MINERALS AND METABOLISM

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Minerals

Inorganic elements

Much less is needed than energy and protein.

Minerals must be available in sufficient quantities and in suitable proportions for health and yield performance in animal species.

Importance of Minerals in Animal Nutrition

1. Structural components of tissues and organs. In this context, muscles, organs, blood cells and other soft tissues that participate in the formation of organic compounds such as protein and oil enters the structure.

2. They constitute the constituents of the skeleton system of the bones. They provide hardness and durability to the bones. In other words, they provide structural support to the body.

3. Macro minerals perform a physicochemical task by adjusting the osmotic pressure in the body. Ca, Mg and P and a significant proportion of Na, K and Cl are found in the body fluids and soft tissues as electrolytes. In setting up the osmotic pressure, blood has a very important relative.

Importance of Minerals in Animal Nutrition

4. They adjust the acid base balance in the body. Some minerals such as Ca, Na, K, and Mg are alkaline, and some such as P, Cl, and S are also effective in acid formation. So blood and

It is a question of maintaining pH at a constant level in 70 tissues. Decreases and increases that can occur in the blood pH bring about various events.

5. Minerals play a role in fulfilling important functions in metabolism by entering into the structure of some enzymes, vitamins and hormones.

6. Some mineral salts are used as buffers to control the H ion concentration in the body. Carbonate and phosphate are the most suitable buffer systems.

7. Minerals are also effective in stimulating muscles and nerves.

8. In recent years when some micro minerals have supported the immune system

are the results of studies.

Importance of Minerals in Animal Nutrition

In addition to these general functions mentioned, minerals may contain one or more specific functions. Minerals act against each other. because of it is necessary to find a suitable balance between minerals. In this respect, it can be argued that no mineral acts alone in the organism.

For example, the effect of Ca and P on bone and tooth formation

Mutual relationship of Fe, Cu and Co in hemoglobin synthesis

Classification of Minerals

1. Macrominerals

Needed in excess of 100 ppm (parts per million)

2. Microminerals

Needed in less of 100 ppm (trace elements)

3. Ultra Trace Elements

Needed in less of 1 ppm

Alternatively, Macromineral is found above 50 ppm per kilogram of lean body weight, and micromineral is found in those with lower amounts.

Classification of Minerals

Macrominerals	Trace and Ultra Trace Elements		
Ca	Mn	Cr	Si
P	Fe	Fl	Ni
Mg	Cu	Lead, Pb	Br
K	Zn	Vanadium, V	
Na	I	Arcenic, As	
S	Se	Mo	
Cl	Co	Li	

Classification of Minerals

Minerals are also classified as cations (Ca, Mg, K, Na, Fe, Mn, and Zn) and anions (Cl, I, Phosphate PO4, Molybdate MoO4).

Anionic or cationic rations or electrolite balance of diet

Essential Elements

These elements form the structural matter of skeleton and other organs in the organism, and their total amount in the body is 3-5%.

Constitudes acidic (P, S, Cl), basic (Na, K, Ca and Mg) and neutral salts, so attends to the buffer system of body.

Therefore, prevented the stabil pH (7-7,8) in body tissue. Because if pH increase, tetani will occure.

If pH decrease, coma will form.

Interaction between minerals in nutrition

Therapeutic nutrition focuses on the identification and elimination of nutritional deficiencies.

The loss of vital balance (especially the imbalance of trace elements) constitutes subclinical deficiencies.

Direct and Indirect Interaction
Synergetic Relationship
Antagonist Relationship

Direct and Indirect Interaction

Taking a mineral element more or less than the required level causes a decrease or increase in the ability the evaluation of another mineral element.

Synergetic relationship: For exp. Cu and Fe
Cu is necessary for evaluating the Fe

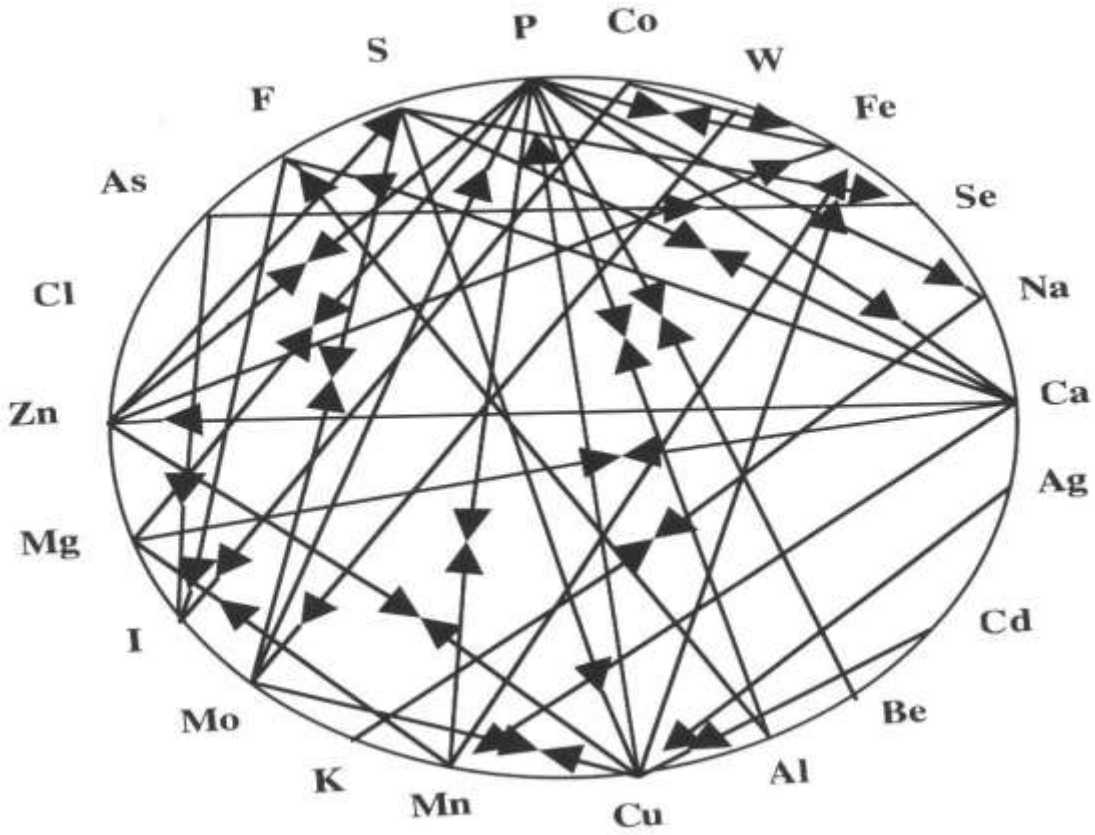
Mg, Ca and P (essential for sustaining of bone tissue maintenance and repair)

Direct and Indirect Interaction

Antagonist interaction:

1. Antagonist interaction in digestive (phytin not also effect P but also Ca and Zn)
2. Antagonist interaction during the absorbtion (excess Ca effect Zn absorbtion negatively, additively excess Zn effect Cu absorbtion)
3. Antagonist interaction in metabolic process (Zn and Cu, Zn and Fe, Fe and Cu, Ca-P and Mg)
4. Antagonist interaction during the excretion (excess Na in diet, increase the Ca level of urine)
5. Antogonist interaction in the toxic accumulation process (in deficiency of Ca and Fe, Pb toxication will be occure)

Direct and Indirect Interaction



Calcium (Ca)

Most part of Ca are found in bones and teeth.
It is also important for blood, muscle and other tissues.
Ca/P ratio is so important in ration.
This ratio is 2:1 in bones.

Functions of Ca

Regulation of nervous impuls
Normal functions of muscles
Coagulation of blood
Plays a role in the structure of bones and theeth
Necessary for enzyme activation
Necessary for milk and egg production

Deficiency of Ca
Rickets/Osteomalacia

Some detoriation in bones and teeth
Breaking the bones
Stop the growing in animals
İn young animals the rickets will be ocur, in old animals the osteomalacia.
Reduction milk and egg production

the deficiency indication is form after shortly in pigs, poultry and dog, however in ruminants –after long time

Deficiency of Ca

After calving the milk fewer will be occurde in that deficiency.

If less of Ca diet= decrease the blood Ca level= Ca mobilisation will be occured from bones
So, bones are broken easily and the milk production reduce..

Sources of Ca

Leguminouse and milk
Feeds of animal origin
Mineral supplements such as Limestone, DCP

Ca:P ratio in ration:

Generally 1:1 or 2:1
In laying hens Ca is more high
If ruminanats consume Ca from natural sources this ratio is 8:1, but the best ratio is 1:1 or 1.5:1

Phosphorus (P)

80% P is in bones in the body.
It is found as phospoproteins, nucleic acids and phospolipids

In deficiency;
Rickets and osteomalacia
Pica
Decrease the P level in blood serum
Reduce the BW, milk and egg production and fertility

Sources of P:
Milk, grains, meat and fish by products
Green forages
Supplemets; DCP, MCP

Magnesium (Mg)

It is necessary in many enzyme systems, skeleton construction.
It is abundant in baits and water.
It is important in meadow tetanus.

It is found 0.05% in whole body and 70% in scotch.
2.3% + 0.36 mg in serum.
Ca and P.
Activator of enzymes.

Deficiency of Magnesium (Mg)

Contractions in spots in rats, (Similar to Vitamin B1 deficiency)
Growth delay & uncoordination
Abnormal bone
Weakness in legs & tilting back
Aortic calcification
Mineral withdrawal from soft tissues is an indication of Mg deficiency.

Grass Tetany

It is observed in young ruminants because of the low Mg in newly emerged grass in the spring.

Appetite disappears, live weight decreases, extreme sensitivity appears.
Respiration and salivation increase, tetanus and convulsions are seen.
High death is observed.

MgO and other Mg salts are added to the diet.

Sodium (Na)

Sodium is insufficient in plants,
It is given in salt form (NaCl)
It is necessary in chlorine, but no indication of deficiency.
It is found mainly in intercellular fluid
it is necessary to regulate acid base balance and osmotic pressure in tissues.
It plays a role in water metabolism

Potasium (K)

In the regulation of the osmotic press
Cellular fluid
In normal operation of the nervous system and heart muscle
In the activity of some enzymes (CHO metab.)
IMPORTANT

Since the baits are so many, the deficiency is not seen much

Sulphur (S)

It is found in the structure of amino acids such as methionine, cystine and cysteine, vitamins such as biotin and thiamine, saliva, bile and insulin hormone.
When it is in the structure of proteins, it is important for connective tissue.

In deficiency;
Decrease in growth (decrease in protein synthesis)
reduction in wool, mohair production
Spillage on the wool
Salivation, lacrimation

Iron (Fe)

It is found in hemoglobin and myoglobin structure
It is found in the structure of some enzymes, cytochrome, catalase, peroxidase
the need for pregnancy, rapid growth, milk feeding, overfeeding increases.

In deficiency;
Anemia
Decrease in growth
Decrease in activity
Loss of appetite

Cuppor (Cu)

It is necessary for;
In the use of Fe in hemoglobin,
In some enzyme systems
Brain, kidney, eye
In the normal pigmentation of the hair and bark

Cuppor (Cu)

In deficiency;
Anemia
Decrease in growth
Bone-connective tissue disorders
Neonatal ataxia, (enzootic ataxia)
Depigmentation in hair and wool
Brain & spinal cord disorder
Infertility
Cardiovascular disorder
Glucose, impairment of lipid metabolism
Suppression of immune functions

Enzootic ataxia

Congenital and delayed

Full-paralyzed lambs: They can not suck their ankles and die within a few days

Moderate severity: Sit on the back legs like a dog, walk sideways due to uncoordinated back legs.

Mild violent: It is noticed when it is put into action.

The waist area slides sideways. The back legs and the town are sensitive.

Cobalt

Vitamin B12 synthesis is required.
Rumen m.o. Can synthesize Vit B12 using Co
The liver, kidney, spleen, bone are found in excess.

In deficiency;
It is seen in lamb, calf, cattle, sheep goats. It is not seen in pigs and carnivores.
Vitamin B12 deficiency occurs in cobalt deficiency
Pernicious anemia

Iodine

Found in thyroid gland
Thyroxine is the component of the hormone
It is found in the hair, ovary, skeleton, muscle, bile and salivary gland.
In deficiency;
GOITER is seen.
Growth of the thyroid gland.
Weak and weak birth,
Stillbirth
In newborn lambs and calves Allopecia and mixed edema

Zinc

Found in the structure of enzymes
Carbonic anhydrase, Glutamic dehydrogenase
Alcohol dehydrogenase, Pancreatic carboxypeptidase
Lactic dehydrogenase,
As an element of insulin hormone, CHO metabolism
It is found in the liver, bone, kidney, skin, hair, fleece, eye, prostate, muscle, pancreas
Carrying CO2 from the erythrocyte
Development of reproductive organs

Deficiency of Zinc

Pigs - Growth reduction, parakeratosis
Ruminants - parakeratosis, dermititis, rough appearance, delay in wound healing
Poultry - Decrease in growth, weak feather, skin lesions

Ewes:
Low weight birth in the lambs,
Decline in growth
Wool spillage
salivation
Anorexia
Growth of testicles

Selenium

Important for growth and fertility

It is a toxic mineral

Sulfur-rich feathers, wool and nails are the first affected tissues

Glutathione is added to the structure of the peroxidase enzyme

The presence of polyunsaturated fatty acids in the rations and the absence of Vit E. increase the need for Se.

Deficiency of Selenium

In Lamb, calf and kid: WHITE MUSCLE (Stff Lamb Disease)
In the cows:
Prenatal and postnatal heart failure
Reproductive problems
On the Rats: Cirrocus in the liver,
In chickens: EXHUDATIVE DIATESIS
In pigs: HEPATOSIS DIATHESIS

Toxication of Se:
Some plants accumulate in excess of the soil.
(Astragalus bisulcatus) In consuming these, Se is replaced by sulphated amino acids.

Toxic Mineral Elements

Arsenic
Barium
Boron
Bromine
Cadmium
Vanadium
Bullet
Lithium
Nickel
Silicon
Strontium
Tin