



# DEPARTMENT OF ANIMAL NUTRITION

*TOPIC : ROLE OF VITAMINS IN RUMINANT NUTRITION*

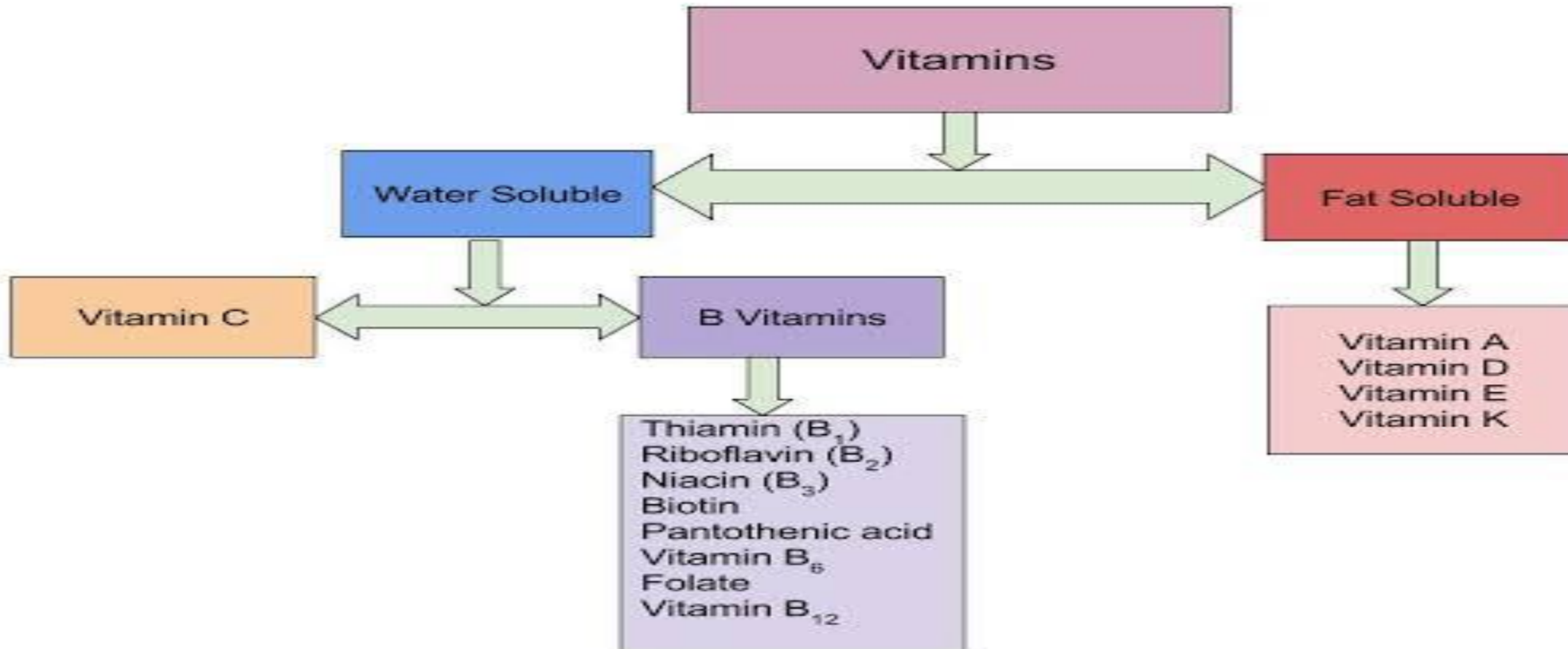
# WHAT ARE VITAMINS?

- Vitamins are group of complex organic compounds.
- These are required in trace amounts.
- That are essential to normal metabolism.
- Performs specific cellular functions.
- Lack of which in the diet causes deficiency diseases .
- These are not synthesized by humans, monogastric animals therefore must be taken in diet.
- Prevent acute deficiency disease; maintain general health.

## VITAMINS: DIETARY ESSENTIAL AND METABOLIC ESSENTIAL

- Some vitamins are metabolic essential, but not dietary essential, for certain species because they can be synthesized readily from other food or metabolic constituents.
- For example B- vitamins are essential for normal ruminant metabolism but are not needed in the diet because of bacterial synthesis in the rumen.
- Vitamin B12 is not dietary essential for ruminants provided cobalt is present in the diet since bacteria can synthesize it in the rumen.
- Vitamin-C is not dietary essential for many animals except humans, Guinea pigs.

# CLASSIFICATION OF VITAMINS

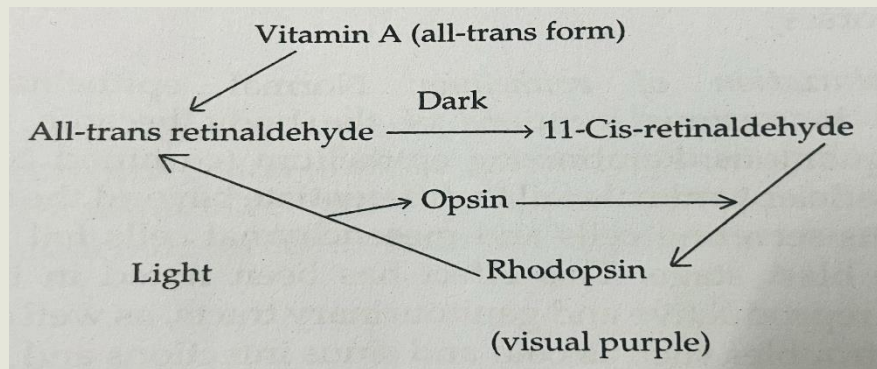


# VITAMIN -A

- **SOURCE :** 1. Carotenoids present in plants, yellow maize, carrots, greens are rich in source.  
2. Fish liver oils, liver, egg yolk, butter, cream, whole milk are rich in source.

- **PHYSIOLOGICAL FUNCTIONS:**

## 1. Vision :



**2. Bone growth:** In cattle, a blindness occurs as a result of narrowing of the bone canal through which optic nerve passes. Changes in bone growth are reported to cause the rise in CSF pressure.

**3. Maintenance of mucus secreting cells of the epithelia .**

- **DEFICIENCY SYMPTOMS :**

1. **Night blindness (Nictalopia):** Deficiency of vitamin A first manifests as a slow, dark adaptation and progresses to total blindness.
2. **Xerophthalmia :** It is characterized by a dry condition of the cornea and conjunctiva, cloudiness and ulceration.
  - **Copious lacrimation** is a more prominent eye symptom in cows and horses.



Source: <https://www.cram.com/flashcards/ocular-diseases-of-cattle-and-sheep-7741052>

3. **Keratinization of epithelium:** Normal epithelium (columnar epithelium) in various locations of body like Respiratory, alimentary, reproductive and genitourinary tracts become replaced by a stratified squamous, keratinising epithelium (cornified cells).
4. **Reproductive performance is impaired in male and female.**

# VITAMIN -D

- **SOURCE:** Ergosterol of plants and 7- dehydrocholesterol do not possess any vitamin D activity but on conversion to ergocalciferol (D2) and cholecalciferol (D3), respectively, by UV light they become active.
  - The natural foods that contain vitamin D are those of animal origin e.g. egg-yolk, liver, salt water fish (salmon etc.) fish liver oils like cod liver oil rich in vitamin D.
  - Sun cured hay and roughages for livestock.
  - The dead leaves of growing plants also contain vitamin D as ergocalciferol.
- **FUNCTIONS:**
  1. Vitamin D3 is the 3<sup>rd</sup> major hormone involved in the regulation of calcium metabolism and skeletal remodelling.
  2. Vitamin D3 stimulates both intestinal calcium and intestinal phosphorous transport.
  3. Active form of vitamin D (i.e.,  $1,25(\text{OH})_2\text{D}_3$ ) stimulates the synthesis of calcium binding protein. The binding protein is necessary for calcium absorption.

- **DEFICIENCY SYMPTOMS:**

- 1. Rickets in young ones:**

- It is a disease of growing bone.
- Deficient mineralization at the growth plate.
- occurs before the growth plate fuse.
- muscle weakness.

- 2. Osteomalacia in adults:**

- Impaired mineralization of the bone matrix.
- softening and weakening of bones.





# VITAMIN- E

- **SOURCE** : Tocopherol is a plant product

- It is also found in milk, meat, fish, eggs etc. (plant source ingredients are richer in vitamin E than animal source ingredients.
- young green grass is a better source than mature fodder.
- **Alfalfa** meal is a rich source of tocopherol .

- **FUNCTION** :

1. Natural antioxidant at a cellular level and play important role in biological oxidation- reduction reactions.
2. Vitamin- E plays a significant role in the development and function of the immune system.
3. Vitamin-E also closely associated with sulphur amino acid metabolism, the synthesis of ubiquinone, phosphorylation reactions.

- **DEFICIENCY SYMPTOMS:**

1. **Nutritional muscular dystrophy:** It is seen in cattle, sheep, pigs, chicks affecting primarily skeletal muscle and occasionally heart muscle, in pigs it is commonly known as mulberry heart disease
2. **Stiff lamb disease** in suckling lambs and **white muscle disease** in calves are variable forms of nutritional myopathy.

## VITAMIN- K

- **SOURCE:** Green leafy vegetables are rich source of phylloquinone.
  - liver, egg and fish meal are good animal source.



- **Menaquinones K2** are synthesized by bacteria in the digestive tract of animals.

- **FUNCTIONS:**

1. Vitamin K is required for synthesis of prothrombin and other clotting factors.
2. It is also involved in electron transport and in bacteria, oxidative phosphorylation.

- **DEFICIENCY SYMPTOMS:**

1. **Haemorrhagic sweet clover disease:** Ruminants consuming mouldy sweet clover develop vitamin K deficiency symptoms.
  - when sweet clover undergoes spoilage with certain moulds, the moulds convert the coumarin to dicoumarol, which is a potent vitamin K antagonist.

# VITAMIN- B COMPLEX

## ▪ SOURCE :

1. Brans and rice polish are rich sources of **Thiamin**.
2. Milk is a rich source of **Riboflavin**.
3. About **40%** of niacin in **oil seeds** and **85-90%** of niacin in **cereals** is present as bound niacin.
4. Liver and kidney are excellent sources of **vitamin B12**.
5. Groundnut meal, rice bran, wheat bran, cane molasses are rich sources of **pyridoxine**.

## ▪ TYPES OF B- COMPLEX:

- |  |                                  |                                 |
|--|----------------------------------|---------------------------------|
| 1. VITAMIN B1 (THIAMINE)               | 4. VITAMIN B5 (PANTOTHENIC ACID) | 7. VITAMIN B10, B11(FOLIC ACID) |
| 2. VITAMIN B2 (RIBOFLAVIN)             | 5. VITAMIN B6 (PYRIDOXINE)       | 8. VITAMIN B12                  |
| 3. VITAMIN B3 ( NIACIN/NICOTINIC ACID) | 6. VITAMIN H (BIOTIN)            | ( CYANOCOBALAMIN)               |

| VITAMIN               | DEFICIENCY SYMPTOMS   |
|-----------------------|---|
| THIAMINE (B1)         | RUMINANTS : polioencephalomalacia .<br>POULTRY : polyneuritis, star gazing.<br>HUMAN : Beriberi.  |
| RIBOFLAVIN (B2)       | SWINE: Nerve degeneration, crooked and stiff legs.<br>POULTRY: Curled toe paralysis, clubbed down condition.  |
| NIACIN (B3)           | HUMAN & PIGS : pellagra / Blue tongue.<br>DOGS: Black tongue.<br>CHICKS: Enlargement of hock joint.   |
| PANTOTHENIC ACID (B5) | POULTRY: Retarded growth.<br>PIGS : Goose stepping gait.  |
| BIOTIN / VITAMIN H    | POULTRY: perosis, slipped tendon in chick.  |
| FOLIC ACID (B10, B11) | CHICKS: Retarded growth, macrocytic hypochromic anaemia and perosis.  |
| CYANOCOBALAMIN (B12)  | HUMANS: pernicious anaemia<br>CHICKS : poor hatchability, low growth rate.<br>RUMINANTS : Impairs the utilisation of propionate.<br>CALVES: Cessation of growth, poor appetite. |

# VITAMIN -C

- **SOURCE:** Citrus fruits, Tomatoes, green vegetables and potatoes are principal sources.
  - Raw milk is good source, but most of its lost during pasteurization.
- **FUNCTION:**
  1. It is a strong antioxidant and used in industry for the preservation of fruits and vegetables.
  2. Not required in rations of farm animals\*.
- **DEFICIENCY SYMPTOMS:**
  1. None demonstrated in livestock.
  2. Human deficiency : **SCURVY** – swollen and painful joints and bleeding gums and brittleness of bones.

REFERENCE: D.V. REDDY (2022) PRINCIPLES OF ANIMAL NUTRITION AND FEED TECHNOLOGY 3<sup>rd</sup> edition  
chapter 12: 296-341 (Oxford & IBH Publishing Co.Pvt.Ltd.)

<https://agriking.com/the-importance-of-fat-soluble-vitamins-in-ruminant-diets/>

<https://www.sweetlix.com/research-articles/immunity/the-role-of-vitamin-a-in-ruminant-nutrition/>

# THANK YOU

***SEE YOU AGAIN!*** □