

- **Vitamins** are organic substances, do not synthesized in the body in sufficient quantities to meet the body requirements, therefore needed in the diet.
 - They are essential for health and growth.
 - Needed in a very small amount.
 - Must be taken in the food [may not formed in the body].
 - Do not enter in the body structure [or tissue structure].
 - Act as catalyst and are not oxidized to give energy.
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- **Vitamins of two types:**
 1. **Fat soluble vitamins:**
 - Vitamin A
 - Vitamin D
 - Vitamin E
 - Vitamin K
 2. **Water soluble vitamins:**
 - Vitamins B complex
 - Vitamin C

Vitamin D:

- Present in two forms:
- **Vitamin D₂ (Ergocholecalciferol):**
- Present in plants and yeast with no dietary nutritional importance, since it is poorly absorbed from small intestine. Its provitamin is ergosterol.
- **Vitamin D₃ (Cholecalciferol):**
- Provitamin D₃ is 7- dehydrocholesterol.
- Present in fish, liver, oil, meats, butter, eggs, and milk.

- Synthesized in the skin by the action of ultraviolet light on the precursor 7- dehydrocholesterol, in addition to the skin sources it can be synthesized endogenously and present in subcutaneous fat in the human body.
- Daily requirement about 100 I.U = 2.5 µg for normal adult.
- For infants, children, pregnant, and lactated women about 400 I. U.

- **Vitamin D deficiency:**

occurs due to inadequate of:

1. Sun rays.
2. Foods rich in vitamin D₃.
3. Defect of renal tubular phosphate reabsorption.

- **Deficiency of vitamin D leads to:**

- **1. Rickets:** due to defect in long bones calcification, mainly occur in children which lead to soften and deformities of bones. (before epiphysis).
- **2. Osteomalacia:** occurs in adults, due to defect in calcification or mineralization of the organic matrix of bone.
- In both conditions, the effect of calcitriol is indirect through the effect on calcium and phosphate levels.

Ascorbic Acid (Vitamin C):

- **Deficiency:**
- Its deficiency will lead to defective hydroxylation of proline and lysine in procollagen, which is unstable as hydroxylation is necessary for the formation of the normal tertiary structure of collagen. Also important in the hydroxylation reactions involved in corticosteroid synthesis due to its high concentration in the adrenal gland.
- Does not synthesize in the human body, so, it is supplied by food, but synthesized in other animal.
- Important for iron absorption, reduce ferric to ferrous.



- **Sources:**
- Citrus fruits, (lemon, orange), potatoes, tomato, green pepper, cabbage, spinach, grapes and other green leafy vegetables.
- **Recommended daily intakes:** 60-80 mg per day.
- Acts as antioxidant and required for collagen synthesis, so, it is needed for the maintenance of connective tissue and for normal wound healing.

- **Clinically its deficiency causes:**
 - Scurvy occurs due to inadequate dietary intake of vitamin C.
 - First in infants of 6-12 months who receive processed milk without supplements containing ascorbic acid.
 - Second the diet of elderly subject who live alone may also deficient in ascorbate-rich foods.
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- **Clinical signs in adults:**
 - 1. Skin papules.
 - 2. Purpura
 - 3. Muscular hemorrhages
 - 4. Poor wound healing
 - 5. Gum diseases
 - 6. Anemia
 - 7. Osteoporosis: occurs as vitamin C needed for collagen synthesis in the matrix of the bone.
 - Infants suffer from intracranial hemorrhage and bleeding into the periosteum of long bones causing swellings.
 - Vitamin C is important to prevent cold and flu, therefore, used as a daily requirement as 1 g or more, it may be increase oxalate excretion.