



Vet Call

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Polio due to sulfur toxicity

Polioencephalomalacia (commonly called polio) in cattle is due to brain damage that can be caused by a number of things, including lead toxicity, salt toxicity or thiamine deficiency.

The sulfurous culprit

I see several cases a year of polio caused by high levels of sulfur (S) in the diet. Cattle with polio, regardless of the cause, may have aimless wandering, indications of blindness, head-pressing, stumbling, circling, muscle tremors and possibly convulsions. Polio due to sulfur toxicity is usually seen at least one to three weeks after first starting animals on a diet high in sulfur.

There is great animal-to-animal variation with this toxicity; only 10%-35% of cattle subjected to high-sulfate diets actually develop signs of the disease. Current knowledge of all nutritional factors that interact to cause sulfur-induced polio is not complete, but thiamine or cobalt deficiency, carbohydrate source, and rumen pH, among others, may be involved.

Sulfur is an essential dietary mineral. It is crucial for good rumen microbial growth and for digestion of feeds. It is necessary for protein production in the rumen and is found throughout the animal's body and milk. This means that like so many other nutritional components, while the appropriate amount is vital to normal performance and productivity, excessive amounts can be deadly.

Rumen bacteria normally produce sulfide, but high-concentrate diets that are high in sulfur/sulfate and low in long fiber, or forage-based diets with high levels of sulfur/sulfate increase the production of sulfide to the level that has been shown to induce polio. Hydrogen sulfide (smells like rotten eggs) is highly toxic to brain tissue and will cause polio when present in rumen gas that is eructated (belched) and inhaled. The concentrations of hydrogen sulfide in the rumen gas cap increase as pH declines and are associated with acidosis.

Many cases of sulfur-induced polio occur in groups of cattle at risk for acidosis, such as cattle on high-grain diets or cattle on self-feeders. A low rumen pH, such as levels that occur with acidosis, will increase the amount of hydrogen sulfide gas produced compared to diets with the same dietary sulfur level but that don't lower pH.

Diagnose and prevent

To diagnose sulfur-induced polio, it is important that total sulfur (water and feed) intake be considered. The recommended dietary concentration of sulfur is 0.15% of the total ration dry matter for most beef animals, with a recommended upper limit of less than 0.3% and the maximum

tolerated total intake level of 0.4% [as dry matter intake (DMI)]. Dietary sulfur levels above 0.4% are known to cause polio in cattle.

Feeds that can be high in sulfur include water; molasses; beet pulp; gypsum, which is used as an intake limiter in self-fed diets; ammonium sulfate, which acidifies urine and is used to prevent urinary calculi; and some corn processing byproduct feeds such as corn gluten feed, steep liquor and distillers' grains. Some plants, such as kochia or fireweed, are also linked with polio due to high sulfur levels.

Water is an important consideration in cases of polio caused by high sulfur levels. Moderate sulfur content in water is 1,000 parts per million (ppm). Sulfate may easily contribute 0.1%-0.2% of dietary sulfur, pushing sulfur intake to the limit of safety if feeds also contain a moderate to high amount of sulfur and during hot weather, when water intake is increased. Because of the increasing recognition that moderate intake of sulfur can cause polio, sulfur toxicosis should be an important consideration in cattle that act like they have brain damage, and both feed and water should be tested for total sulfur content.

Increasing availability of corn processing byproducts such as corn gluten feed and distillers' grains, as well as free-choice diets with molasses or sulfur-containing intake limiters, indicates that cases of sulfur-induced polio will remain a likely diagnosis in cases of brain disease in cattle. Careful attention to animal behavior and quick involvement of a veterinarian will help minimize the losses due to this toxicity. Treatment and prevention of sulfur-induced polio involves changing to a lower-sulfate water source, or removing or diluting high-sulfur feeds. In addition, thiamine is often added to rations high in sulfur because of a positive response, although it hasn't been well-defined.

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