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Calf Note #113 - Rumen acidosis and rumen drinking in milk-fed calves

Introduction

We've all seen these poor performing calves before – unthrifty, depressed, rough hair coat, poor growth and are always being treated. They may be that are suffering from rumen acidosis caused by a phenomenon called “rumen drinking”. This Calf Note explores rumen acidosis caused by rumen drinking and what producers can do about calves with this problem.

Rumen acidosis

Rumen acidosis is the abnormally low pH in the rumen. Excess acidity (leading to low pH) can occur in all ages of cattle, including young calves. There are a couple of reasons for low pH in calves fed milk or milk replacer, including reflux of abomasal fluid into the rumen and bacterial fermentation of liquid within the rumen. Abomasal reflux does happen (especially if calves drink large meals), but fermentation of liquid in the rumen is the key contributor to rumen acidosis in milk-fed calves.

How does milk get into the rumen? There are a couple of possibilities, but first, we need to understand a little about the esophageal groove.

The esophageal groove (also called the reticular groove) is a specialized part of the ruminant stomach that has been defined as “a muscular structure extending downward from the cardia to the omasum on the median wall in the reticulum” (Hegland et al., 1957). It is composed of folds of muscular tissue that close in response to nervous stimulation, forming a “tube” that directs milk or milk replacer past the reticulum and rumen and into the abomasum. The abomasum is the gastric portion of the stomach with low pH that functions like the monogastric stomach.

Closure of the esophageal groove occurs when calves are stimulated to drink milk or milk replacer. The nervous stimulation to drink causes the groove to close when the calf drinks from either a bucket or bottle. Over time, this response fades, so that by a few weeks after weaning, the groove is no longer functional. In addition, liquids (milk, milk replacer, electrolytes, etc.) administered by esophageal feeder will be directed into the rumen because the esophageal groove does not close when a calf is tubed. In addition, free water will not cause closure of the esophageal groove and will enter the rumen.

Bacteria are found in the rumen from a couple days of age. These bacteria ferment carbohydrate and protein that enters the rumen when the calf consumes dry feed, bedding, milk or milk replacer. The result of this fermentation are volatile fatty acids (VFA), including acetic, propionic and butyric acids as well as lactic acid. When rumen pH falls from normal levels of about 6.5 to 7.0 to less than 5.0 in the case of rumen drinkers, VFA and lactic acid will accumulate in the rumen and will subsequently be absorbed into the bloodstream. As lactic acid builds up in the blood it causes a number of clinical signs, including depression, anorexia and may ultimately kill the calf.

When milk or milk replacer enters the rumen instead of the abomasum, the calf is a rumen drinker. Failure of the esophageal groove to close completely is the primary cause, though this failure can be secondary to a primary problem (e.g., transport or poor feeding practices) or a chronic one (e.g., congenital malformation of the groove).

Rumen drinking

There are a number of conditions that can make calves more susceptible to rumen drinking caused by failure of esophageal groove closure. These factors (as listed in Gentile et al., 2004) include:

1. neonatal diarrhea
2. irregular feeding times
3. low-quality milk replacer
4. milk or milk replacer fed at too cold temperature
5. drinking from an open bucket
6. tube feeding
7. stressors such as long-distance transportation

Calves are indeed creatures of habit, so feeding management and changes in housing and environment are key factors that can affect closure of the esophageal groove. Care must be taken to avoid changes, provide high quality milk replacer and to feed at the proper temperature (approximately body temperature of 101°F or 39°C). Stress such as transport can result in rumen drinking, so it's very important to be aware of the potential for rumen drinkers in arriving calves.

Whether feeding liquid from buckets contributes to rumen drinking is the subject of some debate. Calves drinking from buckets may be able to consume milk in larger volumes – “gulps” which may force the esophageal groove open. Some researchers suggest that closure of the groove in calves fed from buckets is less efficient; however, controlled research has shown that closure of the groove is a function of neural stimulation and closure is equally efficient with either buckets or bottles, at least to six weeks of age (Hegland et al., 1957). So, for calves that will be weaned at an early age (less than 8 weeks of age), it's unlikely that drinking from buckets should increase the risk of rumen drinking. However, it seems prudent that producers who feed milk from buckets should try to minimize the risk of rumen drinking by using good milk feeding practices.

Signs of ruminal acidosis caused by rumen drinking

There are a number of clinical signs that indicate the presence of rumen drinking by calves:

1. off-feed
2. appearance of pain, kicking at the flanks, shifting from one foot to another, teeth grinding, vocalizations, arched back
3. dehydration due to diarrhea and loss of water
4. bloat caused by the build-up of acid and gas in the rumen
5. poor growth
6. depression
7. hair loss
8. sticky clay-like feces with a white, putty-like appearance

Gentile et al. (2004) suggested that the color, pH, smell, consistency and presence of casein coagula are indicators of rumen drinking. Rumen fluid from rumen drinkers will be light or white in color with low pH and sour milk smell. Conversely, normal rumen fluid will be darker in color with pH between 6 and 7. It will smell of fermentation, but not of sour milk.

Effects of rumen drinking

When calves have failure of the esophageal groove, there are a number of effects on the animal – in the intestinal tract and also systemically. These include:

1. Inflammation of the tissues lining the stomach (including rumen, reticulum, omasum and abomasum). Inflammation of the rumen and reticulum mucosa can cause continued failure of groove closure, making the situation worse
2. Parakeratosis – this is the build-up of keratin on the epithelial cells caused by high concentrations of volatile fatty acids in the rumen. Parakeratosis will impair absorption of VFA from the rumen into the bloodstream, which can further depress pH and result in extremely high rumen VFA concentrations.
3. Impaired ruminal motility – this also will contribute to high VFA concentrations and low pH in the rumen.
4. Atrophy of the intestinal villi, causing impaired absorption of nutrients. Villus atrophy can result in diarrhea and poor digestion so that the calf doesn't get a sufficient amount of nutrients from the milk.
5. Lactic acidosis
6. Immune depression

What to do

If rumen drinking is caused by management issues, the solution to the problem is to correct the management problem. Milk or milk replacer feeding programs should be carefully scrutinized for variation and stress. Some problems to be aware of: changes or variation in feeding temperature, variation in density of milk (particularly waste milk) milk replacer (if mixed at different concentrations), differences in feeding time, excessively large nipple holes (nipples should be checked regularly and changed as needed), and changes between milk and milk replacer. Calves that are stressed may become rumen drinkers – improving management and housing may solve the problem. Some calves may need some help in “learning” to drink. Remember, the groove closes when calves are excited about drinking a meal of milk. If they are timid, weak or stressed, this stimulation may not occur.

Calves with acidosis should be treated with electrolyte solutions to restore acid-base balance and provide water to treat dehydration. For more information on feeding electrolytes to calves, see [Calf Note #43](#). If the calf is not willing to drink electrolytes, then subcutaneous or intravenous fluids are required. For more information, see your veterinarian.

Rumen drinking may also be secondary to a primary bacterial or viral infection – therefore, treating the underlying disease is vital. Calves showing signs of acidosis caused by rumen drinking should be evaluated carefully to determine whether there is an additional problem.

In the case of chronic rumen drinkers, an effective treatment is to wean the calf as early as possible so that normal rumen function can be established. Calves are ready to be weaned when they are eating approximately 1 kg of calf starter for two consecutive days; however, in the case of rumen drinkers, earlier weaning is appropriate – they should be weaned when intake reaches 600-700 grams per day. Be sure starter and water are clean, fresh and always available. A small amount of high quality forage daily would be appropriate, also, to slow down rumen fermentation and maintain ruminal pH.

Summary

Rumen drinking is an occasional problem of young calves that is exacerbated by management changes, poor feeding practices, and disease. If the condition causing problems with esophageal groove closure are corrected, the problem may resolve; however, in chronic conditions, calves may suffer from rumen drinking until they can be weaned.

Producers should be aware of the signs of rumen drinking as well as methods of intervention. Milk refusal by calves that are limit-fed milk should be a “red flag” that signals some problem because normal, healthy calves are usually aggressive when it comes to drinking milk..

References

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