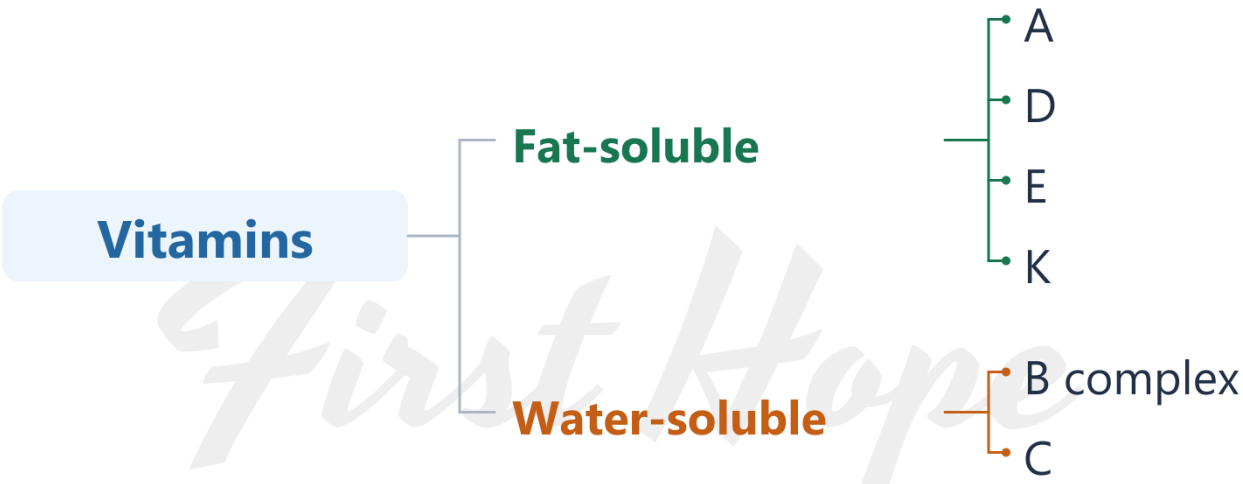
Pediatrics - Topic 12 - Micronutrients in Health and disease-1 (Vitamins ADEK, B Complex and C)

Vitamins in Child Health

- Vitamins are organic nutrients that the body needs in small amounts for normal growth and function.

Functions and Requirements

- Fat-soluble vitamins are absorbed with dietary fat and may accumulate when excessive supplements are given.
- Water-soluble vitamins usually have smaller stores, although vitamin B12 has substantial liver stores.



Interpreting Daily Requirements

- A recommended dietary allowance guides the usual intake of a healthy child; it is not the dose used to treat deficiency.
- Requirements vary with age, growth, diet and disease, so a single adult dose must not be used for every child.
- The following selected daily values use Indian nutrient recommendations for healthy children.

Age	Vitamin A (micrograms/day)	Vitamin D (IU/day)	Vitamin C (mg/day)
1–3 years	390	600	30
4–6 years	510	600	35
7–9 years	630	600	45

- Vitamin K intake is usually described as an adequate intake rather than a firmly established pediatric RDA.

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- An internationally used adequate intake is 30 micrograms daily at 1–3 years and 55 micrograms daily at 4–8 years.
- These vitamin K intake values are different from the intramuscular dose used to prevent neonatal bleeding.

Why Deficiency Develops

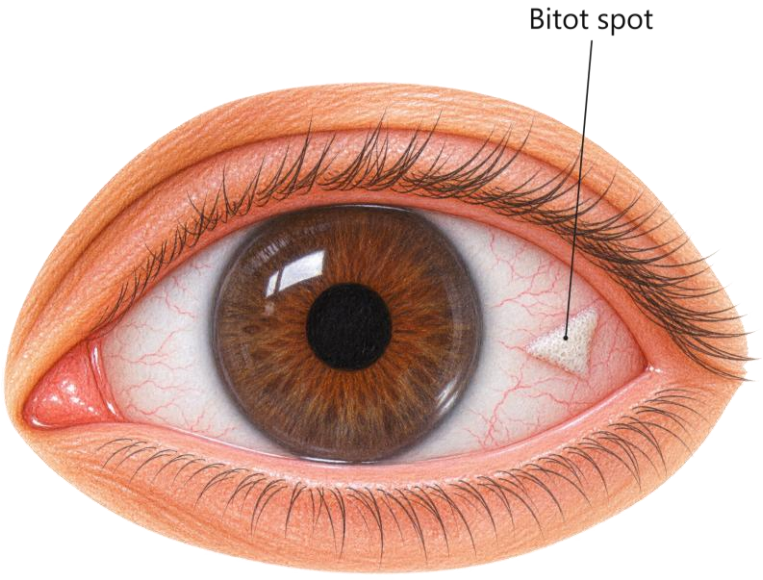
- Limited food variety, prolonged food restriction and inadequate complementary feeding reduce intake.
- Cholestasis, pancreatic disease and intestinal malabsorption particularly affect fat-soluble vitamins.
- Prematurity, rapid growth and chronic illness can increase nutritional vulnerability.
- Ask about every prescribed supplement, over-the-counter preparation and traditional product to detect duplication.

Vitamin A

Sources, Metabolism and Functions

- Egg yolk, dairy foods and liver provide preformed vitamin A; orange and dark green vegetables provide provitamin A carotenoids.
- Dietary vitamin A is absorbed in the small intestine and stored mainly as retinyl esters in the liver.
- Retinol circulates with retinol-binding protein and reaches tissues that use it for vision, epithelial health and immune function.
- Retinal participates in the visual cycle, while retinoic acid regulates gene expression and cell differentiation.

Causes and Clinical Features of Deficiency



A Bitot spot is a foamy conjunctival plaque; corneal involvement requires urgent assessment

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- Deficiency is associated with a poor diet, malabsorption, severe undernutrition and repeated infections.
- A child with night blindness sees poorly in dim light and may become unusually hesitant after sunset.
- Dry conjunctiva and Bitot spots suggest xerophthalmia, but the eye must also be examined for corneal disease.
- Corneal dryness, ulceration or softening can rapidly threaten sight and require urgent treatment and ophthalmic assessment.

Code	Finding
XN	The child has night blindness.
X1A / X1B	Conjunctival xerosis or Bitot spots are present.
X2	The cornea is dry.
X3A / X3B	Corneal ulceration or softening involves less than one third, or at least one third, of the cornea.
XS / XF	A corneal scar or xerophthalmic fundus change is present.

Assessment and Urgent Treatment Decisions

- Assess dietary intake, recent measles, growth, diarrhea and the history of previous vitamin A doses.
- Low serum retinol supports deficiency, but infection can temporarily lower the result and should influence interpretation.
- Do not delay treatment of characteristic sight-threatening eye disease while waiting for laboratory confirmation.

Vitamin A Regimen and Eye Care

- For childhood xerophthalmia, give oral vitamin A immediately, repeat it the next day and repeat it after two weeks.
    - Each dose is 50,000 IU below 6 months, 100,000 IU at 6–11 months and 200,000 IU from 12 months of age.
- Arrange urgent eye care for corneal involvement and treat associated infection and undernutrition.
- Adolescents who may be pregnant require a specifically checked regimen because excessive preformed vitamin A can harm the fetus.

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Prevention and Excess

National Prophylaxis and Dose Records

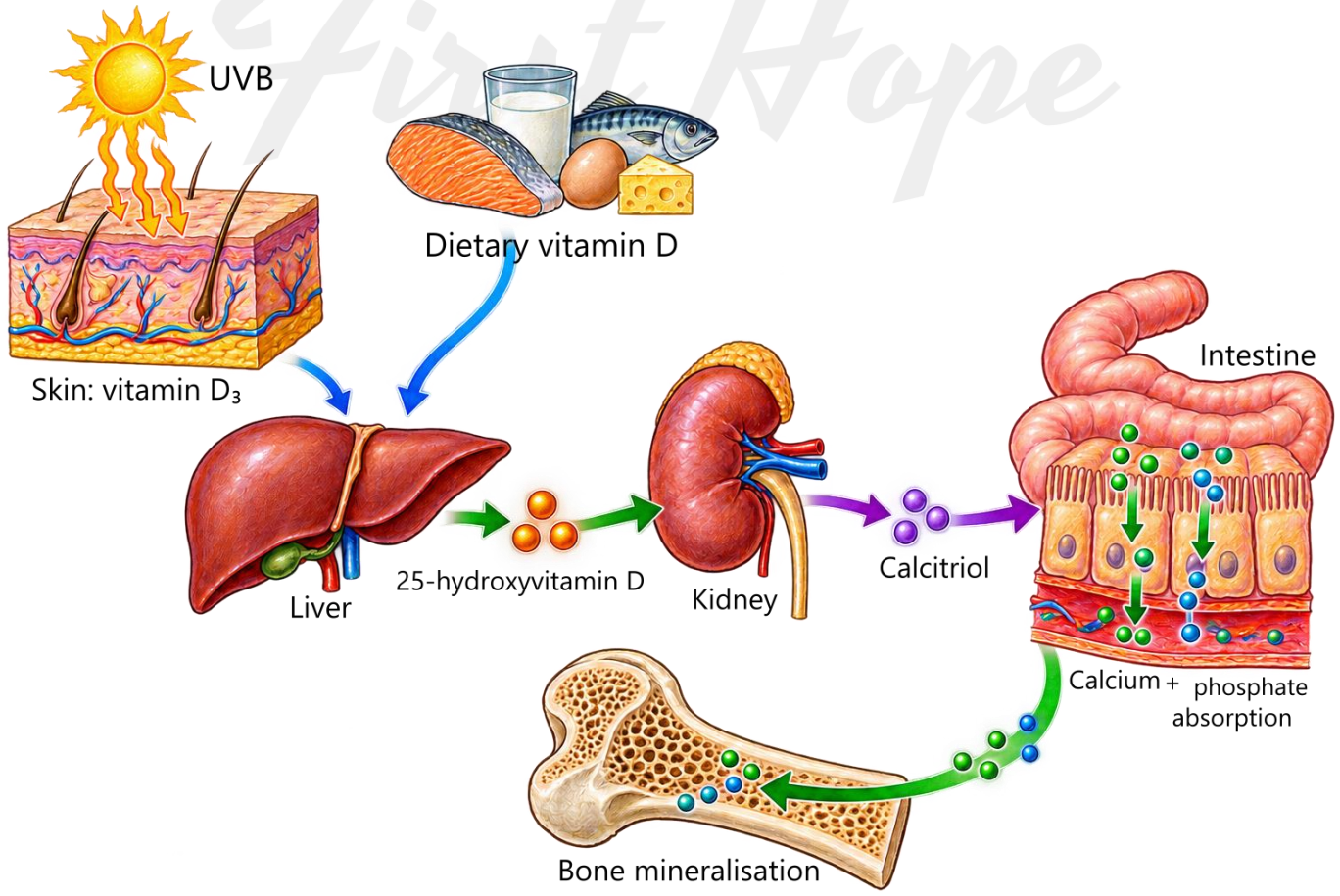
- India provides nine prophylactic vitamin A doses from 9 months to 5 years through child-health services.
    - The first dose is 100,000 IU at 9 months, followed by 200,000 IU doses at the scheduled contacts, generally six months apart after the second dose.
- Record doses on the child-health card and check recent administration before prescribing another high dose.

Vitamin A Excess

- Acute excess can cause vomiting, irritability and a bulging fontanelle, while chronic excess can cause bone pain, skin changes and liver injury.
- Stop unnecessary supplements and assess a symptomatic child for toxicity rather than assuming that more vitamin is beneficial.

Vitamin D and Rickets

Vitamin D Pathway and Bone Mineralization



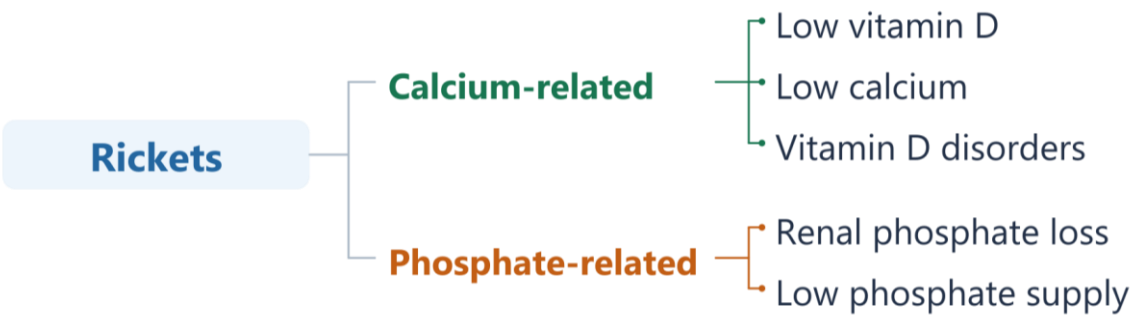
Vitamin D is activated through the liver and kidney and supports calcium and phosphate absorption

- Ultraviolet B light allows the skin to form vitamin D3, and food or supplements provide additional vitamin D.

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- The liver forms 25-hydroxyvitamin D, and the kidney forms the active hormone calcitriol.
- Calcitriol supports calcium and phosphate absorption and helps maintain normal mineralization of bone.
- Rickets affects the growing growth plate, while osteomalacia affects mineralization of bone matrix.

Causes and Classification



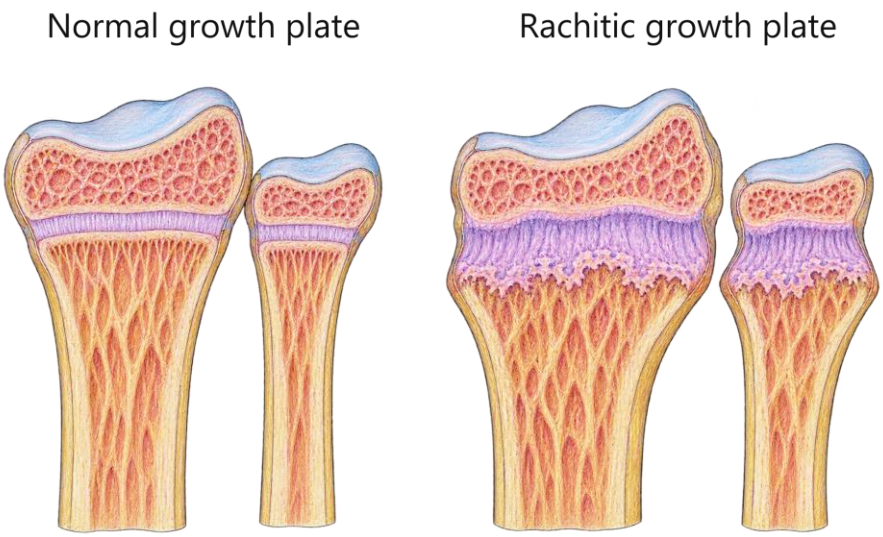
1. Calcipenic Rickets

- Nutritional rickets usually results from inadequate vitamin D, inadequate calcium or both.
- Limited sunlight exposure, low maternal vitamin D, malabsorption and some antiseizure medicines increase the risk.

2. Phosphopenic and Other Non-Nutritional Forms

- Renal phosphate loss, chronic kidney disease and inherited vitamin D disorders cause non-nutritional forms that need different treatment.
- Phosphopenic rickets results from inadequate phosphate availability, commonly because the kidneys waste phosphate.
- Inherited disorders of vitamin D synthesis or action and chronic kidney disease require biochemical assessment rather than repeated empirical nutritional vitamin D courses.

Clinical Recognition



Rickets disrupts growth-plate mineralisation, producing widening, cupping and fraying

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