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Grass tetany in cattle

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Introduction

This is one of three Primefacts about grass tetany. This Primefact describes the causes of the disorder. Primefact 421 focuses on treatment and prevention. Primefact 785 is concerned with predicting its likelihood.

Grass tetany

Grass tetany is a disorder in cattle where the level of magnesium in the cerebrospinal fluid, which surrounds the brain and spinal cord, decreases below a critical level. In the development of grass tetany, the level of magnesium in the blood decreases before the level in the cerebrospinal fluid. Hence the level of magnesium in the blood is a guide to the disorder. Low levels of blood magnesium (hypomagnesaemia) are usually associated with low levels of blood calcium in late pregnant cows and cows with calves at foot. These low levels mean that the muscles of the body cannot work properly, so the animal dies as it cannot breathe.

Grass tetany may not always arise from a simple deficiency of magnesium. The disorder can be quite complex, and different circumstances can lead to a reduction in magnesium concentration in the blood and cerebrospinal fluid, thus producing signs of grass tetany as follows.

- Simple form: a deficiency of magnesium.
- Complex form: potassium is the most important factor which interferes with magnesium absorption from the rumen.

Potassium concentrations in the rumen increase when:

- cattle graze pastures on soils naturally high in potassium;
- cattle graze pastures fertilised with inappropriately high levels of potassium fertiliser;
- cows are deficient in salt (sodium);
- the diet is changed from hay or dry feed to lush pasture.

Symptoms

For most farmers, the first sign of an outbreak of grass tetany is finding dead cows. Usually, there is froth from the mouth and nose, and the ground is rubbed where the animal's legs moved violently before she died. Excitement and muscular spasms (tetany) are the most common symptoms.

In the mildest form of the disorder, the cow may have an abnormally low level of magnesium in the blood and yet show no symptoms. All may be well for days or even weeks until she is stressed by, for example, yarding, mustering, trucking, after which symptoms may show. Initial signs of the disorder include twitching of the face and ears, a wary appearance and a stiff gait. Often, these early warning signs are missed.

In the intermediate form of the disorder, the cow is wild, her front legs 'goosestep', she does not like being driven, the tail is held a little high and she may appear blind. A few recover at this stage, but without treatment the condition of most of them will worsen and they will die.

Excitement, galloping, bellowing and staggering are common in the worst form of the disorder. The cow soon goes down on her side, with her legs outstretched, stiff and thrashing backwards and

forwards (leg paddling). Her head arches back slightly and she froths at the mouth. If the animal is down and has survived an attack, any disturbance (especially if she is touched) may start a new attack of leg paddling. The animal may die within minutes of being seen staggering, especially if she is driven or stressed in any way.

Why grass tetany usually occurs in late autumn/ winter

Grass tetany usually occurs in late autumn/winter for the following reasons.

- The seasonal change in southern and tableland pastures alters the chemical composition of pasture ingested by cows that are calving, so they are under physiological and environmental stress at this time. Extra stress will enhance potential grass tetany disorders.
- Tetany-prone pastures have low:
  - magnesium (Mg) concentrations < 2 g/kg dry matter
  - calcium (Ca) concentrations < 3 g/kg dry matter
  - sodium (Na) concentrations < 1.5 g/kg dry matter
- and have high:
  - potassium (K) concentrations > 20 g/kg dry matter
  - nitrogen (N) concentrations > 50 g/kg dry matter.

Note. These pastures are usually grass dominant or cereal crops, for example grazing oats.

These conditions equate to acid soils in the south-west of the State.

Tableland and coastal soils do not have naturally high potassium concentrations, but this is offset by the addition of potassium fertilisers.

Clovers tend to contain higher concentrations of magnesium and calcium.

Magnesium absorption in the animal

The cow requires a constant intake of magnesium. The maximum level of dietary absorption is about 35 per cent of intake directly from the rumen. There is only a small reserve of magnesium in the body fluids, and bone metabolism is often insufficient to meet increased magnesium requirements when demand is increased.

Lactating cows are more prone because of milk production. Higher milk producers can be more prone to grass tetany (see Figure 1).

Phosphorus and calcium effects

The concentration of phosphorus in the rumen is also important, with higher levels of phosphorus favouring magnesium absorption. Cows grazing phosphorus-deficient pastures may have low concentrations of phosphorus in the rumen, and magnesium absorption may be further impaired. On these farms, we may expect to see 2 and 3-year-old cows affected with grass tetany and milk fever.

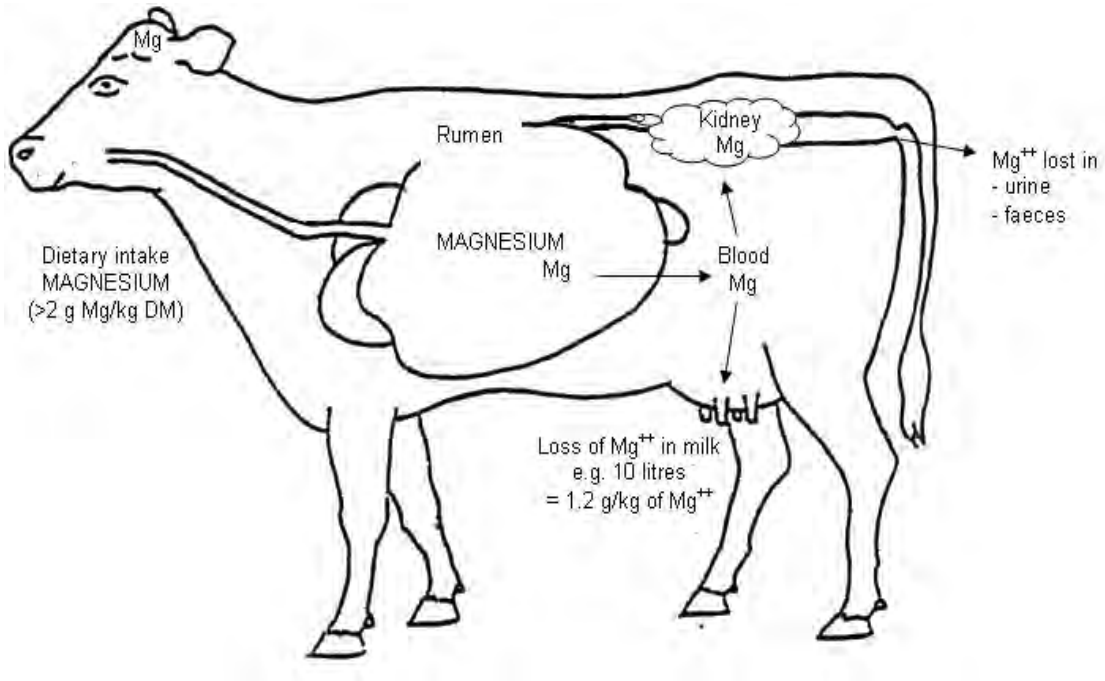

Figure 1. Flow and excretion of magnesium in the cow

Calcium concentration in the blood also plays a role in the development of grass tetany in some cows. If it decreases, the concentration of magnesium in the cerebrospinal fluid falls more rapidly when magnesium in the blood decreases, as absorption is insufficient. The ability of cows to absorb calcium from pasture usually decreases after the autumn break and increases again when the pastures mature in spring. Feeding high quality legume hay to cows is one way of ensuring that they absorb sufficient calcium to maintain the calcium level in their blood. On many farms, it is an essential step in the prevention of grass tetany.

Effects of age of the cow

- A cow's milk production tends to rise until 4 years of age, and then it stabilises.
- In older cows, the absorption rates of magnesium decrease with age.
- Some cows are just poor magnesium absorbers.
- Older cows lay down more fat. Fat cows are more prone to grass tetany because they have less available magnesium in their body fluids.
- Lean cows have more body fluids on a weight basis than do fat cows.

Effect of breed

Research at Texas A. and M. University in 1990 compared the susceptibility of various breeds of cattle to grass tetany. This study compared Angus, Hereford, Brahman, Holstein and Jersey cows, and their crosses, over a period of 4 years. Angus and Angus crosses were more susceptible than were Hereford, Jersey, Holstein and Brahman, in that order.

Further studies showed that these differences in part were probably due to the ability of Brahman to better digest and absorb magnesium, and to differences in milk production.

High production demand

Selection based on high growth rate and more muscle increases the demands on the metabolic ability of the cow.

Some genetic lines of cattle, as well as individuals within a line, cannot cope with the increased biochemical demands.

Therefore, as production demands increase pressure on the cow, the incidence of metabolic disorders such as grass tetany will increase.

Starvation and interference from other elements

Sudden starvation of fat cows or heifers can lead to reduction in available magnesium to the body system. Cow or heifer fatness should be controlled over a period of time to prevent over-fatness, or if a cow is over-fat, she should be put under a careful diet and not starved.

In the soil, plant and animal elements such as sodium, potassium, chlorine and magnesium can interfere with the amount of magnesium a cow will be able to obtain.

Positive correlations exist in the K : Ca + Mg ratio, that is, a high-potassium fertiliser and/or high-potassium soil will depress the magnesium level.

Other factors contributing to the risk of grass tetany

- Time of calving
  - Autumn/winter calving cows will be more susceptible to grass tetany than will spring calving cows.
  - May/August calving cows are the most susceptible to grass tetany.
- Stress

Any additional stress on the cow at the critical time may be enough to trigger grass tetany. Some of the more common stresses are:

- wind, rain and exposure
- sudden change of feed and feed quality
- sudden lowering of temperature
- first oestrus after calving
- mustering
- transport – do not transport cows in the last 6 weeks of pregnancy.

Facts to note

- Cattle exhibiting hypomagnesaemia may not develop grass tetany.
- Blood sampling alone may not establish which cattle will develop grass tetany.
- Certain body hormones contribute to grass tetany, notably from the thyroid gland and ovaries, which results in extra animal activity.
- Genetic variation means that some cattle are more susceptible than others.
- High fat and protein in the diet can depress magnesium absorption.

- Up to now, the most effective supplement is hay treated with magnesium oxide – MgO (Causmag®).
- The period of supplementation will vary between regions and between seasons in the same region.

Notes on supplementation

- Feed out in as long a trough as possible so that each animal can obtain the required Causmag dose.
- Causmag daily requirements for cattle: 60 g/head/day (up to 100 g/head/day may be necessary in some circumstances).
- After you start feeding it takes 2 to 3 days before the stock are protected.
- Protection ceases immediately supplementation ceases.

Etiology and pathogenesis for vets and scientists (Reference Prof. Ivan Caple)

Cerebrospinal fluid (CSF) magnesium concentrations are maintained in relative constancy despite wide variations in plasma magnesium concentrations. Plasma magnesium concentrations below 0.4 mmol/L may result in a decrease in the concentration of magnesium in CSF below 0.5 mmol/L and lead to hyperexcitability, muscular spasms, convulsions and death from hypomagnesemic tetany. More commonly sudden decreases in plasma magnesium and calcium (Ca) and an increase in plasma potassium concentrations precipitate the disorder by causing a rapid decrease in CSF magnesium concentrations.

The normal plasma magnesium concentration in ruminants ranges between 0.75 and 1.3 mmol/L. There are no hormonal systems directly controlling plasma magnesium concentrations and magnesium homeostasis depends on a continual absorption of magnesium from the gut to provide the amounts lost in milk, faeces and urine. Magnesium absorbed in excess of requirements is excreted in urine.

The main factors controlling magnesium absorption from the reticulorumen are its concentration in the liquid phase of the digesta and changes in the rate of active magnesium transport through the rumen wall caused by factors such as potassium. Increasing potassium concentrations in the reticulorumen from 10 to 30 mmol/L in cattle and from 30 to 60 mmol/L in sheep reduces magnesium absorption by increasing the transcellular potential difference across the rumen wall. Intraruminal potassium concentrations increase following ingestion of herbage with high potassium (greater than 0.3 per cent DM) and low sodium (less than 0.15).

Further information

For information on the treatment and prevention of grass tetany, see Primefact 421 *Grass tetany in cattle – treatment and prevention* and Primefact 785 *Grass tetany in cattle – predicting its likelihood*.

References:

Prof Ivan Caple – Former Dean, Veterinary Medicine, Melbourne University

Dr Keith Helyar – Former Director, NSW DPI, Wagga Agricultural Research Institute

Dr Mark Conyers – Principal Research Scientist, Wagga Agricultural Research Institute

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