

Preventing Ruminal Acidosis When Using Supplemental Feeds for Beef Cattle

Ruminal acidosis is a digestive disorder characterized by low rumen pH (more acidic than normal). Cattle are at greatest risk for acidosis when consuming feed that is high in rapidly fermentable carbohydrates, particularly when they have not had adequate time to adapt to a high-energy supplemental feed. Cattle that go off feed for an extended period are also at risk when they resume feed intake. Ruminal acidosis can result from errors in ration formulation and/or feeding strategies.

Ruminal acidosis can occur in beef cattle of all ages. Risk for ruminal acidosis increases when calves are weaned onto rations high in rapidly fermentable carbohydrates, especially when they have not had time to adapt to the new ration. Calves are also at risk when creep-fed supplements high in rapidly fermentable carbohydrates. Mature cows and bulls are at greatest risk of ruminal acidosis when provided new or irregular access to supplemental feeds high in rapidly fermentable carbohydrates, as may occur during drought conditions.

Cattle are able to digest grasses and other fibrous material because of microbes (bacteria, fungi and protozoa) in the rumen. Each of these microbes has a preferred food source. Ruminal microbes convert feedstuffs to volatile fatty acids (VFAs) such as acetate, propionate, and butyrate. These VFAs are then absorbed through the rumen wall into the bloodstream and provide an important energy source for cattle. In forage-based diets most often found in the Southeast, rumen pH is typically neutral (between 6.5 to 7.0) and the production and utilization of VFAs is in balance. However, the use of rapidly fermentable carbohydrates in supplemental feeds may disrupt this balance and pose a risk for rumen acidosis to occur. Ruminal acidosis is classified as either acute acidosis or subacute acidosis, depending on the severity of clinical symptoms.

Acute acidosis

Acute acidosis (also sometimes referred to as 'grain overload') usually occurs when ruminants consume too much rapidly digestible starch, as can occur with overconsumption of a grain-based feedstuff. This situation can certainly occur in feedlots with cattle on high-grain rations, but it can also be a problem on stocker and cow-calf operations. While relatively rare, this most commonly occurs in the Southeastern United States on stocker and cow-calf operations with irregular supplementation programs that do not allow enough time for cattle to adapt to a high-energy supplement. Rapid starch fermentation causes rumen pH to drop severely and remain low for an extended period of time due, in part, to the overproduction, under-utilization, and/or inadequate buffering of VFAs. To make the situation even worse, many rumen microbes die when rumen pH gets too low. However, some lactic acid producing microbes can thrive in an acidic environment, and the lactic acid they produce can cause rumen pH to spiral downward even more, resulting in severe acidosis. Animals with acute acidosis are often noticeably sick, and can even die within a matter of hours.

Symptoms of acute acidosis include, but are not limited to:

- Little or no feed intake
- Little or no rumination
- Increased heart rate
- Increased breathing rate
- Diarrhea
- Dehydration
- Reduced rumen contractions
- Decreased fiber digestion
- Decreased nutrient absorption
- Production of toxins within the rumen
- Damage to the rumen lining. When damage to the rumen wall is severe, bacteria may enter the blood stream, contributing to the formation of liver abscesses and laminitis (founder).
- Lethargy
- Incoordination
- Collapse
- Death in severe cases
- Survivors are likely to become “poor doers”

Subacute acidosis

A milder form of acidosis is referred to as subacute acidosis. Subacute acidosis is a temporary imbalance between acid production and absorption, associated with reoccurring bouts of low rumen pH followed by recovery of rumen pH to normal levels. If the low pH causes reductions in rumen motility, fiber digestion will decrease. In severe cases, where a low pH causes damage to the rumen lining, bacteria can invade the rumen wall causing ruminitis, which damages the inner rumen lining and inhibits nutrient absorption. Bacteria can even enter the blood stream and cause other problems such as liver abscesses and laminitis.

Although it is less severe, subacute acidosis is thought to be more costly. Affected cattle may not show serious clinical signs, but often have reduced performance, daily gain, and feed efficiency. Costs are also associated with extra trimming or processing needed at the packer due to liver abscesses or other carcass defects caused by subacute acidosis.

Symptoms of subacute acidosis include, but are not limited to:

- Reduced feed intake
- Lower feed efficiency
- Weight loss or reduced gain
- Low body condition score
- Lameness (laminitis/founder)
- Dehydration
- Liver abscesses
- Grain in manure and diarrhea

Causes of acidosis

Ruminal acidosis can result from errors in ration formulation and/or in feeding strategies. Acidosis is usually the result of a sudden change in diet to rapidly fermentable carbohydrates, typically occurring when animals are switched quickly from forage-based to grain-based diets or supplements, or from overconsumption of a feedstuff containing rapidly fermentable carbohydrates. When this happens, carbohydrates in the rumen are rapidly digested by rumen bacteria and converted to sugars, which are then fermented to produce excess VFAs and in some cases, lactic acid, that reduce the pH in the rumen.

Inadequate transition time

Cattle have a remarkable ability to digest a very wide variety of feedstuffs, but they do not tolerate rapid changes from a forage-based diet to a grain-based diet or supplement very well. Rumen microbes need time to adapt to a new feed source. A rapid change to or the overconsumption of a high-energy supplement does not allow rumen microbes the time they need to adapt, nor does it allow the rumen time to adapt as needed to facilitate absorption of the increased acids being produced.

Low fiber levels in the diet

High grain rations and supplements often have limited amounts of fiber. Cattle's saliva production is limited when fiber is lacking, because fiber stimulates saliva production and rumination. Saliva serves to buffer the acid produced in the rumen and prevents rapid changes in pH. The buffering capacity in one day's production of saliva is equivalent to about 7 pounds of sodium bicarbonate. Any factor that reduces the amount of saliva produced will increase the risk of ruminal acidosis.

Fiber stimulates rumen motility, which enhances acid removal. Fiber in the diet also helps to slow down fermentation, thereby reducing the rate of VFA production, which helps prevent a rapid pH drop. With limited fiber intake and saliva production, decreased rumen motility, and impaired buffering capacity, rumen pH is at a greater risk of decreasing.

Preventing acidosis

Consistent dry matter intake

Good rumen health is not only key for efficient animal growth, but it can also reduce the risk of acidosis. There are many complex components to rumen health, but the overall goal is to maintain an active and effective microbial population in the rumen that has adapted to the feedstuffs commonly fed. Consistent dry matter intake is one of the key factors in maintaining rumen health. When dry matter intake varies, the nutrient supply for microbes within the rumen changes, resulting in changes in nutrients available to the animal, both in how they are absorbed and how they are used within the animal. Without consistent intake, animals are at risk of acidosis because of reduced feed consumption, and because the rumen will have a more limited ability to absorb nutrients across the rumen lining. Again, the rumen and ruminal microbes can both adapt to a wide variety of feedstuffs, but this adaptation takes time and must be maintained with consistent intake.

Sufficient effective fiber in the diet

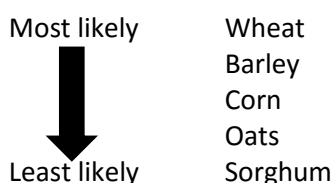
Forage level in the diet is important for proper rumen function. Mature cows typically consume between 2.0 to 2.5% of their body weight per day in dry matter from forage. As supplemental feeds are provided, some of this forage may be substituted for feed. It is important to include a level of forage in the diet that allows for proper rumination and saliva production while not decreasing intake. If forage particles are too small, the forage losses

effectiveness in stimulating rumination, less saliva is added to the feed, and ruminal acidosis may develop. Therefore, fiber type and length is as important as fiber level. Very fine forage particles will not encourage rumination or promote rumen health as effectively as large forage particles (i.e. greater than 1.5 inches in length). A minimum of 1/2-inch fiber chop length is recommended for most production systems.

Type of feed grain

Depending on their physical structure and nutrient profile, feed grains differ in their likelihood to cause acidosis. Feed grains that are more rapidly digested within the rumen are more likely to cause acidosis. Feed grains with a thick hull are less likely to cause acidosis because the rumen microbes take more time to digest the fibrous hull. Hulled feed grains also have more fiber in them to help maintain proper rumen function.

In general, feed grains that are most to least likely to cause acidosis are:



Grain processing

The more grain is processed, the more starch is exposed to microbes in the rumen, making it easier to digest and ferment and therefore more likely to cause acidosis. It is important to find a balance between making feed more digestible to improve feed efficiency without increasing the risk of acidosis. The incidence of acidosis is reduced when feed grains are processed just enough to expose the starch. This allows microbes to utilize the starch more efficiently than in the whole grain state, but particle size is sufficient to reduce the fermentation rate and prevent a severe pH drop. Because every feed variety and feed mill is different, constant monitoring to ensure proper consistency and particle size is recommended.

Ionophores

Including an ionophore in a supplemental ration can help reduce acidosis by inhibiting the growth of major acid producing bacteria. Examples of commercially available ionophores include Cattlyst[®], Rumensin[™], and Bovatec[®].

Frequency of feeding

The frequency with which cattle are fed can affect both animal performance and acidosis. If cattle are fed less frequently, they may be hungrier, more likely to overeat when access to supplemental feed is available, and more prone to ruminal acidosis.

Avoid feeding variability

Maintaining consistent feeding time(s), bunk space, and adequate mixing are some things that will help maintain an optimal microbial population in the rumen. Once cattle have adjusted to a feeding schedule and ration (whether it is high grain or high forage), rumen microbes can handle minor digestive disturbances such as late feeding or slight over-feeding much better.

Feeding management

The easiest form of feeding management is to feed cattle free-choice. In other words, putting out a large amount of supplemental feed for cattle to consume over several days. While this might be the easiest option, it often decreases feed efficiency, and can result in acute acidosis when cattle have free-choice access to high-energy feeds.

Mild limit feeding is another feeding management method in which cattle are fed a daily supplemental ration that is less than what they would consume if fed free-choice.

Guidelines for reducing the risk of acidosis when using supplemental feeds

- 1) An adaptation period is required when providing a new feed to cattle. Allow a one week adaptation period for mature cows. Start with 2 to 3 pounds of feed and increase by this amount every three days until the target feeding rate is achieved.
- 2) Feeding rate should be based on a forage analysis and the stage of production of the animal being fed.
- 3) Hand-feed high-starch feeds daily. Do not bulk feed every-other-day or every few days.
- 4) Provide free-choice hay or adequate pasture to meet animal daily dry matter requirements. Cattle require a minimum of 0.5% of their body weight per day in long-stemmed roughage when fed supplemental feeds. Cattle should not be withheld from forage/roughage prior to starting a new feed. Pastures should have a minimum of 4 to 6 inches of growth for adequate forage to be provided in the diet of grazing beef cattle.

References:

1. Beef Cattle Research Council: <http://www.beefresearch.ca>
2. Merck Veterinary Manual: <https://www.merckvetmanual.com>
3. The Compendium of Veterinary Products:
<https://www.bayerlivestock.com/show.aspx/resources/compendium-of-veterinary-products>

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