D.PHARM • SECOND YEAR

Biochemistry & Clinical Pathology

CHAPTER 7

Vitamins



ENGLISH CHAPTER NOTES

DIPLOMA IN PHARMACY

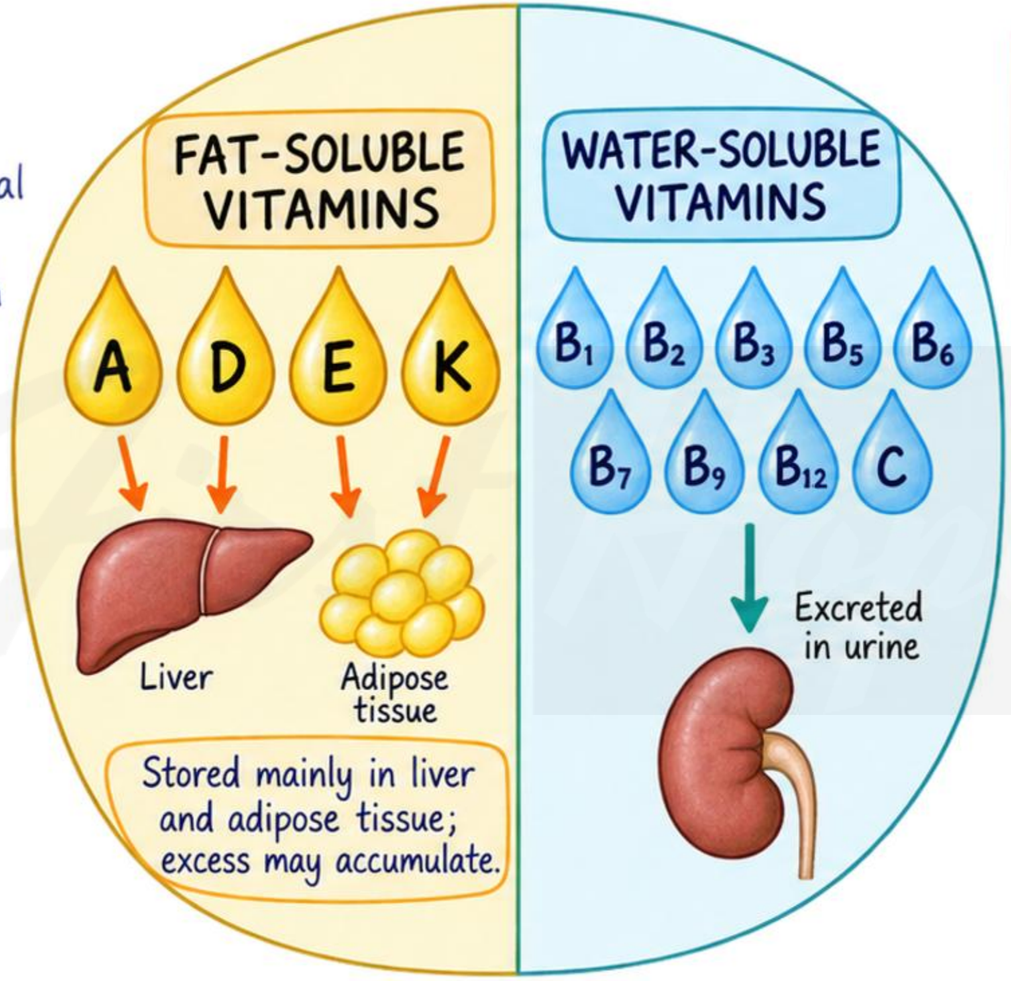
VITAMINS: OVERVIEW & CLASSIFICATION

DEFINITION

Vitamins are organic compounds required in small amounts for normal physiological function, growth and health. The body cannot make enough of them, so they must come mainly from the diet.

KEY POINTS

- do not supply energy or calories
- regulate metabolic pathways
- many act as coenzymes or form parts of coenzymes
- deficiency causes characteristic disorders



FAT-SOLUBLE VITAMINS

A — retinol, retinal, retinoic acid
D — cholecalciferol D_3, ergocalciferol D_2
E — tocopherols, tocotrienols
K — phylloquinone K_1, menaquinones K_2

Stored mainly in liver and adipose tissue; excess may accumulate.

WATER-SOLUBLE VITAMINS

B_1 thiamine • B_2 riboflavin • B_3 niacin
B_5 pantothenic acid • B_6 pyridoxine group
B_7 biotin • B_9 folate • B_{12} cobalamin
C — ascorbic acid

Usually stored only in limited amounts; excess is commonly excreted in urine. Vitamin B_{12} is an important exception because the body stores substantial amounts.

MEMORY KEY

Fat-soluble = A D E K • Water-soluble = B and C

VITAMIN A

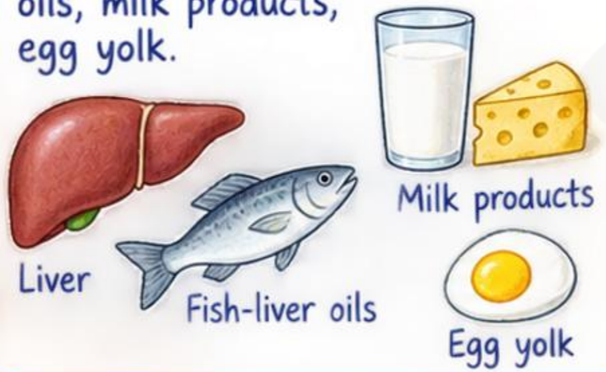
SCIENTIFIC FORMS

Retinol • retinal • retinoic acid

β-carotene is a provitamin A carotenoid.

SOURCES

Animal: liver, fish-liver oils, milk products, egg yolk.



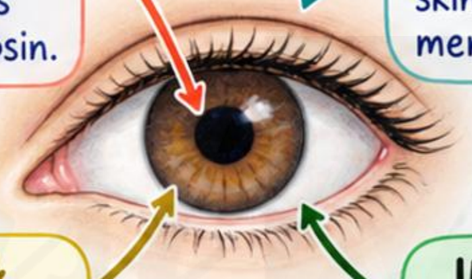
MAJOR FUNCTIONS

VISION

retinal combines with opsin to form visual pigments such as rhodopsin.

EPITHELIUM

maintains healthy skin and mucous membranes.



GROWTH & REPRODUCTION

supports normal cell differentation.

IMMUNITY

helps maintain defence against infection.

RECOMMENDED INTAKE

Adult men: about 900 µg RAE/day

Adult women: about 700 µg RAE/day

RAE = retinol activity equivalents.

Plant carotenoids: carrot, spinach, mango and other yellow-orange or dark-green vegetables.



and other yellow-orange or dark-green vegetables.

DEFICIENCY PROGRESSION

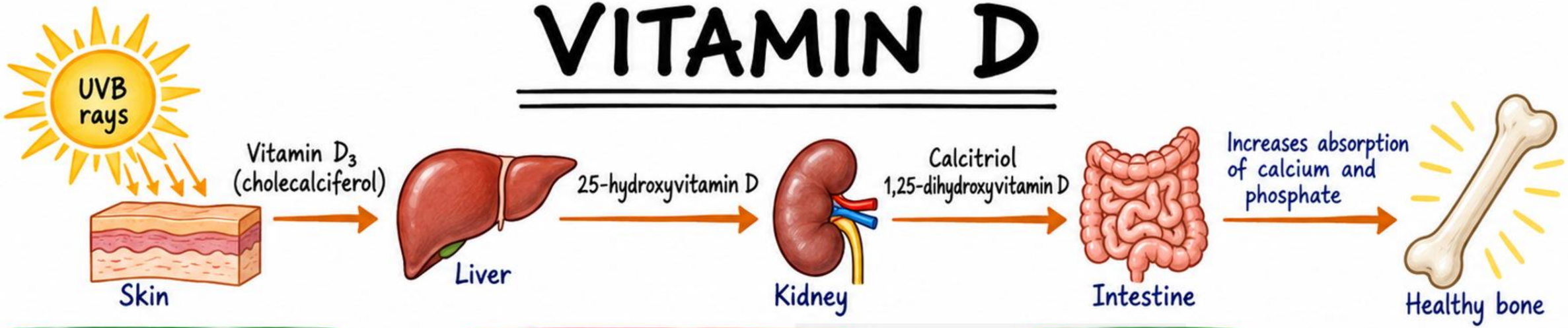


Poor dark adaptation → night blindness → conjunctival dryness and Bitot's spots → xerophthalmia → corneal softening called keratomalacia.

IMPORTANT

Retinal is important in vision; retinoic acid regulates gene expression. These are active vitamin forms, not coenzymes in the usual sense.

VITAMIN D



FORMS & NATURE

- Vitamin D_3 = cholecalciferol
- Vitamin D_2 = ergocalciferol
- It is a fat-soluble, cholesterol-related secosteroid.

SOURCES

- Sunlight exposure enables skin synthesis of vitamin D_3.
- Dietary sources include fish-liver oils, fatty fish, fortified milk and egg yolk.



ACTIVATION PATHWAY

Skin or diet → liver: 25-hydroxyvitamin D → kidney: calcitriol, 1,25-dihydroxyvitamin D

Calcitriol is the active hormonal form.

RECOMMENDED INTAKE

About 15–20 µg/day = 600–800 IU/day, depending on age and guidance.

1 µg vitamin D = 40 IU.

15–20 µg/day = 600–800 IU/day

REMEMBER

Sunlight, liver and kidney are linked in vitamin D activation.

FUNCTIONS

- increases intestinal absorption of calcium and phosphate
- maintains blood mineral balance
- supports mineralisation and strength of bones and teeth
- contributes to muscle and immune function

DEFICIENCY

- Children: rickets – poor mineralisation and bone deformity.
- Adults: osteomalacia – soft, painful or weak bones.
- Severe deficiency may contribute to hypocalcaemia.



VITAMIN E

SCIENTIFIC FAMILY

Vitamin E includes tocopherols and tocotrienols. α-Tocopherol is the principal form used to express human vitamin E activity.

MAIN FUNCTION: ANTIOXIDANT

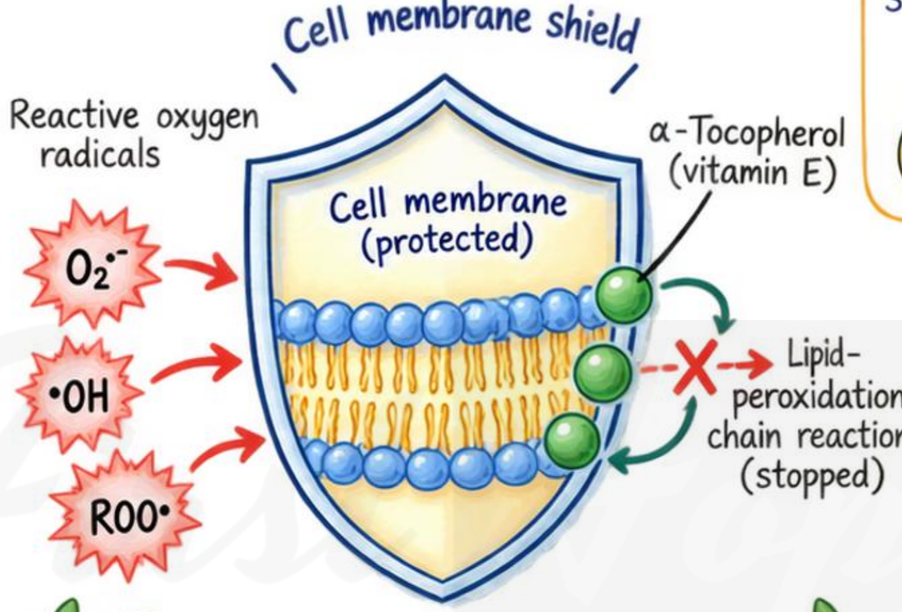
Vitamin E protects polyunsaturated fatty acids in cell membranes from oxidative damage. It interrupts lipid-peroxidation chain reactions caused by free radicals.

WHY THIS MATTERS

- protects red-blood-cell membranes
- helps maintain nerve and muscle cell membranes
- works with other antioxidant systems

RECOMMENDED INTAKE

Adults: about 15 mg α-tocopherol/day.





MEMORY KEY

E = membrane antioxidant and erythrocyte protection.

SOURCES

Vegetable oils • wheat germ • nuts • seeds • green leafy vegetables



DEFICIENCY

Deficiency is uncommon but may occur with severe fat-malabsorption disorders. Possible effects include:

- haemolytic anaemia, especially in premature infants
- peripheral neuropathy or ataxia
- muscle weakness

IMPORTANT

Vitamin E is stored with body fat. Very high supplemental doses should not be treated as harmless because they may increase bleeding risk in susceptible people.

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