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Hypomagnesemia Tetany in Cattle

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Introduction:

Grazing animals on pasture can be an integral part of an effective feeding regime for cattle and other livestock. Grazing reduces valuable labor time and cost for the farmer because no harvesting is needed and provides exercise for the animal; however, as with other feeding programs, it does not come without risk. Grass tetany occurs in ruminants grazing early spring grasses, while winter tetany occurs in ruminants consuming cereal forages such as wheat (*Triticum aestivum* L.), barley (*Hordeum vulgare* L.), oats (*Avena sativa* L.), and rye (*Secale cereale* L.). Grass tetany is typically found in ruminant animals, with lactating cows being the most susceptible. Grass tetany generally becomes a problem when the diets of cattle are changed from winter stockpiles (silages) to rapidly growing, lush, spring grasses. Testing may indicate high levels of potassium (K) and nitrogen (N) and low levels of magnesium (Mg), calcium (Ca), and sodium (Na) in the soil.

Magnesium:

Magnesium (Mg) is an essential mineral for life was for the first time described in animals by Leroy. It is the second most prevalent intracellular cation after potassium and the fourth most abundant cation in the body. Magnesium has many physiological functions; with one of the best function is the activation of enzymes. Intracellular magnesium is important for several enzymes that regulate the metabolism, and although the extracellular concentration is only 1% of the total magnesium in the body, magnesium plays a key role as an extracellular ion for nerve transmission. Plasma magnesium, just like calcium, is also found in ionized form, protein-bound and in complexes, with the ionized magnesium being the most active form. Mg is a constituent of bones (approximately 60 to 70% of the total body magnesium is present in the skeleton), 30-40% is distributed in the soft tissues and only about 1% can be found in the extracellular space. The normal level of magnesium in plasma for cows is in the range of 0.75-1.00 mmol/l or 1.8-2.4 mg/dl. The cow is almost solely dependent on a constant

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dietary uptake of the mineral since magnesium metabolism is not regulated by specific hormones. In a 500 kg dry cows weighing have a daily dietary requirement of 1.2 g magnesium/kg DM. For cows in lactation with a milk production of 30 kg/day the requirement increases to 2.0 g/kg DM.

Milk contains about 0.12-0.15 g magnesium /kg and a high yielding cow may lose around 3-4 g through milk per day. Colostrum contains about 0.4 g magnesium/kg. Because the amount of magnesium in the extra cellular fluid equals the amount excreted in 17 kg of milk (0.15 g/kg 4% milk; milk production in high lactating animals can quickly deplete the extracellular pool of magnesium, resulting in hypomagnesaemia if not rapidly replaced.

Etiology:

Grass tetany (also called hypomagnesaemia tetany, lactation tetany, grass staggers, winter tetany, or wheat pasture poisoning) is caused by a deficiency of Mg in the blood. The clinical signs of hypomagnesemia in cows characterized by ataxia, recumbency, neuromuscular irritability, convulsions, and finally tetanic muscle spasm. The termed "grass tetany" because the symptoms developed in the affected animals when they were first allowed to graze on fresh green grass in the spring. A low blood Mg concentration is a precondition of the clinical symptoms, which are probably produced in two steps: a) hypomagnesemia and b) impaired function of the central nervous system (CNS).

Classic tetany was primarily observed after a few days once cows had been let out onto pasture in the spring. Older animals (third or more pregnancy) are more susceptible to grass tetany and hypomagnesemia is not related with parturition as is milk fever.

Clinical Signs:

Incidences of grass tetany can be characterized as acute, sub-acute, or chronic. In acute cases, the animals are generally found dead. If the animal is discovered alive, clinical signs may include excitability, twitching, ear flicking, aggressiveness, abnormal gait, vocalization, convulsions, and from the mouth and nose. Their body temperature begins to rise and their heart beats louder and faster. Death generally occurs within 1 h of the onset of symptoms. In sub-acute cases, animals remain standing and signs develop over a period of a few days and include abnormal gait, excessive blinking, decreased feed intake, weight loss, and decreased milk production. The sub-acute form, if not treated, can also result in death. In

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the chronic form of grass tetany, animals may exhibit unthriftiness, weight loss, and decreased milk production.

Treatment:

Treatment of grass tetany involves removal from the pasture and increasing blood serum levels of Mg. A treatment method that has been suggested by the USDA is a dose of 200 ml of a 50% solution of magnesium sulfate, injected subcutaneously. Another method is an intravenous injection of calcium-magnesium gluconate; however, it is recommended that an injection of chloral hydrate or magnesium sulfate be given intravenously prior to treatment to calm the animal. Also, approximately 30 grams of Mg sulfate should be given daily.

Some factors may predispose cattle to developing grass tetany. They include the age of the cow, breed, amount of milk being produced, time of calving, and stress. As cows age, the level of Mg and other minerals that are absorbed through the rumen are decreased.

Prevention and Management Practices:

Prevention of hypomagnesemia should be aimed at 2 major goals: continuous provision of adequate levels of magnesium in the diet and maximizing absorption of this essential mineral. Possible choices of supplemental salts include magnesium carbonate, magnesium sulfate, and magnesium chloride, but magnesium oxide (MgO) tends to be the most common choice, based on economics, palatability, and fewer laxative effects. Prevention can be accomplished several ways. One method to minimize risk is to delay turnout until the forage is more mature and is past the rapid growth stage (at least 6 inches tall). Delaying turnout also will reduce early-season grazing pressure on range and pastures, allowing soil moisture to be used efficiently to produce as much grass as possible for later in the grazing season.

If possible, fertilizers that are high in nitrogen and potassium should be avoided. When cattle consume forage high in nitrogen, a substantial amount of ammonia is produced in the rumen. If there is a large amount of ammonia present, dietary Mg may be converted to the unfavourable, insoluble hydroxide form. This lowers the availability of Mg in the blood and tissues. Cows depend on a frequent supply of magnesium from the feed since mobilization of magnesium from the bone is not very efficient. Calcium (C) to phosphorus (P) ratio (2:1 is optimum), and energy intake (maintenance or above is desired) of the animal should be adequate.

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Conclusion:

Grass tetany is a serious, preventable disease caused by severely low levels of Mg in the blood. It can strike cattle at an alarmingly fast rate (acute form), which makes detection and treatment often difficult. Because of its rapid onset and its ability to cause death, it is best to try, and prevent grass tetany, rather than treat it. Prevention involves either raising levels of Mg in the forage when cows are on pasture or feeding Mg supplements as part of a ration. With a good management program and regular forage testing when grazing lactating dairy cows, grass tetany can easily be prevented.

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