

Magnesium deficiency in horses

Why magnesium

Magnesium is an important partner in the optimum utilization of calcium, but it is a limiting element world wide. Magnesium oxide can provide a good source of magnesium to horses and be purchased inexpensively from feed stores. Horse can have up to a tablespoon per day. Because it is a laxative it should be introduced slowly into the diet. Excess magnesium is not toxic as the GI tract absorbs what it needs and the rest is dumped.

Horses that have adequate magnesium are:

- More relaxed
- Can work longer in anaerobic conditions because magnesium mobilizes the calcium in the muscles
- Less likely to tie up especially heavy muscled horses like warm blood, by better utilizing the calcium in muscles
- Less likely to get colic because magnesium is a laxative, helping stimulate hind gut motility
- Less likely to founder as magnesium helps the good-keepers be less insulin resistant.

Background

Magnesium and tying-up

Magnesium is a mineral that is required by all animals and functions as an enzyme cofactor. It is very important to the central nervous system because it competes with calcium in the excitation process. Initial symptoms of low magnesium are characterized by excessive alertness, wary appearance, and fine twitching of muscles of the face and ears. Other less severe symptoms include: loss of appetite, exhaustion, poor condition, excessive excitability, nervousness, sweating, muscular tremor, cilliosis, muscle strains, cramps, tetanics, cardiovascular disturbances. Low muscle levels of Mg are associated with tetanic muscle states, e.g., muscle spasms or muscles that cannot relax or return to the normal state. An excess of Ca or a deficiency of Mg can both cause a temporary muscle tetany in horses called tying-up or Recurrent Exertional Rhabdomyolosis (RER). In horses who suffer from RER, characterized by a chronic tying-up during work sessions, supplementation with Mg will help to prevent the symptoms. It is important to distinguish RER from the tying-up that is caused by an inability to handle simple carbohydrates, called Equine Polysaccharide Storage Myopathy (EPSM), as this condition is unlikely to respond to Mg. EPSM should be handled by a low glycemic diet.

Magnesium and endurance

The mineral most discussed in the endurance field is calcium. One of the most important intracellular ions related to calcium is magnesium. Magnesium deficiency is perhaps the oldest known deficiency appear in horses. Besides potassium, magnesium is the most important mineral in the muscles. Since muscles can store only limited quantities of magnesium, the risk of supply deficiencies is high. Magnesium is an important element in the activation of over 300 enzymes. Without magnesium, protein synthesis in the metabolism is disturbed, lipolysis does not function optimally, and blood glucose is not broken down to a sufficient degree. The influence of magnesium on the metabolism of the musculature and nervous system is considerable. Magnesium is considered to be an "anti-stress" mineral, since sufficient supplies reduce the release of stress hormones.

Magnesium, Founder and Cushings

In 2000, a clinical trial was started on the effectiveness of magnesium in horses/ponies with problems related to chronic founder (grass founder in most cases) associated with obesity, "cresty" necks, and abnormal glucose metabolism. Preliminary results are very encouraging, especially in horses with the abnormally long hair coat

and high water consumption of "Cushing's" (pituitary tumor), obesity or normal body weight, but with abnormal fat deposits at tail base and along neck.

Some horses and ponies show symptoms of Pre-Cushings (PC) or Cushings-like syndrome. The condition is characterized by lumpy abnormal fat deposits on the neck, above the tail head and on the shoulders. Unlike a true Cushings sufferer these horses will usually have a normal ACTH response but may well show elevated insulin. The horse may or may not have the extra thick hair coat but the hair will appear to be harsh and staring. There will be either a tendency to founder or a history of founder. These PC horses respond well to additional Mg in their diets.

It should be noted that blood Mg levels normally rise following glucose ingestion or following a meal high in simple carbohydrates, indicating that Mg is involved with the action of insulin to clear the glucose from the blood. The Pre-Cushings horses can be considered to be resistance to insulin and show elevated insulin levels following a carbohydrate meal. These horses will do best if also fed a low glycemic diet but the supplementation of Mg will be beneficial even if the low glycemic diet is not fed.

Magnesium is also important for maintaining normal insulin sensitivity. Insulin resistance is a natural adaptation in the hardy breeds like ponies, Arabs and Morgans that allows them to survive well on sparse vegetation. By being relatively insensitive to insulin, their blood sugars remain more stable, ensuring a constant supply of glucose to critical organs like the brain and heart. They only get into problems when domestication restricts their exercise (another great way to keep your blood sugars level) and provides them with a diet that is much more sugar-dense than they are made to handle. High insulin (triggered by the high sugar content of the diet) slows the metabolism and shifts it over to fat storing. This is why these breeds are such easy keepers and gain weight quickly on even small amounts of carbohydrate/sugar.

Another consequence of this altered metabolism is that the arteries become more sensitive to a chemical in the blood called thromboxane and will go into spasm more easily. This vasoconstrictive (constricted blood vessels) phase of founder is well documented. The combination of restricted exercise and shod feet, or feet that are improperly trimmed, and a tendency for the arteries to spasm easily is probably a key factor in laminitis developing although other factors, including allergy, could be involved as well. Magnesium is involved in literally hundreds of enzyme reactions, including those needed to properly process glucose. It is a well known fact that diabetes are commonly deficient in magnesium and magnesium increases insulin sensitivity. Magnesium is also important for stabilizing cell membranes and membranes inside cells. It will often help alleviate allergic reactions. Finally, magnesium can desensitize the vessels to thromboxane so that they relax and do not go into spasm. Magnesium (in the form of Epsom salts) is an old folk remedy for founder and to decrease the size of large crests.

Magnesium in the body

Magnesium is an intracellular ion with 60% being bound in the bones and 20% found in the muscles. Of all the organs, the heart has the highest magnesium content, which is reflected in magnesium protective effect in cardiac diseases. The muscle store seems to be the primary tissue affected in times of low magnesium intake because the magnesium bound in the bones is not easily available. Therefore, the horse must meet its daily need of magnesium from feed. Because magnesium is not common in the soil for uptake by plants, magnesium is often low in feed.

Even when magnesium is available in feed, its uptake is similar to calcium and so an extra amount is necessary to ensure the body take up enough. Calcium and magnesium are chemically alike, both ions use the same uptake and transport mechanisms in the body. Calcium gets taken up first or better because it is regulated by hormones and vitamin D, so magnesium uptake is often lower. The diagnosis of magnesium deficiency is difficult, because serum magnesium only reflects recent magnesium intake, and does not tell us anything about the magnesium content in the muscles. When low magnesium intake has been present for a while, the body tries to compensate for the low intake and shuts off the urinary excretion of magnesium. If that has happened,

the serum magnesium is normal to high despite low muscle content and low daily intake. Urine magnesium is a slightly better indicator of magnesium deficiency because low magnesium in the urine tells us that the low intake has been going on for a while. The best way for an accurate diagnosis is via muscle biopsy and analyses of magnesium concentration in the muscle tissue.

Magnesium deficiency can appear when magnesium intake is low or when calcium intake is high and magnesium intake is marginal. This leads to horses appearing to be lazy because of muscle tiredness. Other symptoms that usually appear include hypersensitivity in the skin, muscle tremor, hot temperament when trained, intermittent severe hind leg lameness and paresis with the horse standing up but not able to move, or lying down unable to get up.

Feeding Magnesium

Magnesium is non-toxic and is impossible to overdose by mouth. The GI tract absorbs what it needs and the rest is dumped. Magnesium phosphate or magnesium sulphate (Epsom salts) should not be used as a feed additive on a regular basis because this salt form can cause diarrhoea. However, there is some historical precedent for it, as there is an old horseman's trick of giving magnesium salts (usually mag sulfate, aka Epsom salts) to horses that are foundering or in danger of foundering. Increase the daily intake of magnesium by adding a few grams of magnesium oxide to the diet. The recommended dietary magnesium supply for horses is 20 mg Mg/kg of body weight per day, corresponding to a maintenance requirement of 10 g Mg/500 kg body weight. At the same time, if possible, lower the calcium intake if it is excessive. A calcium/magnesium ratio of 1.5-2.0:1 is ideal for the daily intake, with the higher value for maintenance and the lower for intense work. Horses can consume up to 15 grams per day of magnesium oxide without altering GI tract acidity.

Reference

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