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Lecture title: **Animal nutrition: Importance of Minerals in Animal Nutrition**

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Summary:

The term essential mineral is restricted to a mineral element that has been proven to have a metabolic role in the body. minerals were classified as essential depends upon:

- their concentration in the animal
- amounts required in the diet.

Minerals are classified as:

A- **Major elements**:
(Calcium, phosphorus, potassium, sodium, chlorine, sulphur, magnesium)

B- **Micro elements:**(trace elements)
(iron, iodine, copper, manganese, zinc, and cobalt).

Absorption of Dietary minerals:

During feeding, a large amount of water is secreted into the lumen of the small intestine to help food digestion. Digestion of protein, lipids and carbohydrates in the stomach and small intestine releases minerals from their food matrix. Phytase plays a vital role in the release of minerals from plant-source ingredients because most minerals (particularly phosphorus) are bound to phytate and are entrapped within the complex fibers. the ions of free minerals are absorbed into enterocytes through specific or common transporters.

In nonruminants, when the bacteria in the lumen of the small intestine cannot produce sufcient phytase or fiber digesting enzymes, exogenous sources of these enzymes through dietary supplementation can improve the bioavailability of dietary minerals. In ruminants, the ruminal epithelium can absorb certain minerals (e.g., Na and Mg), In nonruminants, most minerals, except for a few (e.g., cobalt and Ca), are absorbed primarily by the enterocytes of the jejunum through specific transporters or receptor-mediated endocytosis.

Functions of minerals

1-Catalytic functions

Some mineral elements are firmly bound to the proteins of enzymes, while others are present in prosthetic groups in chelated form. A chelate is a cyclic compound that is formed between an organic molecule and a metallic ion, chelate is derived from the Greek work meaning 'claw. There are two types of chelates:

- Natural chelates such as chlorophylls, cytochromes, hemoglobin, and vitamin B_{12}.
- Synthetic chelates such as EDTA.

2-Mechanical functions

Minerals have a role in the stability of the body (e.g., Ca, P, Mg, F, and Si)

3-Physiological functions

Sodium, potassium, and chlorine concerned with the maintenance of acid–base balance, membrane permeability and the regulation of osmotic pressure and facilitators of the digestion of feedstuffs in the gastrointestinal tract.

4-Structural functions

Calcium and phosphorus are essential components of the skeleton and sulphur is necessary for the synthesis of structural proteins.

5-Regulatory functions

In controlling cell replication and differentiation, zinc acts in this way by influencing the transcription process, in which genetic information in the nucleotide sequence of DNA is transferred to that of an RNA molecule. Several elements have unique functions. Iron is important as a constituent of haem, which is an essential part of a number of cytochromes important in respiration. Cobalt is a component of vitamin B_{12} and iodine forms part of the hormone thyroxine.

Minerals Interaction:

The interaction of minerals with each other is a major factor in animal nutrition, imbalance of mineral elements is important in the etiology of certain nutritional disorders of farm animals.

toxic causing illness or death if given to the animal in excessive quantities. the supplement should be tailored to the target animal and oversupply should be avoided as it is wasteful and dangerous. Some elements, for example calcium and molybdenum, may interfere with the absorption, transport, function, storage or excretion of other elements. There are many ways in which minerals may interact, but the three major ways involve:

- the formation of un-absorbable compounds.
- competition for metabolic pathways.
- the induction of metal-binding proteins.

Supplementary Sources of Minerals:

Plants and plant products form the main supply of nutrients to animals, factors influence the animal's mineral intake are:

- the composition of plants. (Legumes tend to be richer in the major minerals and certain trace elements than are grasses)
- the species and stage of maturity of the plant
- climate and the seasonal conditions
- the type of soil and fertilizer application (Soil pH also important in mineral uptake by plants, for example, molybdenum uptake by plants increases with an increase in soil pH, but cobalt and manganese contents decrease. Also, Herbage magnesium content and availability can be reduced by potassium and nitrogen fertilizers).

When considering sources of mineral we take into account the following criteria:

- Cost
- chemical and physical form
- the availability of the element

The factors used to assess the relative availability of the different minerals included:

- The absorption
- Accumulation in tissues
- Production of metabolically active compounds.

The addition of chelating agents such as EDTA to poultry diets may in some cases improve the availability of the mineral element. Recently there are four categories of metal complexes:

- Metal amino acid complex
- Metal amino acid chelate
- Metal polysaccharide complex
- Metal proteinate

Acid – Base Balance

Diet is important in the maintenance of the intracellular electrolyte balance owing to the metabolizable anions and cations that it contains and that consume or generate acid during metabolism. an excess of anions will result in the production of hydrogen ions to counterbalance the anions, giving metabolic acidosis.an excess of cations requires ions such as acetate and bicarbonate and causes alkalosis. The balance of acids and bases influences many functions such as:

- Growth rate
- Appetite
- Amino acid metabolism
- Energy metabolism
- Calcium utilization
- Vitamin metabolism
- Intestinal absorption
- Kidney function.