)	20 – 500
B6 (pyridoxine)	10 – 15
B12 (Cobalamin)	5-8
H (Biotin)	300 – 5000
C (Ascorbic acid)	2 – 12 g
D (cholecalciferol)	10
E (tocopherol)	400 – 2000
K	80