# Selenium and/or Vitamin E deficiency

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## It occurs in most species.

- It is characterized by hyaline degeneration of the skeletal muscle, muscular dystrophy and myocardial degeneration.
- □Vitamin E is a tocopherol compound.
- It is widely distributed in nature, the oils obtained from seeds, green leaves and animal tissues.

Physiological function of vitamin E ( $\alpha$ -,  $\beta$ -,  $\gamma$ -, and  $\delta$ - tocopherol):

- (1) It prevents muscular dystrophy and myocardial degeneration.
- (2) Support reproduction.
- (3) It improves utilization of vitamin A.

(4) It has an antioxidant property on unsaturated fatty acid (facilitate their metabolic neutralization) so that increase intake of unsaturated fatty acid require increase intake of vitamin E. 1) Selenium is component of the blood enzyme glutathione peroxidase (GSH-PX) which contains four atoms of selenium per molecule.

2) Selenium, vitamin E and sulfur containing amino acids act synergistically to protect tissues from membrane rich in unsaturated fatty acids which play a role in the protection of the cells by destroying peroxides before attack the cellular membranes (via selenium action) and preventing the formation of these peroxides (via vitamin E function) e.g. mitochondria endoplasmic reticulum and plasma membrane. oxidative damage especially

## **Predisposing causes**

- (1) Sudden unaccustomed exercise.
- (2) Walking for long distance.
- (3) Burned out doors after winter housing and rapidly growing animals.

### Causes

- (1) When animal are fed on poor hay or straw.
- (2) Oxidation during rancidification of the oils caused destruction of vitamin E.
- (3) Presence of myopathic agent in the oil(Unsaturated fatty acid in the fish and vegetable oil)may destroy vitamin E.
- (4) Secondary deficiency occurs due to excess iron intake.

## Pathogenesis

(1) The symptoms come suddenly shortly follow unaccustomed exercise.

(2) Diet low in selenium or vitamin E gives no protection against lipoperoxidation which normally at cellular level resulting in:

1) Hyaline degeneration and calcification of muscle fiber.

2) Abnormal retention of calcium in the muscle fiber lead to destruction of the muscle and release of enzymes as lactic dehydrogenase, aldolase and creatinine phosphokinase (CPK). 3) Degeneration of skeletal muscle as diaphragm (dyspnea), heart (myocardial degeneration & congestive heart failure).

4) Acute degeneration lead to liberation of myoglobin in the blood myoglobinuria.

(3) Selenium has an important role in transportation and retention of vitamin E.

(4) The skeletal muscle lesions occur bisymmetrically (bilateral lameness).

(5) The symptoms of vitamin E and selenium deficiency varies according to the groups of muscle affected.

#### Three main types are described:

1) Skeletal types which affected locomotors and supporting muscle.

2) Thoracic types which affected intercostals and diaphragmatic muscles.

3) Cardiac type in which heart muscles are involved.

## Age susceptibility

(1) In sheep the disease may be congenital. Affected lambs are either born dead or die shortly after birth.

(2) The delayed form of the disease develops in lambs of a few days up to 3 months of age or even in 9-12 month old sheep.

## Symptoms

#### Subacute enzootic muscular dystrophy

- (1) It is more common in calves and lambs.
- (2) Stiffness, weakness and trampling of the limbs may be followed paralysis.
- (3) Inability to stand. Rotator)' movement of hocks and shoulder of calves.
- (4) On palpation of the muscle are hard, rubbery, often swollen and atrophied.
- (5) Dyspnea, labored abdominal respiration when diaphragm and intercostal muscles are affected.

(6) Bilateral lameness and inability to move and graze and death from starvation.

(7) If the animal held to the dam it will suck. In more severe cases the upper borders of the scapula protrude about the back line and widely separate from the chest.

(8) The toes are spread, there is relaxation of the carpal and metacarpal joints and standing on tip- toe (Knuckling on the fetlock).

(9) Inability to rise the head, difficult in swallowing, inability to use tongue and relaxation of the abdominal muscles &choke may occur.

(10) Paralytic myoglobinuria in yearling cattle may occur.

#### Acute form:

- (1) It is more common in calves than in lambs.
- (2) The affected animals may die suddenly after exercise.
- (3) This form is characterized
- 1) Sudden onset of dullness.
- 2) Respiratory distress.
- 3) Frothy blood stained nasal discharge.
- 4) Increase heart rate and irregular heartbeats.
- 5) Death within 6-12 hrs from cardiac and respiratory arrest.

## **Other deficiency signs**

#### • It include

- A. retention of placenta in cattle,
- B. tying up syndrome (muscle degeneration) in horse,
- C. arthritic like condition in dog,
- D. mulberry heart disease in pig &
- E. Nutritional dystrophy in sheep.

# Diagnosis

- (1) From history and clinical signs.
- (2) Clinical pathology

1) Tocopherol level in the liver is more accurate than in the plasma.

2) Plasma Creatinine Phosphokinase (normal plasma level sheep 50 iu / liter and horse 60 iu /liter) will increase above 1000 iu/liter.

3) Ratio of creatine to creatinine (normal lamb 0.7%) reaches 1-5%

4) SGOT (normally less than 100 iu / liter) reaches 400 and 2000 iu/liter in calf and lamb, respectively.

5) Decrease the level of GSH-PX, selenium contents in serum, liver and renal cortex.

6) Decrease of selenium status in the soil

### (3) Postmortem:

 Skeletal muscles and diaphragm showed noninflammatory bilateral hyaline degeneration with localized white or grayish areas of degeneration (fish flesh).

2) Similar lesion of myocardial degeneration are visible (under the endocardium of the left ventricle in calves and both ventricles in lamb).

### **Differential diagnosis**

- In cattle: (1) Calf tetany. (2) Arthritis.
- In sheep: (I) Rickets. (2) Copper deficiency

#### Treatment

(1) Source of vitamin E as alpha tocopherol acetate750 mg / calf and 350 mg / lamb orally or IM.

- (2) Patent preparation as Vitamin E 15% or AD3E (3 cc / Calf and 1 cc / Lamb orally).
- (3) Combination of vitamin E and Selenium

Vitamin E 20% and Selenium orally 2 - 3 g / head.
VitE Selen 3 cc / calf and 1 cc / lamb IM injection.
NB: Combination of selenium and vitamin E in the treatment give good results.

#### Prophylaxis

(1) IM injection of 25 mg sod. selenite and 250 mg of alphtocopherol acetate to pregnant cows at 5-6 months of pregnancy.

(2) 2 mg of sod. selenite and 100 mg alphtocopherol to newborn calves.

(3) Wheat genii oils for calf (10 ml), lambs (1 ml) orally per day.