

Vitamins

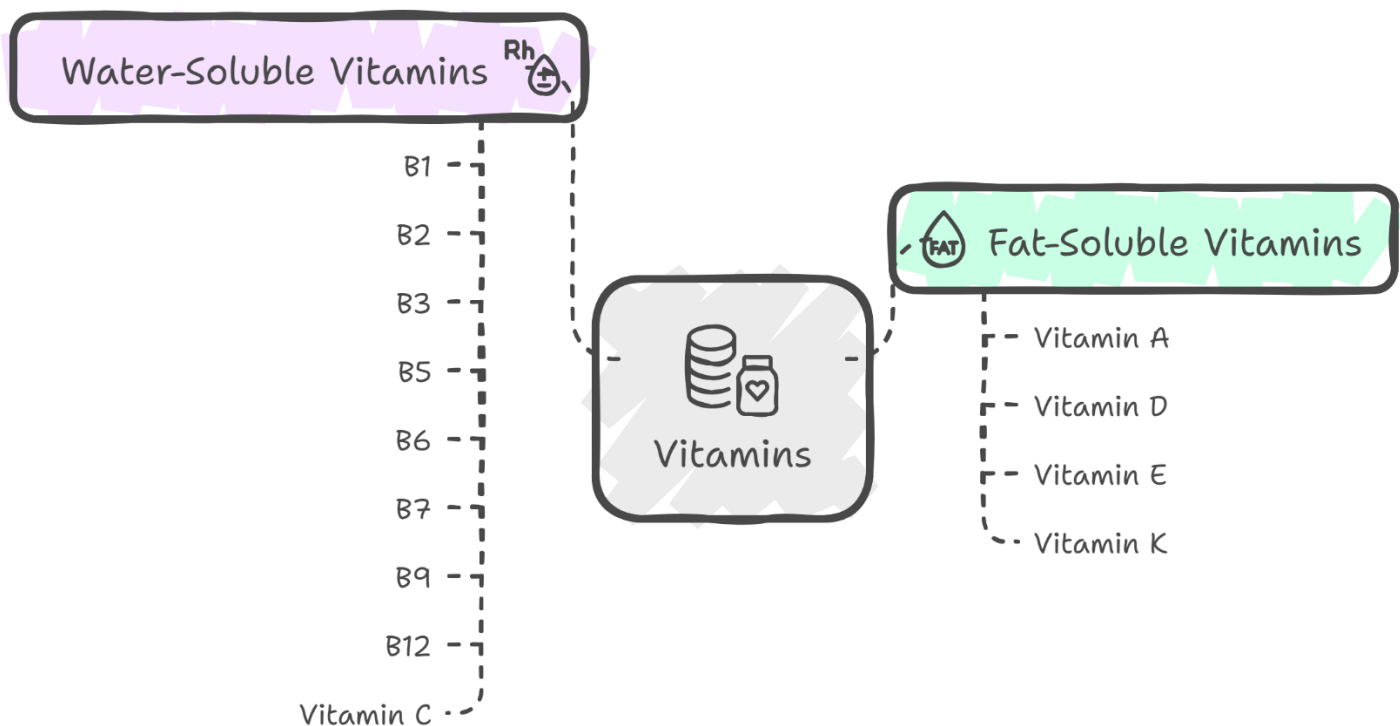
Vitamins

Definition of Vitamins

- In biochemistry and clinical pathology, vitamins are defined as:
- Organic compounds that are required in small quantities for normal physiological functioning, growth, and maintenance of health, but cannot be synthesized in sufficient amounts by the body, and hence must be obtained through the diet.
 - Vitamins are non-energy-yielding nutrients, i.e., they do not provide calories, but they are essential for the regulation of metabolic pathways.
 - Most vitamins act as coenzymes or cofactors in various enzymatic reactions.

Classification of Vitamins with Examples

Vitamins are broadly classified based on their **solubility**:



A. Fat-Soluble Vitamins

- These are soluble in **fats and oils**, stored in **liver and adipose tissues**, and not readily excreted.

Vitamin	Scientific Name
Vitamin A	Retinol, Retinal, Retinoic acid

Vitamin D	Cholecalciferol (D3), Ergocalciferol (D2)
Vitamin E	Tocopherols and Tocotrienols
Vitamin K	Phylloquinone (K1), Menaquinone (K2)

B. Water-Soluble Vitamins

- These are soluble in **water**, not stored in the body in large amounts, and excess is usually **excreted in urine**.

Vitamin	Scientific Name
B1	Thiamine
B2	Riboflavin
B3	Niacin or Nicotinic acid
B5	Pantothenic acid
B6	Pyridoxine, Pyridoxal, Pyridoxamine
B7	Biotin
B9	Folic acid
B12	Cobalamin
Vitamin C	Ascorbic acid

Sources, Chemical Nature, Functions, Coenzyme Forms, RDAs, and Deficiencies of fat-soluble vitamins

Vitamin A (Retinol)

- **Sources:** Liver, fish oils, dairy, eggs; β -carotene in carrots, spinach, mango
- **Chemical Nature:** Retinoids (Retinol, Retinal, Retinoic acid), derived from isoprene units
- **Functions:** Visual cycle (rhodopsin), epithelial maintenance, growth, reproduction, immune support
- **Coenzyme Forms:** Retinal (vision), Retinoic acid (gene regulation)
- **RDA:** Men – 900 $\mu\text{g/day}$; Women – 700 $\mu\text{g/day}$
- **Deficiency Diseases:** Night blindness, xerophthalmia, Bitot's spots, keratomalacia

Vitamin D (Cholecalciferol)

- **Sources:** Sunlight, fish liver oils, fortified dairy, egg yolk

- **Chemical Nature:** Secosteroid (cholesterol-derived)
- **Functions:** Calcium/phosphate absorption, bone health, immune modulation
- **Coenzyme Form:** Calcitriol (1,25-dihydroxycholecalciferol)
- **RDA:** 15–20 µg/day (600–800 IU)
- **Deficiency Diseases:** Rickets (children), osteomalacia (adults), hypocalcemia

Vitamin E (Tocopherol)

- **Sources:** Vegetable oils, nuts, seeds, leafy greens
- **Chemical Nature:** Tocopherols and tocotrienols
- **Functions:** Antioxidant, protects membranes, prevents lipid peroxidation
- **Coenzyme Form:** α-Tocopherol
- **RDA:** 15 mg/day
- **Deficiency Diseases:** Hemolytic anemia, neurological issues (rare)

Vitamin K

- **Sources:** Green leafy vegetables, liver, gut flora
- **Chemical Nature:** Naphthoquinone derivatives (K1 – phyloquinone, K2 – menaquinone)
- **Functions:** Blood clotting (factors II, VII, IX, X), bone metabolism
- **Coenzyme Form:** Menaquinone / Phyloquinone
- **RDA:** Men – 120 µg/day; Women – 90 µg/day
- **Deficiency Diseases:** Hemorrhage, prolonged clotting

Here's a short and structured table summarizing the sources, chemical nature, functions, coenzyme forms, RDA, and deficiency diseases of fat-soluble vitamins:

Vitamin	Sources	Chemical Nature	Functions	Coenzyme Form	RDA	Deficiency Diseases
A (Retinol)	Liver, fish oils, dairy, β-carotene in plants	Retinoids (isoprene-derived)	Vision, epithelial integrity, growth, immunity	Retinal, Retinoic acid	M: 900 µg, W: 700 µg/day	Night blindness, xerophthalmia, Bitot's spots
D (Cholecalciferol)	Sunlight, fish liver oils,	Secosteroid (from cholesterol)	Ca ²⁺ /PO ₄ ³⁻ absorption	Calcitriol	15–20 µg/day (600–	Rickets, osteomalacia ,

	dairy, egg yolk		, bone health		800 IU)	hypocalcemia
E (Tocopherol)	Vegetable oils, nuts, seeds, greens	Tocopherols, tocotrienols	Antioxidant, membrane protection	α -Tocopherol	15 mg/day	Hemolytic anemia, neuro issues (rare)
K (Phylloquinone/K1, Menaquinone/K2)	Leafy greens, liver, gut flora	Naphthoquinone derivatives	Clotting factors, bone metabolism	Phylloquinone, Menaquinone	M: 120 μ g, W: 90 μ g/day	Hemorrhage, delayed clotting

Sources, Chemical Nature, Functions, Coenzyme Forms, RDAs, and Deficiencies of water-soluble vitamins

Vitamin B1 (Thiamine)

- Sources:** Whole grains, legumes, pork
- Chemical Nature:** Thiazole and pyrimidine ring linked by a methylene bridge
- Functions:**
 - Coenzyme in carbohydrate metabolism (e.g., pyruvate dehydrogenase)
 - Nerve conduction and neural membrane integrity
- Coenzyme Form:** Thiamine pyrophosphate (TPP)
- Recommended Dietary Allowance (RDA):** 1.1–1.2 mg/day
- Deficiency Disorders:**
 - **Beriberi:**
 - *Dry:* Neurological symptoms (e.g., peripheral neuropathy)
 - *Wet:* Cardiovascular symptoms (e.g., edema, heart failure)
 - **Wernicke-Korsakoff Syndrome:** Seen in chronic alcoholism; involves mental confusion, ataxia, ophthalmoplegia

Vitamin B2 (Riboflavin)

- Sources:** Milk, eggs, green leafy vegetables
- Chemical Nature:** Isoalloxazine ring linked to ribitol



FREE PREVIEW

[Click here to visit our website](#)

PHARMACY PREMIUM NOTES

Complete subject and semesters are available on FirstHope app only.



[Scan or click here](#)

Click here to get the app



Available on Google Play

JOIN THE FIRSTHOPE COMMUNITY

Join our Telegram channel

Click here to join Telegram



[Scan or click here](#)

@FirstHopeNotes

Instagram

@firsthope.official

[Click here to follow >](#)

YouTube channel

FirstHope-Pharmacy / Live streams

[Click here to watch >](#)

WhatsApp channel

Follow FirstHope on WhatsApp

[Click here to join >](#)

FirstHope website

firsthopenotes.com

[Click here to visit >](#)

B.Pharm / D.Pharm / M.Pharm / Pharm.D

Preview notes. Complete subjects and semesters in the FirstHope app.