Grain Overload

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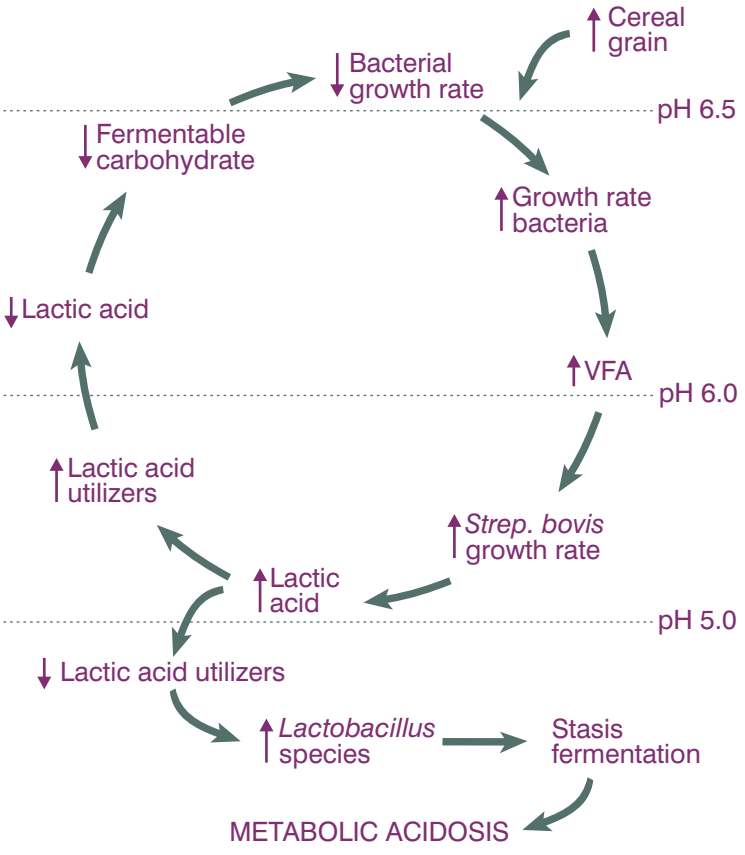
Take Home Message

Improvements in feedlot management practices and the use of various feed additives have reduced, but not eliminated, the occurrence of grain overload in feedlot cattle. Grain overload is associated with several digestive disorders and may result in clinical and subclinical acidosis (Figure 1), liver abscesses or bloat (see articles **2L1** and **2M1**). These conditions may occur singularly or in combination. These disturbances arise from the ingestion of large amounts of highly fermentable cereal grain which fosters proliferation of acid-tolerant bacteria and production of excessive quantities of acid and bacterial slime in the rumen. The bacterial slime stabilizes foam within the rumen, leading to feedlot bloat. The excessive production of acid can damage the rumen wall (rumenitis, sloughing of the rumen wall) and reduce feed intake. The acid condition can produce lesions in the rumen and allow bacteria to enter the bloodstream and form abscesses in the liver. Ruminal contractions may also cease in acidotic animals, and the lack of motility can lead to feedlot bloat. Although treatments have been developed for grain overload, the most profitable approach is to employ management strategies that reduce its occurrence. Adequate forage in the diet, optimal processing of cereal grain, timely adaptation to diets, proper bunk management and various dietary additives are the keys to prevention of grain overload in feedlot cattle.

Figure 1. Sequence of events that lead to grain overload in feedlot cattle.



Economic Importance

Subclinical grain overload, the major symptoms of which are reduced feed intake and impaired animal performance, is of far greater economic significance than is clinical overload. Economic loss from subclinical overload has been shown to reach $9.40 per animal in feedlot cattle fed barley diets (**1**). The incidence of liver abscesses increases in cattle suffering from subclinical overload, and condemnation losses totalled over $1,000,000 in Canada in 1995. Bloat is not as significant economically, but its greater mortality (0.1 to 0.2% of pen deaths) and dramatic clinical symptoms have increased the infamy of the disease.

Occurrence

Grain overload occurs following accidental consumption of toxic levels of grain. Feeding finishing diets to cattle prematurely (e.g., upon arrival in the feedlot or during the step-up period) is the most common cause of the disease. Rapid changes in weather can also influence intake and, therefore, the susceptibility of cattle to grain overload. Other factors that affect intake (e.g., mouldy silage, dust or fines, inadequate water, breakdown in feed mill, improperly mixed diet) can also increase the incidence of the disease (**2**).

Diagnosis

In severe cases of grain overload, cattle do not ruminate and experience severe abdominal pain, as evidenced by kicking at the belly. Some animals will lay quietly, often with the head turned into the flank and will exhibit signs of severe dehydration (sunken eyes). Cattle stagger as they walk, and frequently bump into objects. Diarrhea is almost always present, and the feces are light-coloured and possess a sweet-sour odour. Mild cases of grain overload result in reduced feed intake and impaired growth performance. The mild form of the disease is extremely difficult to detect, because intake by a single animal in a pen is almost impossible to determine in the feedlot setting. Animals that have suffered from acidosis may exhibit an abnormal gait due to the acidotic event altering blood flow and resulting in laminitis or founder. Legs may exhibit swelling and the animal will kick when the legs are palpated. Higher than average incidence of liver abscess at slaughter may also be indicative of grain overload.

Treatment

Cattle that may have consumed a toxic amount of grain should be denied access to grain and provided with a supply of good quality, palatable hay. Water should also be withdrawn for 12 to 24 h. Cattle should be monitored and those exhibiting signs of clinical acidosis and failure to eat should be provided with additional treatment as soon as possible. Antacids (e.g., Oxamin®, Carmilax®, Emblax®) that assist in the neutralization of lactic acid may be administered. In severe cases, removal of rumen contents and replacement with contents from healthy animals may provide relief, but emergency slaughter of the animal for salvage is often the most economical solution.

Prevention

Selection of cereal grain

Cereal grains can be ranked by the rate at which they produce acid in the rumen during digestion, and by their propensity to cause grain overload: wheat > barley > corn > oats > sorghum. Differences in rate of acid production have also been found among barley and wheat varieties. Incidence of overload may be slightly lower when feeding hard wheats and hulled barleys as compared to other cultivars. The use of oats in the diet as opposed to barley and wheat may reduce the occurrence of grain overload.

Proper grain processing

As the particle size of cereal grain is decreased by grinding or rolling, more starch is exposed to digestion and microbial production of acid and slime increases. To moderate acid production, barley should be processed just to the point that the hull of each kernel is cracked. Whole cereal grain is poorly digested in the rumen, but fine rolling or hammer milling will increase the likelihood of grain overload. Tempering of barley (increasing the moisture level 5-15%, see article 1B1) prior to rolling reduces the amount of fine particles formed during processing. Factors such as variety of grain, bushel weight, roller wear and changes in diet composition make it necessary to monitor processing continuously, and adjust methods as required to maintain optimal particle size.

Steam flaking, popping or micronizing involve the application of heat. Most of these methods further increase the rate of acid production in the rumen and are more suited to corn and sorghum. However, dry heat can promote the formation of complexes between starch and protein and slow the rate of

acid production in the rumen. Micronization is a dry heat process that has been used to slow the rate of wheat digestion in the rumen and overcome the negative effect of wheat on average daily gain and feed efficiency (**3**).

Higher level of forage in diet

Increasing the level of hay or silage (other than alfalfa) in the diet reduces the rate of acid production and stimulates the production of acid-neutralizing saliva. Although it reduces the incidence of grain overload, increasing the level of forage above 20% usually depresses average daily gain. However, in diets containing barley or wheat, addition of forage (25-30%) may sustain or improve animal performance as a result of a reduction in grain overload (**4**). The optimal forage:grain ratio in feedlot diets will depend on forage quality, chop length, type of cereal grain and degree of grain processing.

Adequate adaptation

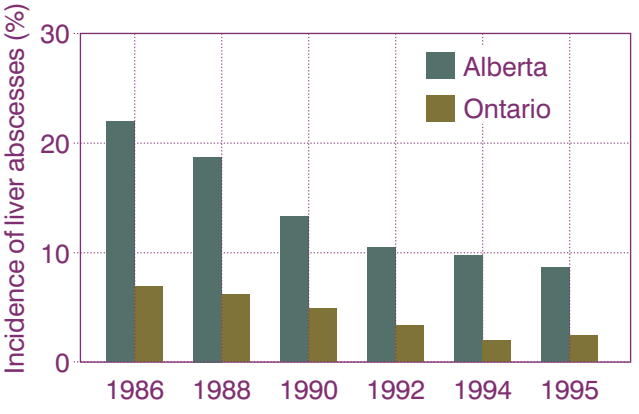
Grain overload occurs most frequently in feedlot animals during the transition from forage-based to high concentrate diets. Bacterial populations that digest cereal grain differ from those that digest forage and require time (14 to 21 d) to adjust as the diet is changed. One of the easiest ways to achieve this transition is to introduce cattle to a mixed diet consisting of 30-40% cereal grain and 60-70% forage (as-fed) upon entry into the feedlot. Maintain the cattle on this diet for 7 to 10 d, and if no digestive disturbances are noted, decrease roughage by 10% every 2 to 4 d until the diet contains 10-20% forage. With optimal feed and animal management, the transition from a high forage to a high concentrate diet can be accomplished in as little as 10 d and may require only two or three step-up diets. With accelerated step-up programs, care must be taken to monitor factors that alter intake patterns, such as changes in weather or forage quality.

Restricting feed intake to 95-97% of full feed has been proposed as a method of reducing fluctuations in feed intake and is employed in some feedlots in the United States with corn-based diets. However, restrictive feeding must be used with caution as it is difficult to control individual intake when cattle are fed in groups. Competition among animals may actually lead to an increase in the incidence of digestive disturbance if excellent management strategies are not employed.

Antibiotics

Tylosin, chlortetracycline, oxytetracycline, bacitracin, methylene disalicylate and virginiamycin have all been shown to reduce the incidence and severity of liver abscess in feedlot cattle. Undoubtedly, the introduction of some of these antibiotics onto the Canadian market is at least partially responsible for the decline in the incidence of liver abscesses in feedlot cattle (Figure 2). Of these antibiotics, tylosin (Tylan®) appears to be the most effective, achieving a 50-60% reduction in liver abscesses. Ionophores have little or no effect on the incidence of liver abscesses.

Figure 2. Incidence of liver abscesses in slaughter cattle 1986-1995.
Source: Agriculture and Agri-Food Canada.



Ionophores

The ionophores salinomycin (Posistac®), lasalocid (Bovatec®) and monensin (Rumensin®) have been shown to prevent the development of lactic acidosis in feedlot cattle (**5**). Ionophores inhibit growth of the major acid-producing ruminal bacteria. At similar concentrations, salinomycin is about three times as potent against these microorganisms as either monensin or lasalocid. Both salinomycin and monensin reduce the occurrence of bloat, but studies have suggested that monensin may be more effective than salinomycin. Feed intake by cattle fed monensin is often lower than by those fed salinomycin, and this difference in ingestion of cereal grain may partially explain the difference in incidence of bloat between the two ionophores. Monensin has been shown to reduce daily variation in feed intake and this change in feeding behaviour may reduce the likelihood of grain overload. Feeding higher concentrations of ionophores (e.g., monensin, 33 ppm of dietary DM; salinomycin at 15 ppm of dietary DM) may also provide feedlot cattle with added protection from digestive disturbances.

Buffers

Buffers such as sodium bicarbonate and magnesium hydroxide can moderate acidic conditions in the rumen, but appear to be more effective for dairy cattle were equal parts of forage and concentrate are fed as opposed to high grain diets. Buffers may offer some degree of protection, but proper management practices (e.g., optimal grain processing) are likely to be more effective at preventing grain overload.

Some Final Pointers That May Prevent Problems

- Provide adequate training to new feed truck drivers or pen checkers to avoid feeding problems.
- Maintain uniformity in the feeding method especially on holidays and weekends.
- Know the history of the cattle when they enter the feedlot (e.g., distance transported, previous diet fed).
- Never make a diet change when the cattle have run out of feed, if cattle run out of feed for more than one day, increase the level of forage in the diet and gradually work them back up to the finishing diet.
- Be especially cautious and observant when dramatic changes in weather occur.
- Pen cattle of similar uniformity and age together and attempt to maintain the number of cattle per pen constant.
- Maintain the same group of cattle in the same pen throughout the feeding period.

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