THE SCIENCE WORLD
A Monthly e Magazine
ISSN:2583-2212
April, 2023; 3(04), 570-572

Popular Article

Physiological Importance of Magnesium in Ruminants

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https://doi.org/10.5281/zenodo.7880257

Introduction

- Magnesium (Mg) is the second most plentiful cation (after K+) of intracellular fluids and fourth most abundant cation in the body.
- Mg supplementation has got importance in ruminants

Distribution of Mg:

- Mg represents about 0.05% of the animal body.
- About 60 – 70 % of Mg is present in skeleton and remaining in the soft tissues and extracellular fluid.
- Only about 1% is in the extracellular fluid.
- Acceptable serum Mg level in cattle is 2.0 – 3.5 mg/dl.

Role of Mg:

- It maintains integrity of bones and teeth.
- More than 300 enzyme actions are dependent on Mg. It is an active component of several enzyme systems in which thiamine pyro-phosphate (TPP) is a cofactor.
- It is involved in the metabolism of carbohydrates and lipids as a catalyst.

- It is essential for synthesis of nucleic acids and proteins.
- It is essential for cellular respiration and in certain tissues; it chelates with imp. Intra cellular anion ligands like ATP and ADP.
- Mg has specific action at N-M junctions and cardiovascular system. The electrical property of membranes and their permeability are affected by Mg.

Absorption of magnesium:

- Mg absorption occurs mainly from the fore stomach (Rumen and reticulum), majorly in reticulum in ruminants and from small intestine in simple stomach animals.

Factors affecting Mg absorption:

1. Age:

- Average Mg absorption rate in adult ruminant is about 25% whereas in young animals it is as high as 70%.

2. Na: K ratio in rumen:

- Optimum dietary Na: K ratio for Mg absorption is 5:1
- Increase in Na: K ratio increases Mg absorption.
- Na: K ratio < 3: 1 decreases Mg absorption.
- Young growing grasses are low in Na and high in K and can significantly depress Na: K ratio in rumen fluid.
- Mg is transported across the epithelium of fore stomach by an active Na-linked ATPase dependent transport system

3. Crude Protein:

- Feeding of young grasses and hay high in crude protein leads to increase in ammonia concentration in rumen which intern leads to decreased Mg absorption.

4. Carbohydrates:

- Increase in amount of readily degradable CHO's in diet increases absorption of Mg.

5. Low fiber and higher water content of grasses decreases absorption of Mg.

6. High level of Ca, P and Al in diet decreases absorption.

Excretion of Mg:

- Magnesium is excreted through both faces and urine and secreted in milk and saliva.

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Published 29.04.2023

- Urine is the major excretory pathway for Mg after absorption.
- The renal threshold is about 1.8 – 2.0 mg /dl of blood plasma.
- Mg level in milk remains reasonably constant i.e., 12 mg/dl (0.12 g/lit)

Mg homeostasis:

- There is no feedback regulatory mechanism to control concentration of Mg in the body of ruminants.
- Mg concentration in blood and ECF depends upon dietary intake of Mg and loss through milk, urine and faeces.
- Kidney is the major organ of homeostasis and can act to conserve Mg.
- Decreased Mg intake leads to decreased plasma Mg which in turn leads to increased reabsorption from kidney.
- Renal threshold for Mg excretion is particularly under the control of PTH and increased level of PTH will act to conserve Mg.

Requirement of Mg:

- Minimal dietary requirement of Mg for growth of cattle is **0.1%.**
- A dietary concentration of 0.18 – **0.2 %** is necessary for lactating cows.
- The recommended safe concentration of Mg in Pasture is **0.2%.**

Sources of Mg:

- Cereal grains (0.13 – 0.22%) are fair sources of Mg.
- Plant protein supplements (0.28 – 0.62%) are excellent sources.
- Forages are variable in Mg content (0.03 – 0.50%).
- Mg content is **higher in legumes** than grasses.
- Mg content is **more in stems** than leaves.
- Mg content generally decline as the plant matures. However, Mg availability increases with increasing maturity of grasses.

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Published 29.04.2023