

## **Vitamin D deficiency**

Vitamin D deficiency is usually caused by insufficient solar irradiation of animals or their feed and is manifested by poor appetite and growth and in advanced cases by osteodystrophy.

### **Etiology:**

A lack of ultraviolet solar irradiation of the skin , coupled with deficiency of preformed vitamin D complex in the diet , leads to deficiency of vitamin D in tissues .

### **Epidemiology:**

#### **A – Ultraviolet irradiation :**

The lack of ultraviolet irradiation becomes important as distance from equator increases and the sun rays are filtered and refracted by an increasing depth of the earth's atmosphere . Cloudy , overcast skies , smoke laden atmosphere , and winter months exacerbate the lack of irradiation . The effects of poor irradiation are felt first by animals with dark skin or heavy coats , by rapidly growing animals and by those that are housed indoors for long periods . The concentration of plasma vit D3 recorded in grazing sheep varies widely throughout the year . During the winter months the level in sheep fall below what is considered optimal , while in the summer months

the level are more than adequate . There is marked differences in vit D status between sheep with long fleece and those that have been recently shorn , especially in the periods of maximum sunlight . The higher blood levels of vit D in the later group probably due to their greater exposure to sunlight .

### **B – Dietary vit D :**

The important of dietary source of preformed vit D must not be underestimated . Irradiated plant sterols with anti – rachitic potency occur in the dead leaves of growth plants . Variation in vit D content of hay can occur with different methods of curing . exposure to irradiation by sunlight for long periods causes marked increase in anti – rachitic potency of cut fodder , whereas modern hay making technique with is emphasis of rapid curing tends to keep vit D levels at minimum .

### **C – Grazing animals**

The grazing of animals , especially in winter time , in lush green feed including cereal crops leads to high incidence of rickets in the young .

### **Pathogenesis :**

Vit D is a complex of substances with anti – rachitogenic activity . The important components are as follow .

A – Vit D<sub>3</sub> ( cholecalceferol ) is produced from its precursor 7-dehydrocholesterol in mammalian skin by natural irradiation with ultraviolet light .

B – Vit D<sub>2</sub> is present in sun – cured hay and is produced by ultraviolet irradiation of plant sterols . Calciferol or viosterol is produced commercially by the irradiation of yeast . Ergosterol is a provitamin .

C- Vit D<sub>4</sub> and D<sub>5</sub> occur naturally in the oils of some fish.

Vit D produced in the skin or ingested with diet and absorbed by small intestine is transported to the liver . In the liver 25- hydroxycholecalciferol is produced which is then transported to the kidney where at least two additional derivatives are formed by 1- $\alpha$  hydroxylase . One is 1 , 25 – dihydroxycholecalciferol ( DHCC ) and the other is 24 ,25 DHCC . Under conditions of calcium need or calcium deprivation the form predominantly produced by the kidney is 1,25 DHCC . At present , it seems likely that 1,25-DHCC is the metabolic form of vit D most active in eliciting intestinal calcium transport and absorption The metabolite also functions in regulating the absorption and metabolism of phosphate ion and especially its loss from the kidney . A deficiency of metabolite may occur in animals with renal diseases , resulting in decreased absorption of calcium and phosphorus , decreased mineralization of bone , and excessive losses of minerals through the kidney.

## **Clinical findings:**

The most important effect of lack of vit D in farm animals is reduced productivity . A decrease in appetite and efficiency of food utilization cause poor weight gains in growing stock and poor productivity in adults . Reproductive efficiency is also reduced and the overall effect on the animal economy may be severe .

In the late stages lameness which is most noticeable in the forelegs is accompanied in young animals by bending of the long bones and enlargement of the joints . This later stage of clinical rickets may occur simultaneously with cases of oseomalacia in adults .

## **Clinical pathology:**

A- Serum calcium and phosphorus :

Typical figure for beef cattle kept indoors are serum calcium 8.7 mg / dl , serum inorganic phosphate 4.3 mg / dl and alkaline phosphatase 5.7 unites .

B – Plasma Vit D

The normal range of plasma concentration of vit D and its metabolites in farm animals are know available and can be used to monitor the response to administration of vit D parenterally or orally in sheep .

## **Treatment :**

It is usual to administer Vit D in the dose rate of 7 – 12 IU / kg BW .  
Affected animals should be also receive adequate calcium and phosphorus in the diet

## **Rickets**

Rickets is a disease of young growing animals characterized by defective calcification of growing bones .

## **Etiology:**

Rickets is caused by an absolute or relative deficiency of any or a combination of calcium , phosphorus or vit D in young growing animals .  
The effect of deficiency are also exacerbated by a rapid growth rate .

## **Pathogenesis:**

Dietary deficiencies of calcium , phosphorus , and vit D result in defective mineralization of the osteoid and cartilaginous matrix of developing bones . There is persistence and continued growth of hypertrophic epiphyseal cartilage , increasing width of the epiphyseal plate .  
Poorly calcified specules of diphyseal bones and epiphyseal cartilage yield to

normal stresses , resulting in bowing of the long bones and broadening of the epiphyses with apparent enlargement of the joints . Rapidly growing animals on an otherwise good diet will be first affected because of their higher requirement of the specific nutrients .

### **Clinical findings:**

Clinical rickets is characterized by

A- Stiffness of the gait .

B- Enlargement of the limb joints especially in the foreleg

C - Enlargement of the costochondral junction .

D – Long bones show abnormal curvature , usually forward and outward the carpus in the sheep and cattle.

E – Lameness and tendency to lie down for long periods.

Outbreaks affecting 50 % of the group of the lambs have been described . Affecting of the back and contraction , often to the point of virtual collapse , of the pelvis occur and there is an increased tendency for bone to fracture .

Eruption of the teeth is delayed and irregular and the teeth are poorly calcified with pitting , grooving and pigmentation . They are often badly aligned and wear rapidly and unevenly . These dental abnormalities together with the thickening and softness of the jaw bones may make impossible for severely affected calves and lambs to close their mouths . The tongue is protrude and there is drooling of saliva and

difficulty in feeding . In less severely affected animals , dental malocclusion may be a significant occurrence . Severe deformity of the chest may in dyspnea and chronic ruminal tympany. In the final stage , the animal show hypersensitivity , tetany , recumbency and eventually dies of inanition .

### **Clinical pathology:**

1 - The plasma alkaline phosphatase is commonly elevated, but the serum calcium and phosphorus levels depend on the causative factors. If phosphorus or vit D deficiencies are the cause, the serum phosphorus level will usually be below the normal lower limit of 3 mg / dl. The serum conc. of 25 hydroxy vit D3 and 25 hydroxy vit D2 are markedly decreased in vit D deficient rickets compared with normal values of more than 5 ng / ml.

2 – The radiographic examination of bones and joints is one of the most valuable aids in the detection of rickets. Rachitic bones have characteristic lack of density compared with normal bones. The ends of the long bones have a woolly or moth-eaten appearance and have a concave or flat instead of the normal convex contour.

**Differential diagnosis:**

- 1 – Copper deficiency.
- 2 – Epiphysitis .
- 3 – Congenital and acquired abnormalities of the bony skeletal system

**Treatment and control:**

As in Vit D, calcium and phosphorus deficiencies