

# Forage-Related Cattle Disorders

## Hypomagnesemic Tetany or “Grass Tetany”

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**M**agnesium is a vital component of normal nerve conduction, muscle function, and bone mineral formation. Hypomagnesemic tetany or “grass tetany” is a disorder caused by an abnormally low blood concentration of the essential mineral magnesium (Mg). Synonyms for this disorder include spring tetany, grass staggers, wheat pasture poisoning, or lactation tetany.

### Disease Occurrence

Hypomagnesemia occurs most often in beef and dairy cows in early lactation because of the large demand for magnesium during lactation and the cow’s limited ability to mobilize magnesium reserves within her body. Affected cattle are often found to have concurrent low blood calcium. Typically this disease occurs when grazing ryegrass, small grains (such as wheat or rye) and cool season perennial grasses in late winter and early spring (February through April). Fast-growing spring grass is often high in potassium (K<sup>+</sup>) and nitrogen (N<sup>+</sup>) and low in magnesium (Mg<sup>++</sup>) and sodium (Na<sup>+</sup>); each of these factors contributes to decreased absorption of magnesium through the rumen wall. Low concentrations of forage magnesium become a problem most often in the late winter and early spring cool weather, when grass plants cannot take up sufficient magnesium from water-logged soils.

“Winter tetany” in beef cattle is an underlying form of hypomagnesemia caused by a chronic energy shortage and insufficient intake of magnesium. The condition may be observed when feeding forage silage from cereal grains such as wheat and rye during the winter since it is often high in potassium and nitrogen but low in magnesium. Clinical signs of grass

tetany are triggered by a stressor such as cold weather following an extended period of consuming forages with low concentrations of magnesium.

### Cause

Maintenance of a normal blood magnesium concentration is almost entirely dependent on absorption of magnesium from the diet rather than under hormonal control as with other major minerals. Factors affecting absorption include:

- Magnesium must be present in dissolved form (“in solution”) to be absorbed in the rumen; only then can it move from the rumen into the bloodstream. In late winter/spring grazing animals, the concentration of magnesium in solution in rumen fluid is often low due to the small amount of magnesium present in the forage, the relatively high pH of the rumen fluid, and magnesium “binders” within forages that form insoluble (unavailable) salts in the rumen.
- High levels of forage potassium (such as with application of potash fertilizers) also disrupt the absorption of magnesium. The movement of magnesium across the rumen wall is primarily dependent on an active transport mechanism (or “pump”). This pump does not work as efficiently with high dietary potassium and low sodium because this changes the electrical potential necessary at the cell membrane. Adding sodium to the ration may help, but excessive sodium will ultimately result in loss of magnesium in the urine due to increased frequency of urination. Research has shown that the negative effects of high levels of potassium cannot be overcome by the addition of large quantities of salt.

- Lush pastures are low in fiber and pass through the rumen rather quickly, reducing the time available for absorption.
- If the active transport mechanism fails to maintain a normal blood magnesium concentration, there is a secondary pathway, but it depends on a high rumen magnesium concentration. This is not attainable when only consuming low Mg forages.

### Signs

Hypomagnesemia often presents as sudden death without premonitory signs. It is encountered most commonly in older lactating beef cows four to eight weeks after calving without appropriate supplementary mineral feeding. This condition should not be confused with hypocalcemia or “milk fever” that typically occurs in dairy cattle around the time of calving. The hypomagnesemic cow is most often found dead with disturbed soil around its feet indicating paddling/seizure activity before death. However, if seen in the acute stage, grass tetany is characterized by hyperexcitability (nervousness), tetany (constant contraction of muscles resulting in muscle stiffness and rigidity), convulsions, then death. The clinical signs begin when blood Mg concentrations fall below 1.1 mg/dL (normal blood concentrations range from 1.9 to 2.4 mg/dL). The earliest signs, twitching of the facial muscles, shoulder, and flank, are due to the uncontrolled activation of peripheral nerves. Affected cows become separated from the group and have a startled expression, show an exaggerated blink reflex, exhibit frequent grinding of the teeth, and may show aggression. As the fall in blood magnesium progresses, sustained muscle spasms become more

common, eventually causing the cow to stagger and fall. Convulsions and seizures quickly follow, with chomping of the jaws and frothy salivation. The low concentration of magnesium in the cerebrospinal fluid (CSF less than 1mg/dL [normal CSF magnesium is 2.4mg/dL]) is responsible for the convulsions seen in grass tetany. Affected animals lie with the head arched back and the legs paddling. The heart rate may reach 150 beats per minute (approximately twice the normal rate) and can often be heard without the use of a stethoscope. Respiratory rates of 60 breaths per minute (normal is 10 to 30 breaths per minute) and a rectal temperature as high as 105°F may result from the excessive muscle activity. Animals may get up and repeat these convulsive episodes several times before they finally die. A milder form of hypomagnesemia with blood Mg concentrations of 1.1 through 1.8 mg/dL can occur with signs of reduced feed intake, nervousness, and reduced milk production.

### Diagnosis

The diagnosis is made based on history, clinical signs, and low magnesium concentration in the blood or CSF. Blood is not always an accurate sample to measure Mg because muscle damage may cause leakage of Mg from within cells into the bloodstream, causing an artificially high result. Postmortem samples of CSF that test below 1 mg/dL of magnesium or vitreous humor (fluid within the eye) below 1.34mg/dL are reliable indicators of grass tetany for approximately 24 to 48 hours after death.

### Treatment

Animals exhibiting grass tetany are in need of immediate veterinary treatment; preferably 1.5 to 2.25 grams of magnesium intravenously for an adult cow. Tranquilization by the veterinarian may be needed to reduce the risk of injury during treatment. Response to therapy is not always good and depends largely on the length of time between onset of symptoms and treatment. Cattle that

do recover take at least an hour, which is the time required for CSF magnesium levels to return to normal. Many of these cows will relapse and require more treatment within 12 hours. Administering oral magnesium gel once the animal has regained good swallowing reflexes or drenching with magnesium oxide or magnesium sulfate will reduce the rate of relapse. If grass tetany has occurred within a herd, an effort should be made to immediately increase the intake of magnesium to other members of the herd to prevent further losses.

### Prevention and Control

Prevention is based on providing a high concentration of soluble magnesium in the rumen during times when conditions for grass tetany exist. As long as the active transport pump for magnesium is working well and driving magnesium across the rumen wall to the blood, problems should not develop. However, when factors such as a high potassium level in the forage prevent this pump from working adequately, a secondary pathway known as passive absorption does exist. Passive absorption requires a high to low concentration gradient; the rumen solution must have much higher magnesium concentrations than exist in the cells lining the rumen. A high rumen magnesium level is achieved by increasing the amount of magnesium in the diet (for example, with a high magnesium mineral mix), and this will allow magnesium to passively flow into the bloodstream of the cow. **For prevention of grass tetany, a general recommendation is to provide a high magnesium mineral supplement at least 30 days prior to calving.** Cows require approximately 17 to 20 grams of magnesium daily or 4 ounces per day of a 15 percent magnesium mineral mix during the late winter and early spring. UK Beef IRM mineral recommendations for free choice supplements for grazing beef cattle include 14 percent magnesium in the trace mineral mix and all from magnesium oxide (no dolomitic limestone or magnesium mica).

These complete mineral mixtures also supply additional sodium in the form of salt to aid in combatting high potassium intakes. Consumption should be monitored because mineral intake is generally inadequate if using poor quality mineral products. Feeding ionophores (monensin, lasalocid) has been shown to improve magnesium absorption efficiency. High magnesium mineral may be discontinued in late spring once the grass is more mature, the water content of the forage is decreased, and daily temperatures reach at or above 60°F.

In addition to supplying supplemental magnesium, several management factors may decrease the risk of grass tetany. These include:

- Soil test and apply fertilizer based on soil test results; use no more potassium than recommended since grasses are often luxury consumers of potassium.
- Legumes are high in magnesium and will help offset the problem, although their growth is limited in late winter.
- Limit grazing to two to three hours per day with free-choice access to high quality hay for early lactation cattle on lush pasture during susceptible periods.
- Graze the less susceptible animals (heifers, dry cows, stocker cattle) on the higher risk pastures since the threat of disease is very low in non-lactating cattle.

In summary, increasing magnesium intake by supplementing with magnesium oxide, offering adequate salt to prevent sodium deficiency, and increasing total energy intake are all effective tools in preventing grass tetany. These are exceptionally important when moving from winter rations to young spring grass pasture, especially in early lactation cows. Grass tetany is considered a true veterinary emergency requiring prompt treatment with magnesium to prevent death.

## References

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