Vitamins

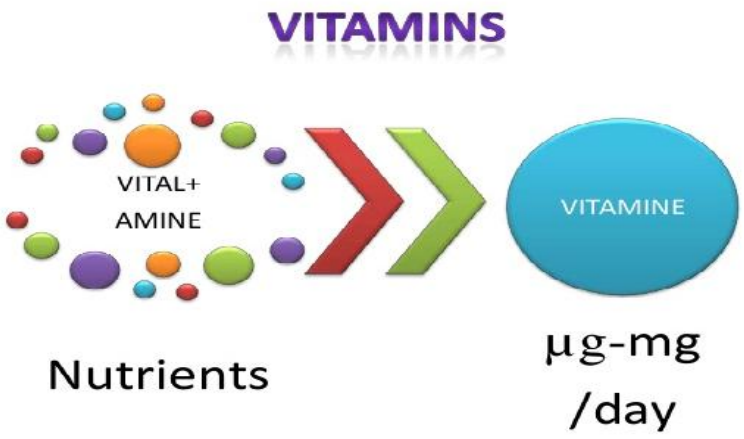
Definition

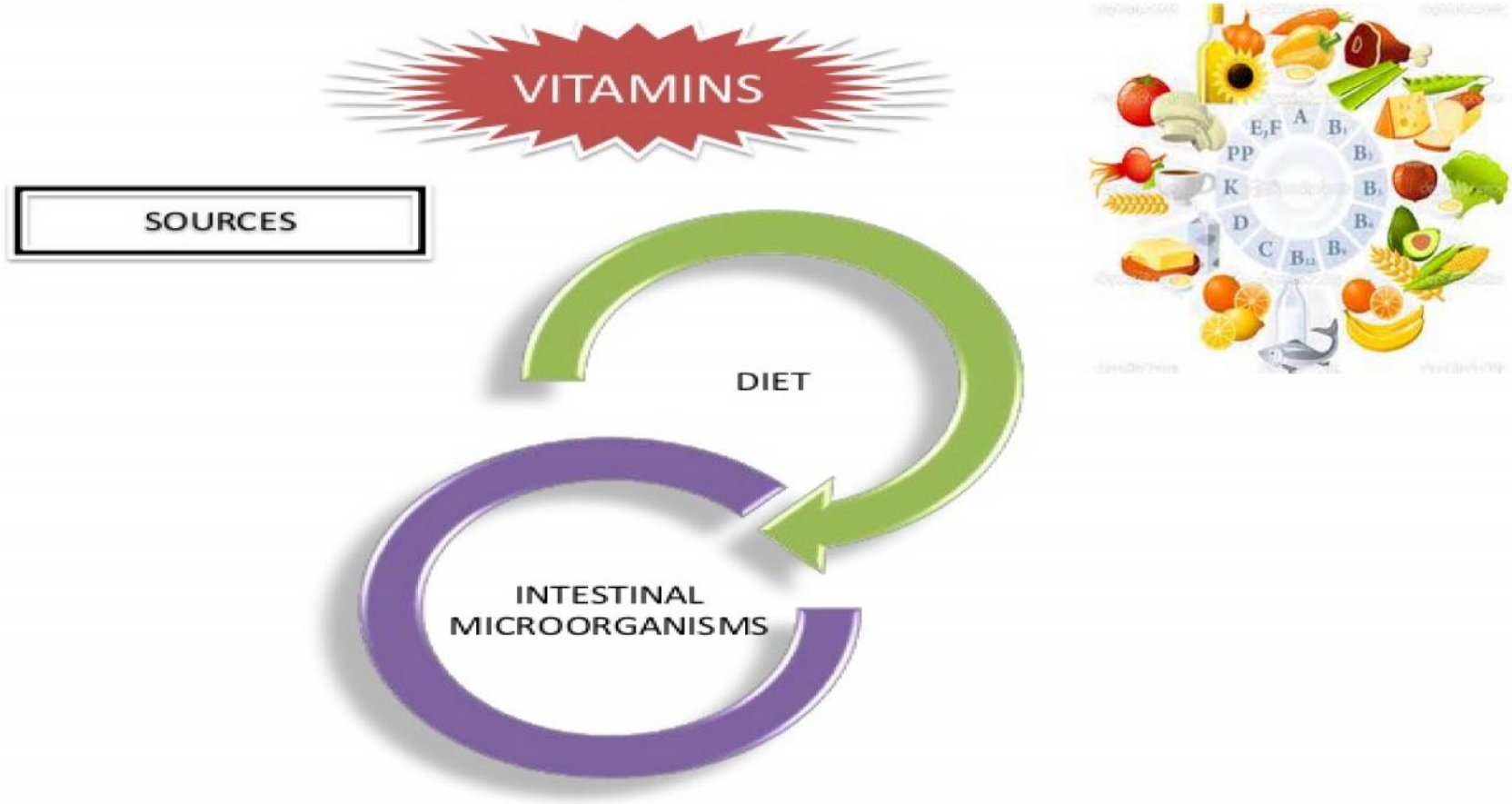
Organic compounds occurring in natural foods either as such or as utilizable "precursors", which are required in minute amounts for normal growth, maintenance and reproduction, i.e. for normal nutrition and health

Vitamin

- An organic compound
- Required by an organism
- As a vital nutrient
- in limited amounts

- Micronutrients
- VITAL+ AMINE Nutrients
- IU or µg-mg /day





- **Non-caloric** organic nutrients
- **Facilitators** – help body processes proceed; digestion, absorption, metabolism, growth etc.
- Some appear in food as **precursors or provitamins**

- Necessary for normal health and growth
- Regulate metabolism & make possible more efficient use of carbohydrates, proteins, fat
- Diverse in chemical structure & function
- Most vitamins generally cannot be synthesized by animals or humans
- IF synthesized, the amounts are insufficient to meet physiological demand
- So, must be obtained from the diet and/or synthetic source
- FOR this reason, vitamins are called essential nutrients
- Distinct from carbohydrates, fats & proteins in function, as well as in the quantities required

Difference form other organic foods

1. They do not enter tissue structures – unlike PROTEINS
2. They do not undergo degradation for providing energy – unlike CARBS and LIPIDS
3. Several plays role as "coenzymes" in energy transformation reactions

Vitamins Versus Hormones

Most vitamins are not produced within the humans and most of them have to be provided in the diet

Classification

- Classification based upon water solubility

Water-soluble

1. Non-B complex – vitamin C (ascorbic acid)

2. B-complex –

- Energy-releasing: Thiamine (vitamin B_1), Riboflavin (vitamin B_2), Niacin (vitamin B_3), Biotin (vitamin H), Pantothenic acid,

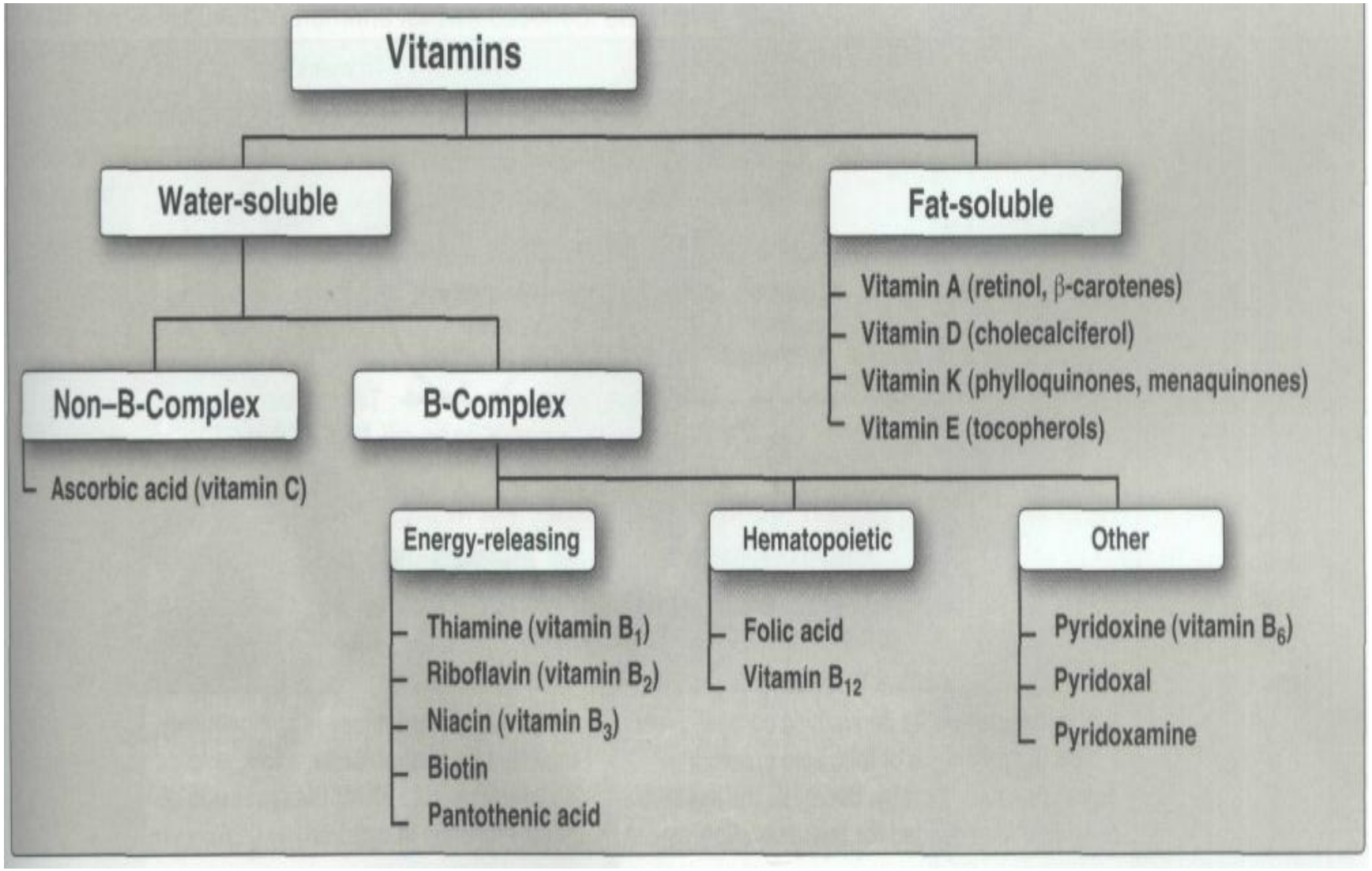
- Hematopoietic: Folic acid, Cobalamine (vitamin B_{12})

- other vitamins: Pyridoxine (vitamin B_6), pyridoxal, pyridoxamine.

2. Fat-soluble vitamins

vitamins A, D, E, K

- Vitamin A (retinol, β-carotenes)
- Vitamin D (cholecalciferol)
- Vitamin K (phylloquinones, menaquinones)
- Vitamin E (tocopherol, tocotrienols).


Vitamins
Water-soluble
Fat-soluble
Vitamin A (retinol, β-carotenes)
Vitamin D (cholecalciferol)
Vitamin K (phylloquinones, menaquinones)
Vitamin E (tocopherols)
Non–B-Complex
B-Complex
Ascorbic acid (vitamin C)
Energy-releasing
Hematopoietic
Other
Thiamine (vitamin B_1)
Riboflavin (vitamin B_2)
Niacin (vitamin B_3)
Biotin
Pantothenic acid
Folic acid
Vitamin B_{12}
Pyridoxine (vitamin B_6)
Pyridoxal
Pyridoxamine

VITAMINS Difference b/w water soluble & fat soluble vitamins

	Water soluble vitamins	Fat soluble vitamins
Solubility	Water soluble	Fat soluble
Absorption	Simple	Along with lipids
Storage	*No storage	Stored in liver
Excretion	Excreted	Not excreted
Excess intake	Nontoxic	Toxic
Deficiency	Manifests rapidly	Manifests slowly
Treatment	Regular dietary supply	Single large dose

VITAMINS

• MEDICAL AND BIOLOGICAL IMPORTANCE

Essential for growth, maintenance and reproduction

Fat soluble vitamins are required for normal and colour vision, blood clotting, bone formation and maintenance of membrane structure.

Most of the water soluble vitamins function as coenzymes

Vitamins A and D act as steroid hormones.

Lack of vitamin in the diet produce characteristic deficiency symptoms

Some drugs and compounds present in natural sources act as antivitamins.

Some vitamin analogs are used as drugs

VITAMINS

RECOMMENDED DIETARY ALLOWANCE

Dietary intake that is considered optimal under ordinary conditions

VITAMINS

DIETARY VITAMIN DEFICIENCIES

Causes

- Inadequate dietary intake
- Inadequate intestinal absorption
- Inadequate utilization
- Increased requirements
- Drug induced deficiency

- Fat soluble vitamins
  - Found in the fats and oils of food.
  - Absorbed into the lymph and carried in blood with protein transporters = chylomicrons.
  - Stored in liver and body fat and can become toxic if large amounts are consumed.

- Water soluble vitamins
  - Found in vegetables, fruit and grains, meat.
  - Absorbed directly into the blood stream
  - Not stored in the body and toxicity is rare.

Table 45–1. The vitamins.

Vitamin		Functions	Deficiency Disease
A	Retinol, β-carotene	Visual pigments in the retina; regulation of gene expression and cell differentiation; β-carotene is an antioxidant	Night blindness, xerophthalmia; keratinization of skin
D	Calciferol	Maintenance of calcium balance; enhances intestinal absorption of Ca^{2+} and mobilizes bone mineral	Rickets = poor mineralization of bone; osteomalacia = bone demineralization
E	Tocopherols, tocotrienols	Antioxidant, especially in cell membranes	Extremely rare—serious neurologic dysfunction
K	Phylloquinone, menaquinones	Coenzyme in formation of γ-carboxyglutamate in enzymes of blood clotting and bone matrix	Impaired blood clotting, hemorrhagic disease
B_1	Thiamin	Coenzyme in pyruvate and α–ketoglutarate, dehydrogenases, and transketolase; poorly defined function in nerve conduction	Peripheral nerve damage (beriberi) or central nervous system lesions (Wernicke-Korsakoff syndrome)
B_2	Riboflavin	Coenzyme in oxidation and reduction reactions; prosthetic group of flavoproteins	Lesions of corner of mouth, lips, and tongue; seborrheic dermatitis
Niacin	Nicotinic acid, nicotinamide	Coenzyme in oxidation and reduction reactions, functional part of NAD and NADP	Pellagra—photosensitive dermatitis, depressive psychosis
B_6	Pyridoxine, pyridoxal, pyridoxamine	Coenzyme in transamination and decarboxylation of amino acids and glycogen phosphorylase; role in steroid hormone action	Disorders of amino acid metabolism, convulsions
	Folic acid	Coenzyme in transfer of one-carbon fragments	Megaloblastic anemia
B_{12}	Cobalamin	Coenzyme in transfer of one-carbon fragments and metabolism of folic acid	Pernicious anemia = megaloblastic anemia with degeneration of the spinal cord
	Pantothenic acid	Functional part of CoA and acyl carrier protein: fatty acid synthesis and metabolism	
H	Biotin	Coenzyme in carboxylation reactions in gluconeogenesis and fatty acid synthesis	Impaired fat and carbohydrate metabolism, dermatitis
C	Ascorbic acid	Coenzyme in hydroxylation of proline and lysine in collagen synthesis; antioxidant;	Scurvy—impaired wound healing, loss of dental cement, subcutaneous