BIHAR ANIMAL SCIENCES UNIVERSITY

BIHAR VETERINARY COLLEGE, PATNA

Department of Animal Nutrition (ANN-602)

UNIT-I (ANIMAL NUTRITION- Mineral, vitamins and Feed Additive

Lecture on

Trace Mineral (Cobalt and iodine)

Date – 26/11/20

Dr. Pramod Kumar

Assistant Professor-cum-Jr. Scientist

Dept. Of Livestock Farm Complex

Bihar Veterinary College, BASU, Patna-14

Cobalt

- As early as 1807, Hogg, an Ettrick shepherd, recognised pining or ‘vinquish’ as being a dietary upset.
- In 1935 Filmer and Underwood reported lack of cobalt in soil and the herbage grown was responsible for the disease of sheep and cattle coast disease and wasting disease or enzootic marasmus or pine. Cobalt was needed to cure and prevent those disease.
- A number of disorders of cattle and sheep, characterised by emaciation, anaemia and listlessness, have been recognised for many years and have been described as ‘pining’, ‘salt sick’, ‘bush sickness’ and ‘wasting disease’.
- These disorders occur in Europe, Australia, New Zealand and the USA.
- In the UK, ‘pining pastures’ occur in many counties and are particularly common in the border counties of England and Scotland.

Physiological Function of Cobalt

- Cobalt is required by microorganisms in the rumen for the synthesis of vitamin B12.
- Cobalt deficiency has not been shown in monogastric animals.
- Parenteral injections of vitamin B 12 would give complete remission of all signs of cobalt deficiency in lamb.
- Ruminants require cobalt in their rations. Rumen microorganisms synthesize vitamin B12 utilizing the cobalt ingested in the feed. So only oral administration of cobalt is effective in deficiency.
- Rumen microbes partition cobalt between active (Cobalamines) and physiologically inactive vitamin B12 like compounds (corrinoids) that the ruminant can neither absorb nor use.
- Vit. B12 is metabolic essential for all species but it is not dietary essential for ruminants.
- In contrast to iron and copper, body has limited capacity to store cobalt.

Deficiency Symptoms

- Cobalt deficiency is the most several mineral limitation to grazing livestock in tropical countries besides phosphorus and copper.
- The symptoms in cattle and sheep are similar to those of general malnutrition (extreme emaciation, wasting of musculature).
- The animals become listless, loss of appetite and weight, become weak and anaemic and finally die.
- General inanition, a fatty degeneration of the liver and deposits of hemosiderin in the spleen are commonly found changes.
- Wool growth is retarded and the fibres are weak.
- A lowering of vitamin B12 content of the blood. Daily administration of 0.1 mg cobalt salt to sheep and 1 mg to cattle prevents its deficiency.

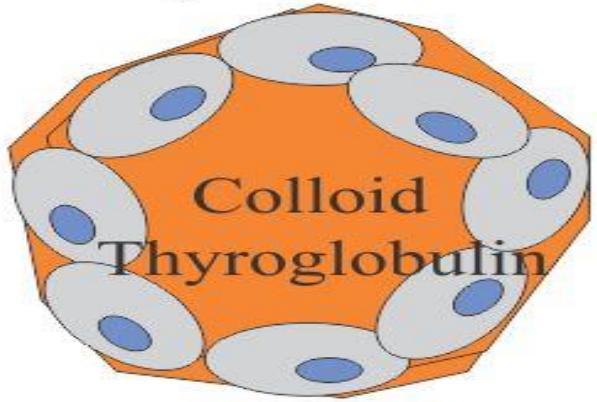
Sources

- Most foods contain traces of cobalt. Normal pasture herbages have a cobalt content within the range 100–250 µg/kg DM.
- Cobalt deficiency in ruminants can be prevented by dosing the animals with a solution of cobalt salts, although this form of treatment has to be repeated at short intervals and precautions must be taken when handling the solution.
- A continuous supply from a single dose can be obtained by giving a cobalt bullet containing 900 g cobaltic oxide/kg; the bullet remains in the reticulum and slowly releases the element over a long period.

Iodine

- The concentration of iodine present in the animal body is very small and in the adult is usually less than 600 µg/kg.
- The element is distributed throughout the tissues and secretions, its only known role is in the synthesis of the two hormones, triiodothyronine (T_3) and tetraiodothyronine (T_4, thyroxine) produced in the thyroid gland .
- Iodine is removed from iodides in the blood and combined with the amino acid tyrosine to form monoiodotyrosine (T_1) and diiodotyrosine (T_2).
- Two molecules of T_2 are condensed to produce T_4, the physiologically inactive transport form of the hormone, which is stored in the thyroid gland.
- T_4 is released into the blood capillaries as required and is activated by deiodinase enzymes to produce the physiologically active T_3. The enzymes are selenium-dependent and occur in the periphery where the hormone is needed, mainly in the liver and kidneys but also in the skin.

Thyroid hormone formation



TSH

Iodine + Tyrosine

Thyroglobulin

Two Iodine mol.

One mol. Iodine

Diiodotyrosine

Monoiodotyrosine

Thyroxine
T 4 90 %

Triiodothyronine
T 3 10 %

Greatest
metabolic activity

Deficiency Symptoms

- When the diet contains insufficient iodine, the production of thyroxine is decreased.
- The main indication of such a deficiency is an enlargement of the thyroid gland, termed endemic goitre, and is caused by compensatory hypertrophy of the gland.
- As the thyroid is situated in the neck, the deficiency condition in farm animals manifests itself as a swelling of the neck, so-called ‘big neck’.
- Reproductive abnormalities are one of the most outstanding consequences of reduced thyroid function
  - Breeding animals deficient in iodine give birth to hairless, weak or dead young;
  - Brain development is impaired;
  - Oestrus is suppressed or irregular;
  - Male fertility is reduced.
- A dietary deficiency of iodine is not the sole cause of goiter, it is known that certain foods contain goitrogenic compounds which causing Goitre in animal.

Source

- Iodine occurs in traces in most foods and is present mainly as inorganic iodide.
- The richest sources of this element are foods of marine origin, and values as high as 6 g/kg DM have been reported for some seaweeds; fishmeal is also a rich source of iodine.
- The iodine content of land plants is related to the amount of iodine present in the soil, and consequently wide variations occur in similar crops grown in different areas.

Iodine Toxicity

- Dietary level of Iodine for calves is about 50mg/kg.
- Symptoms of toxicity include depressions in weight gain and feed intake.
- In studies with laying hens, diets with iodine contents of 312–5000 mg/kg DM stopped egg production within the first week at the higher level and reduced egg production at the lower level.
- Excessively high levels of iodine supplementation should be avoided in diets for ewes in pregnancy because this has resulted in lambs with a reduced ability to absorb immunoglobulins and vitamin E from colostrum.
- Pigs seem to be more tolerant of excess iodine and the minimum toxic level is considered to lie between 400 mg/kg and 800 mg/kg.


Thank You!