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Minerals

The term essential mineral element is restricted to a mineral element that has been proven to have a metabolic role in the body. Thirteen mineral elements were classified as essential depends upon their concentration in the animal or amounts required in the diet, these classified as:

A- **Major elements**
(calcium, phosphorus, potassium, sodium, chlorine, sulphur, magnesium)
B- **Micro or trace elements**
(iron, iodine, copper, manganese, zinc and cobalt).

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.

Table (1) Nutritionally important essential mineral elements and their approximate concentration in the animal.

Major elements	g/kg	Trace elements	mg/kg
Calcium	15	Iron	20–80
Phosphorus	10	Zinc	10–50
Potassium	2	Copper	1–5
Sodium	1.6	Molybdenum	1–4
Chlorine	1.1	Selenium	1–2
Sulphur	1.5	Iodine	0.3–0.6
Magnesium	0.4	Manganese	0.2–0.5
		Cobalt	0.02–0.1

Mineral Functions:

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 :

a. Natural chelates such as chlorophylls, cytochromes, hemoglobin and vitamin B12.
b. Synthetic chelates such as EDTA .

2-Physiological functions

sodium, potassium and chlorine concerned with the maintenance of acid–base balance, membrane permeability and the osmotic control of water distribution within the body.

3-Structural functions

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

4-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.

A number of 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.

Mineral Interaction:

The interaction of minerals with each other is an important factor in animal nutrition, and an imbalance of mineral elements is important in the etiology of certain nutritional disorders of farm animals. Many minerals are toxic causing illness or death if given to the animal in excessive quantities. Therefore, supplementation of any diet with minerals should always be carried out with great care, 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:

1. the formation of un-absorbable compounds.
2. competition for metabolic pathways.
3. 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 :

1. the composition of plants
2. the species and stage of maturity of the plant
3. the type of soil and fertilizer application
4. climate and the seasonal conditions

Legumes tend to be richer in the major minerals and certain trace elements than are grasses, 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. Herbage magnesium content and availability can be reduced by potassium and nitrogen fertilizers.

The main animal products used in animal feeding considered good sources of the major minerals are :

a. Fishmeal
b. whey
c. skimmed milk

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

1. Cost
2. chemical and physical form
3. the availability of the element

Trace elements are usually supplied in a salt form, e.g. selenium as sodium selenite. Calcium tends to have a high availability from most sources and the phosphorus in ortho- and meta-phosphates has an availability of 80–100 %. Magnesium from magnesium sulphate is up to 70 %. Sulphur from sulphates is 50–90 % available.The availability of trace elements in the form of sulphate, chloride or nitrate salts is high because they are water-soluble.

The criteria 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:

1. Metal amino acid complex
2. Metal amino acid chelate
3. Metal polysaccharide complex
4. 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. Thus, an excess of anions will result in the production of hydrogen ions to counterbalance the anions, giving metabolic acidosis, whereas 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:

1. growth rate
2. appetite
3. amino acid metabolism
4. energy metabolism
5. calcium utilization
6. vitamin metabolism
7. intestinal absorption
8. kidney function.

Changes in cellular pH are often accompanied by changes in blood and urine pH.