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G91-1047 Acidosis

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Acidosis

This NebGuide discusses why acidosis occurs, its economic considerations, and methods to prevent and treat acidosis.

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Acidosis is the most important nutritional disorder in feedlots today. Caused by a rapid production and absorption of acids from the rumen when cattle consume too much starch (primarily grain) or sugar in a short period of time, acidosis causes cattle to be stressed. As long as cattle are finished on grain, cows are grazed on cornstalk fields (grain consumption) or high energy (grain) diets are fed to dairy cows, acidosis will be an important problem.

Cattle evolved digesting roughages that ferment slowly in the rumen. The rumen microbes of a forage-fed animal are selected for fiber digestion. Adjusting cattle to high grain diets from predominantly forage diets disrupts the normal microbial environment and precipitates acidosis.

Acidosis is not one disorder, it is a continuum of degrees. Effects of acidosis can be as slight as a .25 lb/day feed intake reduction, or as severe as the death of an animal. Several acidosis-related problems occurring in the feedlot are:

1. sudden death syndrome;
2. polioencephalomalacia - "brainers" (polio);
3. founder;
4. rumenitis;
5. liver abscesses;
6. malabsorption;
7. clostridial infestations;
8. off-feed or reduced feed intakes.

The dairy industry has an additional problem, low milkfat syndrome, that is partly related to acidosis.

Acute Acidosis

Although acidosis is a continuum of degrees of acidosis, for simplicity it can be divided into acute and subacute acidosis. Most feedlot managers readily recognize the effects of acute acidosis. Many cattle diagnosed as "sudden death" may have died from acute acidosis. Managers sometimes observe cattle that are wandering aimlessly in the pen or cannot stand and appear to have "brain damage." When injected with thiamine, these cattle recover quickly and show no signs of brain disorder. During acute acidosis the production of thiamine by rumen bacteria is impaired, resulting in a thiamine deficiency.

However, not all brain disorders are due to acidosis. Proper diagnosis and treatment are necessary.

Acute acidosis can have other, less obvious effects, as well. During acute acidosis ruminal pH drops to levels between four and five, as opposed to the more normal pH of 6.5. The lining of the ruminal wall is damaged, and abomasal and intestinal linings are severely inflamed.

As mentioned earlier, animals may die suddenly or die later due to other acidosis-related problems. Destruction of papillae (finger-like projections lining the rumen wall that aid in absorbing nutrients) in the rumen and damage to the linings of the intestines may result in poor absorption of nutrients, resulting in low gains and poor feed efficiencies ("poor doers"). Foundered cattle are an indication acute acidosis occurred 40 to 60 days previously. Most of the problems associated with acute acidosis can be minimized with proper bunk management.

Subacute Acidosis

Subacute acidosis occurs more frequently, but is seldom recognized by the cattle feeder. The major response by the animal suffering subacute acidosis is reduced feed intake with an accompanying reduction in performance.

When cattle are fed in groups of 100 to 200 head, identification of individual animals with subacute acidosis becomes extremely difficult. It is not until the entire pen is "off-feed" that low feed intakes or erratic intake patterns are observed.

Some additional animal signs of subacute acidosis may be panting, excessive salivation, kicking at their belly, eating dirt, and diarrhea.

Nearly every animal in the feedlot will experience subacute acidosis at least once during the feeding period because it is an important natural function in adapting to high-grain finishing rations. In addition, any interruption in the normal consumption pattern of cattle can cause acidosis.

For example, storms can disrupt feed intake by causing cattle to consume a greater amount of feed before and after a storm. Other environmental effects include mud and heat. Mud and heat reduce feed intake and alter intake patterns. Extreme heat conditions may force cattle to eat a greater proportion of their feed at night, rather than during the day. The design of the feedlot, and location and operation of waterers, also are important so feed intake is not impaired.

Obviously, level of roughage is an extremely important factor affecting acidosis. In general, as the level of roughage increases, the incidence of acidosis decreases. However, cost/gain usually increases as level of roughage increases because roughage is poorly digested in high-grain finishing diets.

The first increment of roughage (5 to 10 percent) will stimulate feed intake and gain without adversely

affecting cost/gain. The roughage should be coarsely chopped to stimulate chewing and rumination, which in turn stimulates saliva production. Saliva contains bicarbonate which buffers the acidic conditions of the rumen and helps reduce acidosis.

Buffers have limited potential in 90 percent concentrate feedlot diets, but have been quite effective in 50 to 60 percent concentrate dairy diets. In a summary of Nebraska research, extra limestone (ration balanced for .7 percent calcium) has been shown to increase feed efficiency 2.25 percent by buffering acidic conditions.

In typical feedlot diets, grain is the single most important factor affecting acidosis. Grains fed to cattle may vary in rate (*Figure 1*), site and extent of starch digestion within the animal's digestive tract. Any grain processing method that reduces particle size and/or causes gelatinization of the starch granules increases the possibility of acidosis.

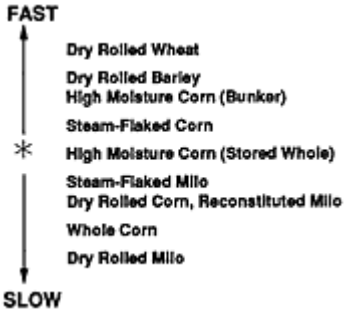


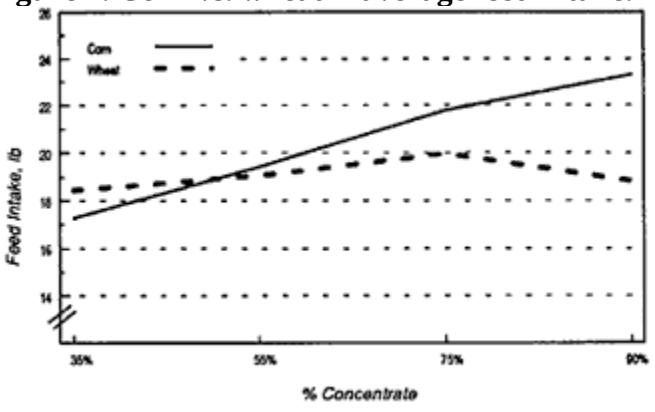
Figure 1.Grains categorized by rate of breakdown in the rumen

Dry rolled wheat, dry rolled barley and early-harvested, high moisture corn have rapid rates of starch fermentation and a greater potential for acidosis than dry rolled corn or grain sorghum. Feeding rapidly fermented grains (wheat, barley and high moisture corn) in combination with more slowly digested grains (dry rolled corn, dry whole corn or dry rolled grain sorghum) may reduce acidosis and improve feed efficiency (see NebGuides *G74-100, High Moisture Corn*, and *G74-136, Grain Sorghum Processing for Beef Cattle*.)

Intake patterns are important in discerning when subacute acidosis has really been a problem. A Nebraska study examined intake patterns of cattle being adjusted to high energy diets, using 35, 55, 75 and 90 percent concentrate diets. Each diet was fed for a five-day period and then the cattle were switched to the next successive concentrate increment.

The grains used in this experience were either dry rolled corn or dry rolled wheat. Intake patterns (averaged across concentrate level) of the cattle fed the corn appeared to be smooth and normal as indicated by increased intake with increasing concentrate level (*Figure 2*). Cattle fed the wheat diets appeared to not increase their intake at all. When the intake data are evaluated on an individual day basis within each concentrate level, rather than averaged over the five-day periods, a much different intake pattern is observed (*Figure 3*).

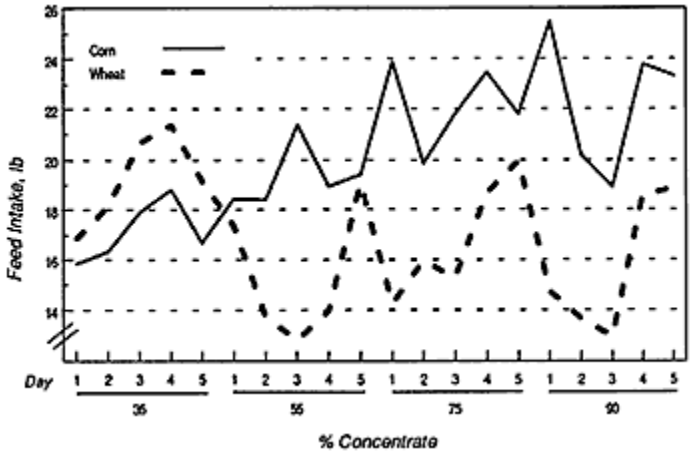
Figure 2. Corn vs. wheat -- average feed intake.



Even though the corn-fed cattle looked like they were going up on feed smoothly, there was a fair amount of variation in intake patterns across each concentrate level. Cattle appeared to eat, then back-off feed for a period of time, then repeat the cycle.

This effect was quite pronounced in the wheat-fed animals. The wheat-fed cattle ate too much, experienced acidosis and backed-off feed rather dramatically for a couple of days. When they felt better they would eat and, again, overeat. Their intake would then decrease for a couple of

Figure 3. Corn vs wheat on daily feed intake

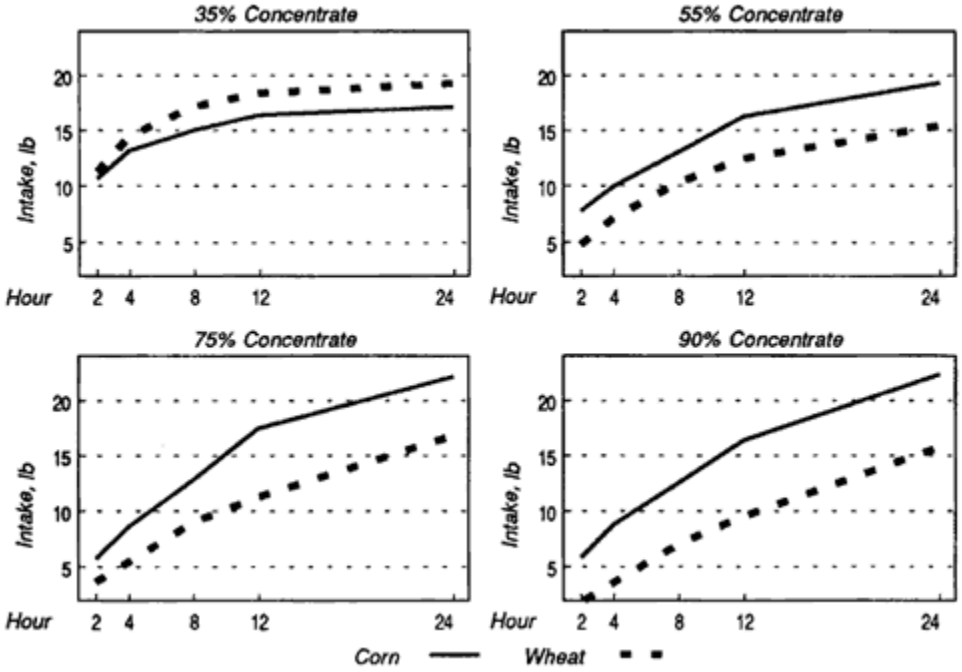


days. This roller coaster eating pattern never really adjusted itself. Similar roller coaster intake patterns have been observed in lactating dairy diets containing in excess of 50 to 60 percent concentrate.

We should remember that, in feedlots, pen feed sheets are really average intakes of all the cattle in the pen. There may be cattle experiencing wide daily intake fluctuations even though pen means are not changing.

These data emphasize that looking at average intakes can be misleading. Intake patterns of these cattle changed drastically over the 24-hour period within each concentrate level (*Figure 4*).

Figure 4. Intake of grain by hour and concentrate level



Cattle fed the corn diet consumed a meal when the diet was offered, and their meal size decreased as concentrate level increased; but they nevertheless still would eat a meal when feed was offered them.

The cattle fed the wheat, however, did not eat a meal when fed the 55 to 75 percent concentrate levels. Once the feeds were increased to 55 percent concentrate, the cattle fed wheat tended to partition their intake over a longer period of time, and ate more during the last 12 hours of the day than during the first 12 hours. This effect is indicative of changing intake patterns due to subacute acidosis. This altering of intake pattern must occur so the cattle will adapt to high-grain finishing rations.

One misconception many feeders have is that if they limit feed offered to a pen of cattle, they can

prevent the up and down swings in feed intake, thus minimizing acidosis. Feed records will show intake variation is small, but this is an artificial situation that does not reflect true feed intakes for two reasons.

First, since bunk space is limited in most feedlots, dominant cattle consume all the feed they want. The more timid cattle are limit-fed. Limiting feed only limits feed for the timid cattle, and not all the cattle.

Second, if feed intake is limited for all cattle, the cattle will be hungry. Rate of feed consumption will be increased at the next feeding, and this change may alter their intake pattern and create additional acidosis, resulting in the roller coaster intake patterns previously described. It is best to not restrict feed intake of finishing cattle in order to prevent acidosis.

When large changes in the amount of feed offered per pen are required, this usually indicates the feed intakes of the cattle are moving in unison (all cattle are increasing or decreasing feed intake), and previous errors in judgment probably were made concerning the amount of feed offered previously to the pen.

Ionophores (Rumensin, Bovatec) increase efficiency of digestion in the rumen. In addition, Rumensin has been shown to reduce variation in feed consumption of feedlot cattle and to prevent the roller coaster intake patterns previously described. Feedlots have observed fewer deaths related to digestive disorders when Rumensin was fed at 25 to 30 grams/ton of ration.

Economics

Overall, subacute acidosis probably costs the feeder more money than acute acidosis because of the unobserved reduction in cattle performance.

We have measured nearly $10 to $13/head advantage by reducing the effects of acidosis in a wheat diet by adding roughage or replacing with corn (*Table I*). Simply evaluating the effect of feed intake alone, a .25 to 1.0 lb reduction in daily feed intake can drastically reduce overall feedlot profit (*Table II*). In addition, several (A+, one or more large, active abscesses, present along with inflammation of liver tissue surrounding the abscess) liver abscesses that were the result of acidosis may reduce daily gain 11 percent and feed efficiency 9 percent. Lost value due to liver abscesses in a pen of cattle (15 percent incidence rate) may be $3/head. Besides the lost value of the condemned livers, extra trimming of the carcass may be required.

Table I. Effect of subacute acidosis on finishing cattle performance

Treatment	Daily gain, lb	Dry matter intake, lb/day	Feed/gain	Cost/gain $/cwt
Dry rolled wheat	3.43	20.86	6.10	38.88
0% roughage (High Acidosis)				
Dry rolled wheat	3.76	21.62	5.77	36.32
10% roughage	Savings $2.56/cwt ($10.24)			
Dry rolled corn	4.01	22.61	5.64	35.02
0% roughage	Additional savings $.76/cwt ($3.04)			

Table II. Subacute (off-feed) acidosis

	Reduction in feed intake				
Measurement	**0**	**.25 lb**	**.50 lb**	**.75 lb**	**1.0 lb**
Daily gain, lb	3.31	3.26	3.20	3.14	3.09
Cost/gain[a], $/cwt	48.94	49.29	49.81	50.58	52.82
Profit, $/hd	16.23	14.52	12.75	10.92	9.02
Lost profit, $/hd	__	1.71	3.48	5.31	7.21
Lost profit[b], $/yr	__	20,525	41,744	63,728	86,483

[a]Ration price $5.20/cwt, $.25/day yardage, $.20/day interest, $10/head processing
[b]Based on 5,000 head, 2.4 turns/year

Solutions

Cattle experiencing acute acidosis should be treated immediately. One possible treatment suggested by Oklahoma State in the April 1989 issue of *University Capsules* is as follows:

500 grams sodium bicarbonate (baking soda),
850 cc 12 percent formaldehyde,
20 grams magnesium oxide,
40 grams charcoal.

Place the above in a plastic container and add enough water to bring the level to two liters.

Then:

a. mix well;
b. administer 100 ml/100 lb body weight in 1 gallon of water via tube;
c. supplement with 20 ml dipyrone.

Shelf life of this mixture is 30 days. The formaldehyde kills the rapidly dividing bacteria.

Work with a local veterinarian for additional treatments. If an animal has symptoms of brain disorder, an accurate diagnosis should be made. If the diagnosis is polioencephalomalacia (polio), an injection of thiamine hydrochloride (10 mg/kg intravenous and repeat for two to three days in the muscle) should be administered. Recovery should be seen in one to three days.

If TEME (hemophilus somnus) is diagnosed, oxytetracycline should be given (5 mg/kg intravenous and 5 mg/kg in the muscle). The animal should be treated in the muscle for three days following initial treatment.

Most cattle will recover on their own from subacute acidosis without any medical treatment. Several management tips should be followed:

1. Feed complete-mixed diets. Don't feed grain and hay separately, if possible.

2. Minimize sorting of ration ingredients by the use of a limited amount of silage, molasses or liquid supplement or fat.
3. Feed slowly fermenting grains (dry rolled corn, dry whole corn, dry rolled grain sorghum) with rapidly fermented grains (barley, wheat, steam-flaked corn, high moisture corn). Limit wheat to a maximum of 40 percent of the diet if not accustomed to feeding wheat.
4. Gradually adapt cattle to high-grain finishing diets in 21 to 28 days using three or four step-up diets. Suggested step-up diets may contain 45, 35, 25 and 15 percent roughage.
5. Feed at least 5 to 10 percent roughage (dry matter basis). Roughage is similar to insurance. The more roughage fed, the less likely acidosis will be a problem. When acidosis is not a problem, feed efficiency and cost/gain increase as roughage level increases.
6. Make sure feed intake is not increasing or decreasing before switching cattle to the next ration.
7. Feed bunks should contain a sprinkle of feed (approximately 1 lb/head) or be slicked clean, but still wet with saliva. Never allow the cattle to be without feed for more than 30 minutes.
8. Feed cattle, as close as possible, at the same time each day.
9. Feed two or more times a day if possible.
10. Use an ionophore (Rumensin or Bovatec) to increase feed efficiency and reduce variation in feed consumption.
11. Balance feedlot rations for .5 to .7 percent calcium and consider using sodium bicarbonate in dairy diets containing greater than 50 percent concentrate.
12. Keep daily records of **dry matter** feed intake.
13. Keep all waterers clean and fresh.

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