

Magnesium in Companion Animals.

June 2026

Agenda

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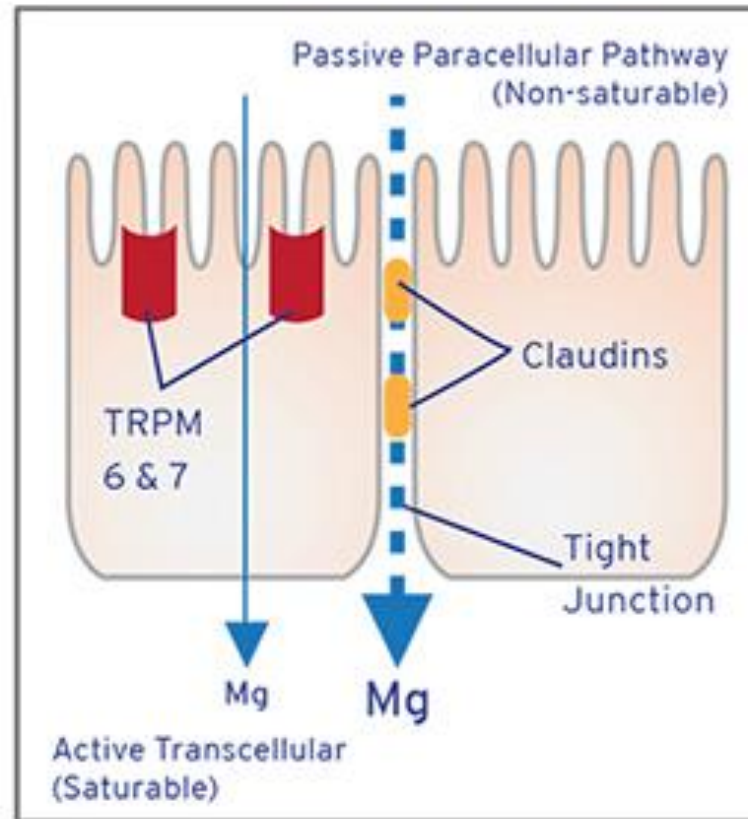
Overview of Magnesium



Magnesium Physiology – Absorption and Metabolism



Magnesium Intestinal Absorption



Predominantly passive with some active transport absorption

Magnesium Physiology – Roles in the Body



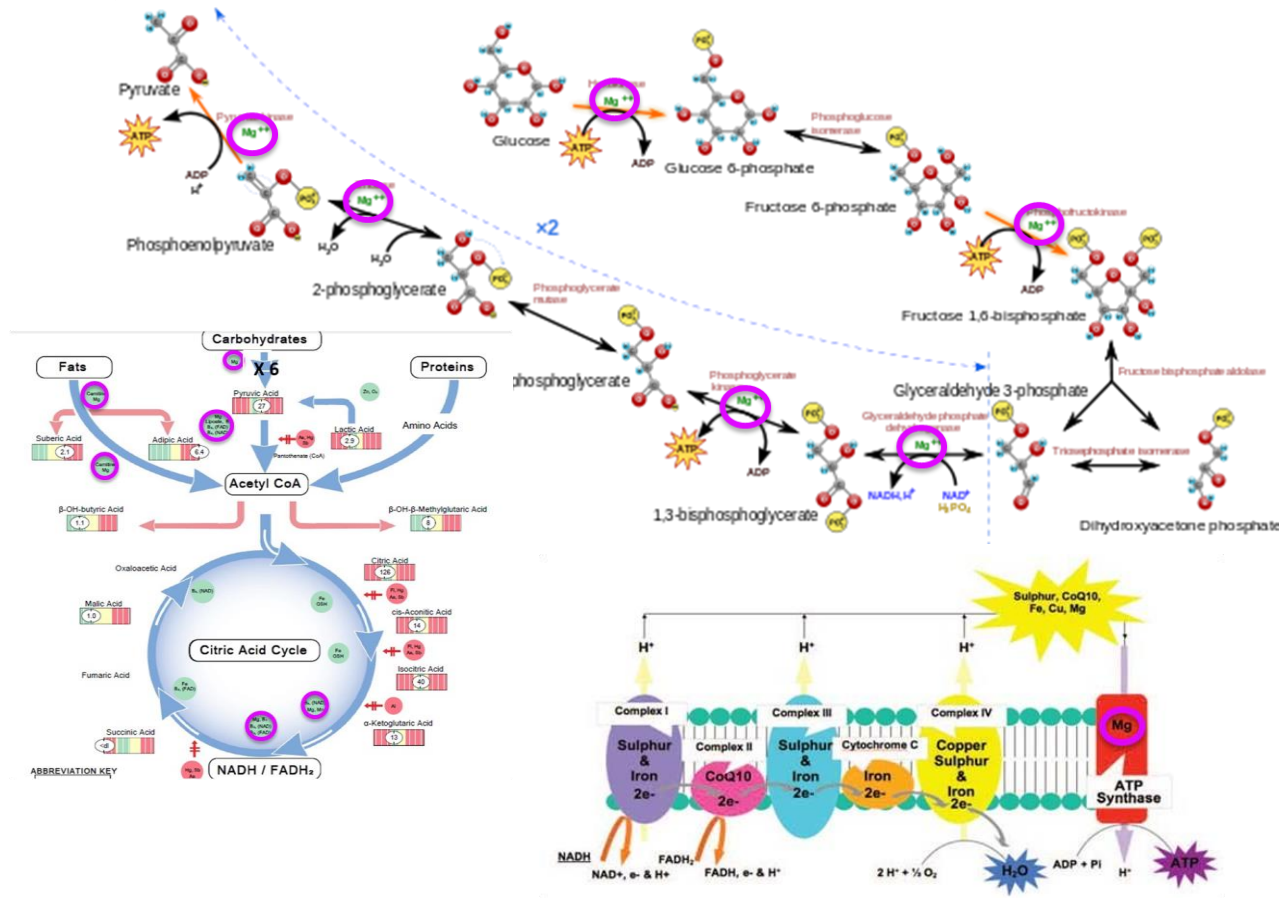
Roles in the Body

- Magnesium is involved in over 300 enzyme and body systems.
- Three major systems are:
 - Energy production
 - Structural support
 - Neurological function.

A biochemically important nutrient

Physiological Roles - Energy

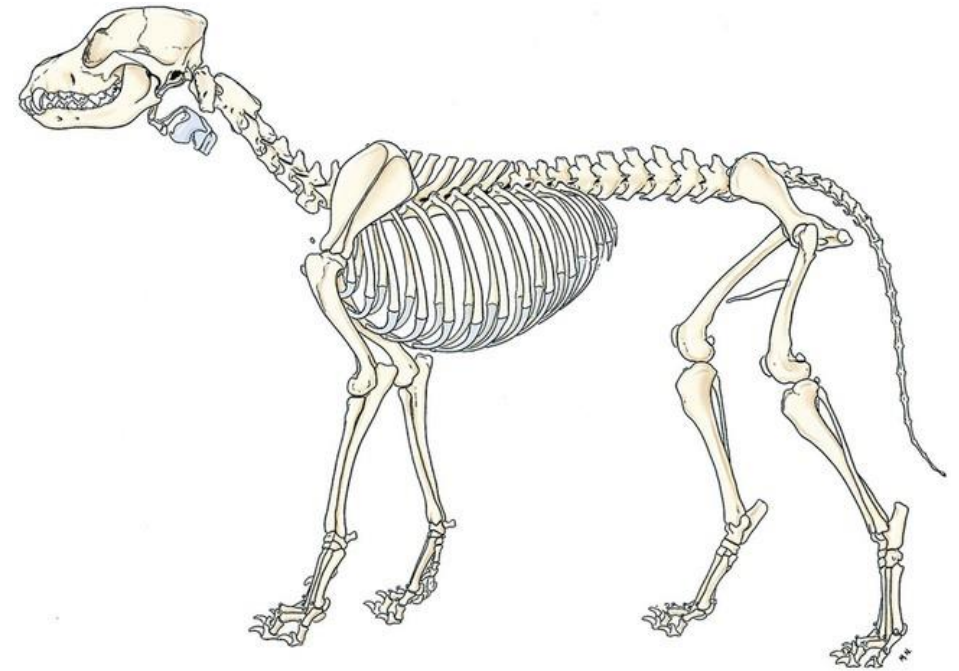
- ATP is mammalian energy currency.
- Magnesium is the cofactor for enzymes that generate ATP through glycolysis and oxidative phosphorylation.
- It is also key to the oxidation of fats in the production of energy.



Energy production is contingent on magnesium

Physiological Roles - Structural

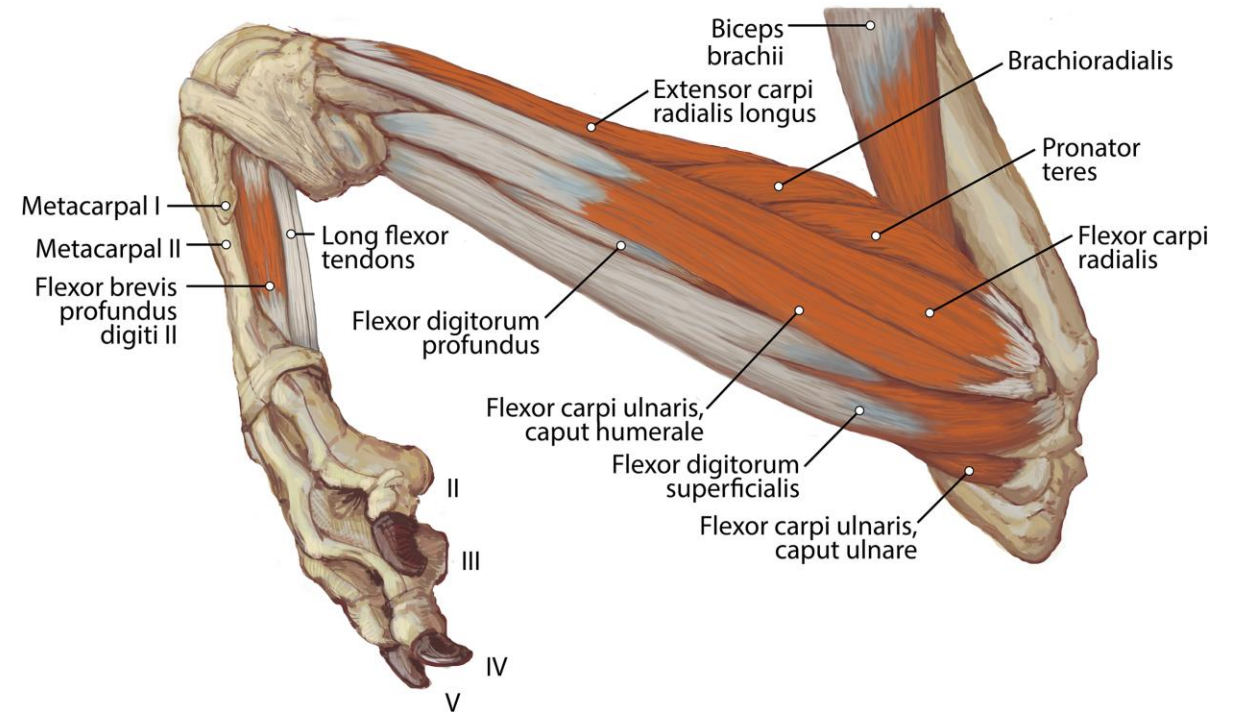
- Approximately half of the magnesium body stores are in the skeletal system.
- Magnesium is co-located with calcium and phosphorus in the mineralization of the protein bone matrix.
- Magnesium, unlike calcium, is not easily resorbed from bone depending on body need.



Magnesium makes bones strong

Physiological Roles - Muscular

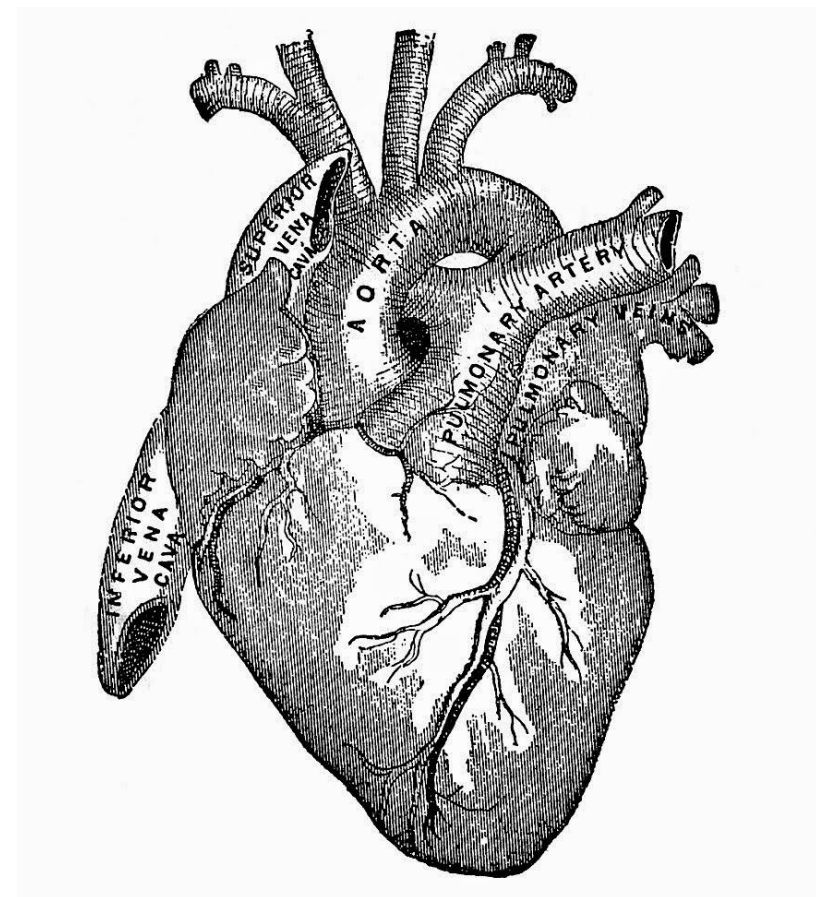
- Magnesium is essential for muscle contraction and relaxation.
- Normal muscle contraction is the result of a calcium ion release with subsequent binding to tropomyosin.
- Magnesium is involved in gathering the calcium from the intracellular space back into the sarcoplasmic reticulum.
- Magnesium plays this role in voluntary, involuntary and smooth muscle.
- Insufficient magnesium may lead to muscle cramps, spasms and tremors.



Magnesium is essential for muscle relaxation after contraction

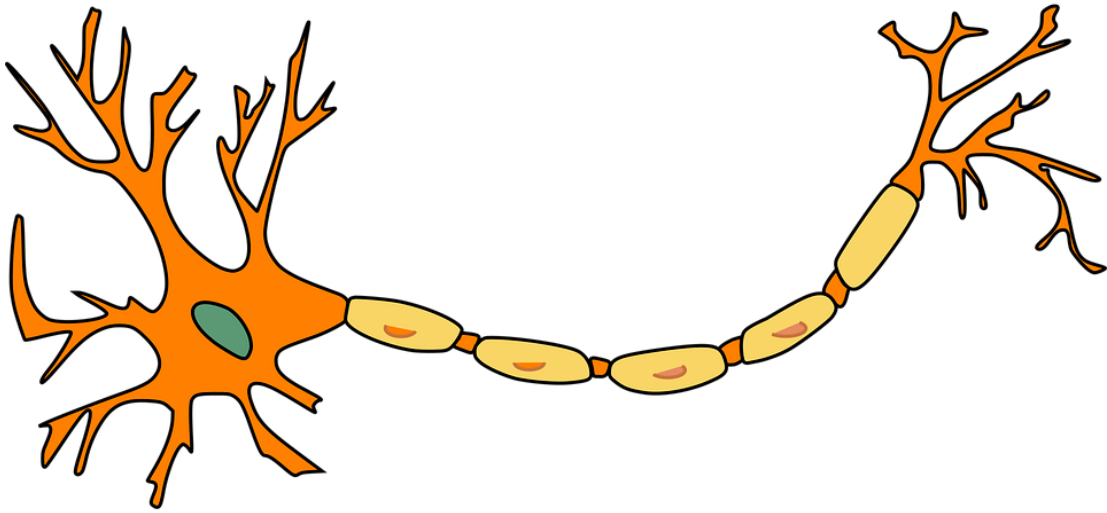
Physiological Role – Cardio-neurological

- Magnesium plays a key role in maintaining healthy cardiac rhythms.
- In synergy with potassium and calcium, magnesium strengthens the myocardium.
- It may also lower age-related cardiac risks.
- Histological examinations of magnesium deficient dogs showed calcification of the arterial tissues. (Circulation Research 9(2):387)



Magnesium is essential for good heart health

Physiological Role – Neurological



- Magnesium modulates N-methyl-D-aspartate (NMDA) and other excitatory receptors, acting as a “brake” on nerve firing.
- Magnesium status influences endocrine and autonomic responses to stress.
 - It may be beneficial in “high-strung” horses
 - There is little beneficial evidence for dogs
- Studies in laboratory animals also indicate that magnesium may be beneficial for neuronal synaptic plasticity.

Formulating with Magnesium



General Notes

- With current regulations regarding complete and balanced feeds for cats and dogs, clinical magnesium deficiency is rare.
- Supplemental magnesium is generally given through the use of treats.
- For larger companion animal, such as horses, who are fed forages or are range feeding, care should be taken to make sure that adequate magnesium is consumed.
 - Forage analysis is a useful tool
 - Top dressing with pre-mix or supplemental vitamins and minerals may be useful.
- Most animals tolerate without issue additional magnesium consumption.
- Due to tight homeostatic control of Mg levels, diagnostic measures of magnesium deficiency are difficult.

| Species | | Units (DM Basis) | Units per 1000 kcal ME |
|---------|-----------------------|------------------|------------------------|
| Canine | Growth / Reproduction | 0.06 % | 0.15 g |
| | Adult Maintenance | 0.06 % | 0.15 g |
| Feline | Growth / Reproduction | 0.08 % | 0.20 g |
| | Adult Maintenance | 0.04 % | 0.10 g |

- AAFCO nutrient profiles for canine and feline diets. 2026. Official Publication

Complete feeds have adequate magnesium

Special Consideration for Feline Diets

- Early research associated magnesium with struvite urolithiasis crystal formation in cats.
- Later research showed that it was not magnesium per se that was causing struvite formation, but rather the alkalinizing of the urine.
- As urine pH increases above 6.4, the risk of crystal formation increases.
- Some magnesium sources, such as magnesium oxide are very strong alkalis.
- Care and deliberateness should be exercised with levels and types of supplemental magnesium to keep urine pH below 6.4.



Feline diets have special considerations

Bioavailability of Magnesium Sources

- There are no studies in companion animals comparing bioavailability of magnesium sources.
- We need to rely on mammalian physiological similarities in model animals:
 - Laboratory rodents
 - Human clinicals
 - In vitro human cells
- In general, insoluble inorganic sources such as oxides and carbonates have high mineral density, but very poor absorption.
- Soluble inorganic sources such as sulfates and chlorides are hydrophilic and may cause laxation.
- Chelated sources of magnesium such as proteinates, amino acid chelates and glycinate have good absorption properties with low stress on the GI tract.

Oxide < Carbonate < Sulfate = Chloride < Chelates

Interactions of Magnesium with Other Dietary Components.

- Various dietary components can impact the bioavailability of magnesium.
- Phytic acid (phytate) is a powerful metal binding molecule that reduces metal bioavailability.
 - Not just for magnesium, but for other metals as well.
 - Because magnesium has a higher concentration in feeds, phytate may have a higher impact.
- High consumption of calcium and phosphorus without concurrent consumption of magnesium may depress magnesium absorption.
- Chelation provides protection of the minerals from antagonists in the diet keeping them bioavailable.



Magnesium bioavailability can be modulated by dietary components.

Conclusion



Conclusions

- Magnesium is essential to a variety of physiological processes.
- Complete feeds, when formulated to AAFCO standards offer adequate magnesium nutrition.
- Cautions are warranted with feline diets and magnesium sources.
- Chelated forms of magnesium are generally more bioavailable and offer protection from antagonistic dietary ingredients.





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