

BIHAR ANIMAL SCIENCES UNIVERSITY

BIHAR VETERINARY COLLEGE, PATNA

Department of Animal Nutrition ANN-602
UNIT-I (ANIMAL NUTRITION- Mineral, Vitamins and Feed Additives)

Lecture on
Trace Minerals(Iron)
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Trace minerals

- The classification of the essential minerals into major elements and trace elements depends upon their concentration in the animal or amounts required in the diet.
- Normally trace elements are present in the animal body in a concentration not greater than 50 mg/kg and are required at less than 100 mg/kg diet.
- Trace minerals include Iron, Iodine, Copper, Manganese, Zinc, Cobalt, Molybdenum, Selenium, Chromium and fluorine.

Iron

- It is constituent of blood pigment, haemoglobin, muscle protein, myoglobin, and enzymes, cytochrome c, peroxidase and catalase.
- Normal haemoglobin content of blood for most mammals lies within the range of 10 to 18g per 100ml of blood depending on species, sex and age.
- More than 90 per cent of the iron in the body is combined with proteins, the most important being haemoglobin, which contains about 3.4 g/kg of the element.
- Iron also occurs in blood serum in a protein called transferrin, which is concerned with the transport of iron from one part of the body to another.
- Ferritin, a protein containing up to 200 g/kg of iron, is present in the spleen, liver, kidney and bone marrow and provides a form of storage for iron.
- Haemosiderin is a similar storage compound and may contain up to 350 g/kg of iron.

- Iron has a major role in a host of biochemical reactions, particularly in connection with enzymes of the electron transport chain (cytochromes)
- Electrons are transported by the oxidation and reduction activity of bound iron.
- Among the enzymes containing or activated by iron are catalase, peroxidases, phenylalanine hydroxylase and many others, including all the tricarboxylic acid cycle enzymes.

Deficiency Symptoms

1. **Anaemia** – Anaemia is defined as reduction in the concentration of haemoglobin in blood below the normal.
 - Anaemia occurs at any time of life when the available supply of the mineral becomes deficient relative to the needs for haemoglobin formation.
 - RBC and their haemoglobin are constantly being destroyed and replaced and hence iron undergoes very active metabolism.

Different Types of Anaemia

1. Cell Size

- Microcytic
- Normocytic or macrocytic

2. Colour Index

- Hypochromic
- Normochromic or hyperchromic

Piglet Anaemia

- Suckling pigs are highly susceptible for iron deficiency.
- Piglets kept in confinement to concrete stalls are more susceptible due to their nonaccessibility to greens or soil.
- characterizes of piglets anaemia-
 1. Low haemoglobin content of blood(3g to 4g/100ml)
 2. Lack of healthy pink colour of the visible mucous membranes.
 3. Poor growth rate
 4. Wrinkled skin and rough coat
 5. Laboured, spasmodic breathing, often called THUMPS.
 6. A dilated heart and oedematous lungs on PM exam.
 7. Mortality is very high.
- Piglet anaemia usually occurs within 2 to 4 weeks of birth.

Nutrition Physiology of Iron Peculiar to Pigs

- The placental transfer of iron is so poor that the piglet is born with usually small store of body iron.
- Polycythemia of birth seen in other species is absent in piglet, so that source of iron from breakdown of the excess haemoglobin is denied to it.
- Low levels of iron in sow's milk.
- Rapid growth rate.
- Large litter size.

Piglet anaemia is prevented or cured by

1. Given saturated solution of ferrous sulphate.
2. Pasting of ferrous salt on the udder of mother.
3. Injection of 100mg iron-dextran i/m or s/c at 4th and 14th day after birth.

Iron absorption and conservation

- Iron is absorbed primarily from the small intestine, mostly duodenum.
 - Iron in haeme compounds is absorbed directly into the intestinal mucosal cells, while inorganic forms of iron and iron protein compounds are broken and the iron reduced to the ferrous state before its absorbed.
1. McCance and Widdowson(1937) – the amount of iron in the body was regulated by controlling absorption of iron and not by excretion of excess iron into the urine or faeces. that is iron absorption is quantitatively controlled by body needs.
 2. Mucosal block theory – was pronounced in 1943 by P.F. Hahn and coworkers and elaborated by S. Granick(1951). The intestinal mucosa absorbs iron during periods of need and rejects it when stores are adequate. Mucosal cells of the GI tract absorb iron and convert it into ferritin. when the cells become physiologically saturated with ferritin, further absorption is impeded until the iron is released and transferred to plasma.
 3. Conrad and Crosby(1963 and 1964) – The main regulator of iron uptake is the iron concentration in the epithelial cell of the duodenal mucosa.
 4. Morris(1987)- The mechanisms by which the body regulates iron absorption in accordance with body iron needs are not completely understood

Toxicity of Iron

- Very high level of iron may cause nutritional problems by decreasing phosphate absorption.
- Iron toxicity is characterized by excessive deposition of storage forms of iron in tissues(siderosis) accompanied by high plasma iron(hypersideremia) and damage to the intestinal mucosal cells.
- High iron intake associated with grazing pastures irrigated with iron-rich bore water and contaminated with soil may inhibit copper absorption or may even cause copper toxicity if Sulphur content of the diet is low.
- Sources- All green feeds, Liver, Egg yolk are rich in iron. The outer coating(brans) and germ of cereal grains are rich in iron. Colostrum contains 3-5 times more iron than milk.