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Lecture title: **Animal nutrition: Selenium and Molbdenyum**

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Summary:

Selenium

A biochemical role of selenium in the animal body was demonstrated in 1973, when it was discovered that selenium was a component of glutathione peroxidase, an enzyme that catalyses the removal of hydrogen peroxide, thereby protecting cell membranes from oxidative damage. Selenium has an effect on vitamin E by ensuring normal absorption of the vitamin. This is due to its role in preserving the integrity of the pancreas and thereby ensuring satisfactory fat digestion. Selenium also reduces the amount of vitamin E required to maintain the integrity of lipid membranes . Vitamin E and selenium have roles in the immune system and protect against heavy metal toxicity. The other major role of selenium is in the production of the thyroid hormones. The distribution of Se in the body is as follows: skeletal muscle and heart, 50–52% ; bones, 10% ; liver, 8%; hide, hair, and horny tissues, 14–15%; and other tissues, 15–18% .

Absorption of selenium

Organic forms of selenium are better utilized by animals, as compared with inorganic forms, The inorganic form of selenium, selenate, is absorbed rapidly by the small intestine completely while 50-90% of selenite, is absorbed into the enterocyte via facilitated diffusion. Inside enterocytes, inorganic selenium is incorporated into selenoprotein and reach to liver and blood.

Sources of selenium

Selenium content in concentrate feeds varies greatly with plant species, soil and seasons. The main form of selenium in most foods is protein bound seleno-methionine and and seleno-cysteine. Supplements of selenium are provided by mineral salts containing sodium selenite, slow-release capsules and selenium enriched yeast.

Deficiency symptoms

The effects of selenium deficiency are similar to those of vitamin E. It can lead to a:

1. condition known as 'ill thrift' occurs in lambs, beef cattle and dairy cows at pasture. The clinical signs include loss of weight and sometimes death.
2. In hens, selenium deficiency reduces hatchability and egg production.

3. In chicks exudative diathesis occurs characterized by accumulation of fluid under skin on breast and abdomen with small hemorrhage.

4. In chicks skeletal muscle dystrophy appear in pectorals muscle and characterized by white striations that are visible through the skin.

5. lack of selenium can produce the symptoms of iodine deficiency.

6-Selenium deficiency impairs thyroid hormone metabolism by inhibiting the synthesis and activity of the iodothyronine deiodinases, which convert thyroxine (T4) to the more metabolically active 3,3'-5 triiodothyronine (T3).

Excess of selenium

• The level of selenium in foods of plant origin is variable and depends mainly on the soil conditions under which they are grown. Normal levels of the element in pasture herbage are usually in the range100–300 µg/kg DM.

• Some species of plants that grow in seleniferous areas contain very high levels of selenium. One such plant, Astragalus racemosus, was reported to contain 14 g selenium/kg DM. legume Neptunia amplexicaulis contained over 4 g/kg DM of the element.

• Selenium is a highly toxic element and a concentration in a dry diet of 5 mg/kg or 500 µg/kg in milk or water may be potentially dangerous to farm animals.

• Alkali disease and blind staggers are occurring in animals grazing in certain seleniferous areas. Symptoms include dullness, stiffness of the joints, loss of hair from the tail, hoof deformities.

• Acute poisoning can arise from sudden exposure to high selenium intakes and results in death from respiratory failure.

Molybdenum

The most common form of molybdenum is molybdate (MoO^{4-}).Three molybdenum-dependent enzymes require iron. These enzymes play an important role in purine catabolism and uric acid synthesis, aldehyde detoxification. Also, Molybdenum plays an important role in the utilization of nitrate and nitrogen gas by bacteria through Nitrate reductase and Nitrogenase.

Sources

Seafoods, meats, milk and dairy products, egg yolk, legumes (e.g., beans and peas), leafy vegetables, and whole grains are good sources of molybdenum.

Absorption of Molybdenum

Molybdenum is absorbed by the stomach and small intestine through an active, carrier-mediated process, which is inhibited by sulfate. This may explain why high dietary sulfate content reduces the absorption and retention of dietary molybdenum in ruminants and why these animals are more susceptible to molybdenum toxicity when dietary sulfate is reduced to sulfide in the rumen. molybdenum is predominantly excreted via the kidneys.

Deficiency symptoms

Molybdenum deficiency is rare in farm animals. Molybdenum deficiency has not been observed under natural conditions in any species. But experimentally it reduced growth and the chick's ability to oxidise xanthine to uric acid was impaired as well as neurological dysfunction.

Excess of Molybdenum

High levels of molybdenum, which can result in molybdenum toxicity interfere with the absorption and utilization of dietary copper, leading to anemia, diarrhea, fatigue, and exhaustion in animals. There are reports that 200 ppm of molybdenum in diets is safer.