Bloat in Calves & Other Young Livestock

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Animals can bloat due to a variety of factors. However, the common thread through all bloat cases is production of gas by organisms in the digestive tract. Feed equipment, feed temperature, feed ingredients, amount fed, feeding frequency, water availability, weather, stress etc., may be involved, but they do not cause bloat by themselves. Organisms, and not necessarily the pathogenic ones, produce the gas that causes bloat. Keeping these relationships in perspective can be a big help when it comes to figuring out how various components fit together to create a specific bloat situation.

Susceptibility of individual animals to bloat is variable and genetics may play a part in some cases. Bloat can be a chronic problem on some farms and never occur on others. Heifer growers that raise calves for more than one client or from more than one farm location may notice that calves from one farm regularly have bloat problems while calves from other farms remain bloat free. Although working through a bloat problem can be truly frustrating, many contributing factors can be controlled to actually prevent bloat or to at least minimize its occurrence.

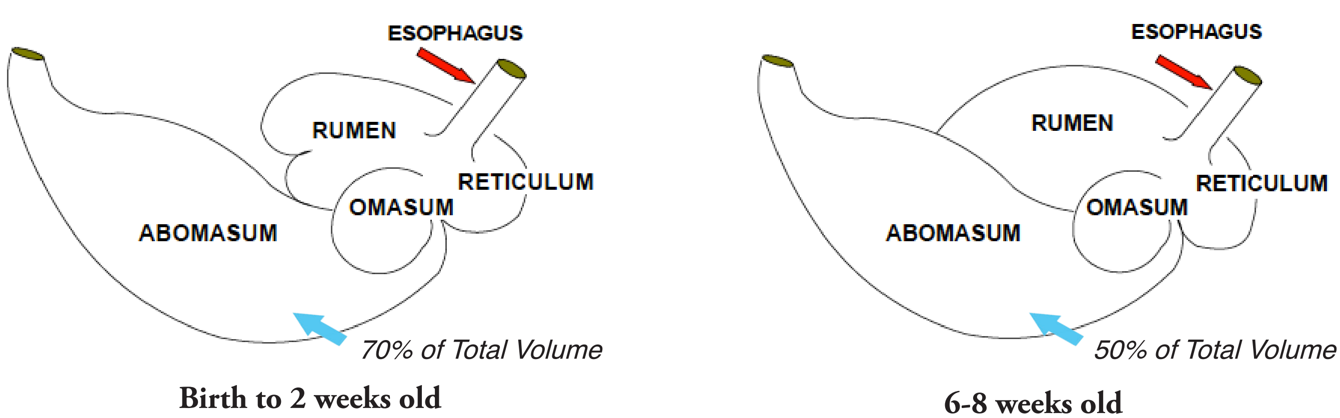
Bloat can affect either the abomasum or the rumen. Since the nature of abomasal bloat is quite different from that of ruminal bloat, it is important to have some understanding of what's happening inside the calf's stomach as the calf grows from a pre-ruminant into a ruminant animal.

Rumen Development. The pre-ruminant stomach is made up of the same four structures or compartments as the adult ruminant stomach. At birth, the abomasum is the dominant structure while the rumen is basically non functional. As the calf consumes various feeds and water, its rumen gradually develops and increases in size and digestive function.

Figure 1 shows changes in the calf's stomach from birth to about 8 weeks of age, by which time many dairy calves have been weaned. During the first two weeks of life, the calf is essentially monogastric with a simple stomach, the abomasum, to digest milk components. As the calf consumes dry feed and water, the rumen begins to develop and becomes more important.

Figure 1

Rumen Development From Birth To Weaning



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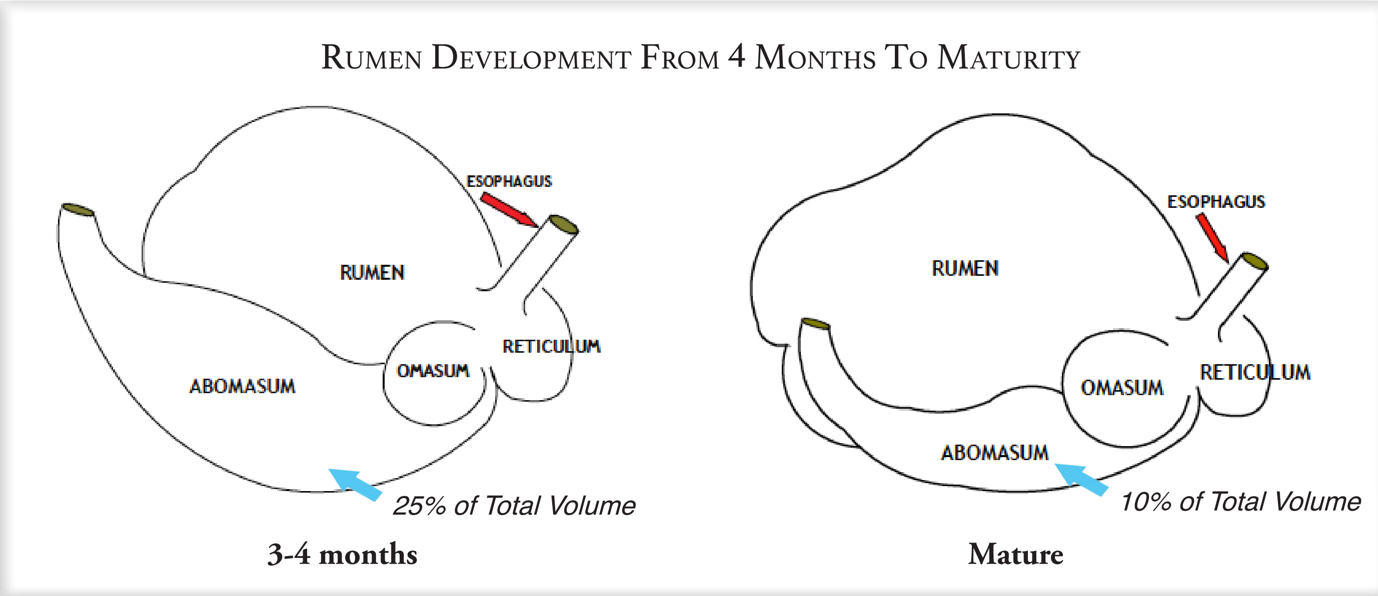


Figure 2

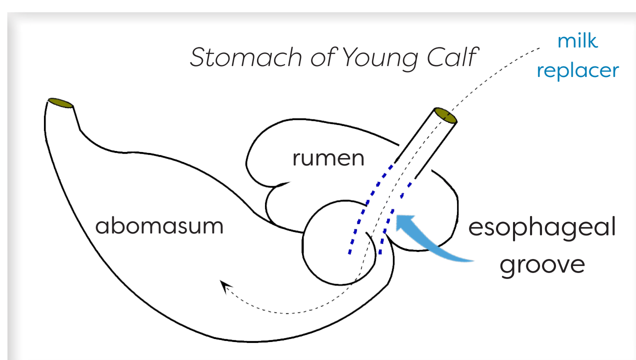
Figure 2 shows the relative sizes of the abomasum and rumen as the calf grows from 3 -4 months of age into a mature animal.

At birth, the abomasum accounts for about 70% of the volume of the entire stomach. By eight weeks of age, the rumen has increased in size and function to the point where the abomasum provides about 50% of the total stomach volume. By the time the animal reaches maturity, the abomasum accounts for less than 10% of the total volume while the rumen, reticulum and omasum make up the remainder.

	Percentage of Stomach Capacity	
Age	Abomasum	Rumen, Reticulum & Omasum
Birth to 2 weeks	70	30
6-8 Weeks	50	50
3-4 Months	25	75
Mature	≤10	≥90

Esophageal Groove. After feed is swallowed, it moves down the esophagus toward the stomach. Since the esophagus joins the stomach in the area of the rumen and reticulum, ingested feed first enters this section of the stomach. However, prior to weaning, milk and milk replacer take a different route. A combination of factors such as suckling, the presence of milk proteins and anticipation result in neural responses that cause muscular folds in the reticulorumen to form a groove that extends from the esophagus to the abomasum.

The esophageal groove allows milk and milk replacer to bypass the rumen, reticulum and omasum and to flow directly into the abomasum for digestion. Water should be fed at least 10 minutes after milk feeding to give the groove a chance to relax. Water needs to enter the rumen, not the abomasum to facilitate grain digestion and rumen development.



Types of Bloat: Abomasal Bloat

Abomasal bloat is often rapidly progressive and life threatening. The processes involved are not completely understood. A rapid growth or proliferation of organisms results in the production of an excessive quantity of gas that cannot escape the abomasum. This causes severe distention that compresses the abdominal and thoracic organs (heart, lungs) and blood vessels that lead to them. The result is asphyxiation and heart failure.

Abomasal bloat typically occurs between 1-4 weeks of age and results in a high mortality rate. The abomasum usually becomes grossly distended after feeding with death occurring shortly after the distention becomes clinically obvious.

At necropsy, the abomasum is grossly distended with gas, fluid and milk or milk replacer. The abomasum is often inflamed and gas bubbles may be visible under the mucosa. Ulcers may be present in the abomasal wall. Occasionally ulcers perforate, releasing abomasal contents into the abdominal cavity.

Treatment of abomasal bloat is very difficult. Attempts to release the gas with a stomach tube will not likely be successful since the esophageal groove is not present to guide tube movement. Little success has been achieved by inserting a needle into the abomasum through the distended right flank of the animal to release some of the gas and is not recommended.

Factors Contributing To Abomasal Bloat

Nutrition & Feeding Management

- ***Abomasal emptying.*** Overfeeding milk, feeding too fast, inconsistent feeding times or anything that results in a large quantity of milk or milk replacer arriving at the abomasum slows the rate of abomasal emptying and provides the substrate and the time for bacteria to grow rapidly. Rapid fermentation of sugars results in excessive gas production.
- ***Solids.*** As the concentration of milk replacer powder in water increases, so does the osmolarity of the solution. High osmolarity solutions slow abomasal emptying. Maintaining solids at 13 to 15% minimizes risk. Low solids, common with waste milk, can also affect digestion.
- ***Water availability.*** Water consumption is key to maintaining osmolarity in the abomasum, especially when calves are fed higher solids or a higher volume of milk/milk replacer.
- ***Colostrum feeding.*** Inadequate colostrum consumption compromises the calf's immune system during the first few weeks of life leaving it vulnerable to disease challenges.
- ***Vitamin/mineral deficiencies.*** Deficiencies of vitamins and minerals such as vitamin E, selenium and especially copper have been proposed as factors in the development of this disorder.
- ***Feeding Equipment.*** Improper cleaning and sanitation of feeding equipment results in a feeding system that can harbor bacteria, spread disease and increase susceptibility to bloat.

Bacteria

- ***Clostridium & Sarcina.*** The organisms involved are typically a related group of bacteria that includes Clostridium and Sarcina. Clostridium perfringens A are most commonly associated with abomasal bloat in calves. Sarcina are frequently found in association, are prolific gas producers, cause ulcers and are often involved in abomasal bloat in lambs. Little is known about potential interactions between these organisms. Both are normal inhabitants of the intestines of ruminant animals.

Other Factors

- Impactions of the abomasum or intestines with substances such as bedding or hairballs; structural or physiological problems that lead to improper function and bloat.

Types of Bloat: Ruminal Bloat

A functional rumen is required for development of ruminal bloat. Pre-weaned calves are far more likely to develop abomasal bloat. Animals developing ruminal bloat are typically on pasture or being fed high levels of grain (especially finely ground grains). Pre-weaned calves with an improperly functioning esophageal groove can also develop ruminal bloat. Repeated accumulation and fermentation of milk or milk replacer in the calf's rumen can result in acute or chronic ruminal acidosis and bloat.

Bloat occurs when gas produced during rumen fermentation builds up in the rumen and can't escape. Gas becomes trapped in the upper area of the rumenoreticulum. Normal rumen contractions decrease and belching becomes impossible, preventing gas from being expelled. As gas accumulates, abdominal swelling can be observed behind the rib cage on the left flank. Affected animals often stop eating, are reluctant to move, show signs of discomfort and distress and increase vocalization. Ruminal bloat can become life threatening within a few hours and usually requires medical attention.

Bloat needs to be relieved quickly. Treatment of individual bloat cases can be as simple as gently inserting a flexible stomach tube coated with mineral oil into the esophagus down into the rumen to release some of the trapped gas. A little mineral oil or antifoaming agent can be administered through the stomach tube to facilitate gas release. In severe cases, inserting a large gauge needle or a trocar through the left flank of the animal, puncturing the rumen, may be required to save the animal's life. Follow-up treatment for peritonitis may be needed.

In the case of esophageal groove dysfunction, first correct the cause of the problem: repeated esophageal tube feeding, painful cough, diarrhea, irregular feeding times, low quality milk replacer, drinking from open buckets, milk replacer temperatures etc. Calves can then be trained to drink properly, such as training to suck a nipple and feeding multiple, smaller meals per day. Systemic, or metabolic acidosis often occurs with ruminal acidosis in pre-weaned calves and any dehydration or acid-base imbalances should be corrected.

Management Checklist For Bloat Prevention

☑ **Colostrum Management.** Ensuring a newborn calf receives an adequate amount of high quality colostrum at the right time is the single most important factor in preparing the animal to withstand disease challenges during the first few weeks of life. It may be appropriate to enhance colostrum quality by improving the antibody levels against certain disease organisms such as Clostridium through dry cow vaccinations.

☑ **Feeding Frequency.** Feeding twice-a-day is convenient, but it can put digestive stress on animals, especially if you are feeding a large volume of milk or milk replacer. Consider dividing the daily allotment over 3 feedings -- or more with automated feeders. This can reduce hunger and provides smaller meals that are less likely to slow the rate of abomasal emptying which reduces the amount of time bacteria have to feed, grow and produce gas.

☑ **Feeding Consistency.** Feed at the same time each day. Variable feeding times can cause calves to become very hungry. Hungry calves eat and drink quickly and often over-eat, leading to changes in digestion. Feed volume and feed types should be consistent with no sudden changes. The feeding temperature of milk should be around 102^{O}F. Check it with a thermometer.

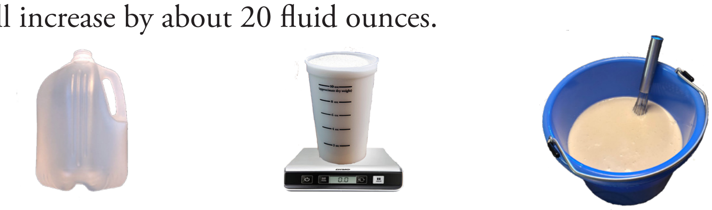
Cold feeding systems are used to reduce bacterial growth and limit intake when calves have free access to milk or milk replacer. Although cold milk replacer is sometimes listed as a possible factor for bloat in calves, cold feeding systems have been associated with reduced incidence of bloat in lambs.

☑ ***Solids.*** Whole milk is about 12.5% solids. Mastitic milk often contains lower solids and non-saleable whole milk for calf feeding may contain water that has been added during the collection process. A refractometer should be used with every batch to check solids. Brix refractometers underestimate actual milk solids by two points, so be sure to add "2" to the refractometer reading. The amount of milk replacer or balancer powder needed to increase milk solids to the desired level can be calculated.

Measuring solids of milk replacer is less accurate than measuring whole milk due to variability in how milk replacer ingredients refract light within the refractometer. You can develop a chart that compares actual refractometer results to calculated values. Since milk replace ingredients vary from company to company and from product to product, this needs to be done for each milk replacer.

When feeding milk replacer, weigh the amount of powder you use per gallon and use one of the following calculations depending on your mixing procedure:

1. *Start with a set amount of water and add powder.* The final mix volume will increase due to the volume of added powder. For example, add 1.25 pounds of powder to 1 gallon of water, which weighs about 8.3 pounds. The final mix will weight about 9.6 pounds. The total volume will increase by about 20 fluid ounces.



8.3 lb + 1.25 lb = 9.6 lb

To calculate the solids percentage, divide the weight of the powder by the total volume and multiply by 100 to convert to a percentage:

$$1.25 \text{ lb} \div 9.6 \text{ lb} \times 100 = 13\% \text{ solids}$$

2. *Add water and powder to a fixed final volume.* Mix 1.25 pounds of powder with enough water to equal one gallon of total milk replacer solution. In this case, you end up with exactly one gallon of total solution

1.25 lb + water = 8.6 lb

Divide the weight of the powder by the total volume and multiply by 100 to convert to a percentage:

$$1.25 \text{ lb} \div 8.6 \text{lb} \times 100 = 14.5\% \text{ solids}$$

Management Checklist For Bloat Prevention

☑ ***Water quality.*** Bacteria in water pose an increased risk for calf health problems. Well water should be routinely evaluated for coliforms. This test serves as an overall indicator of the presence and level of bacterial contamination. Increased health issues, especially during or following wet weather can be an indicator that ground surface bacteria on the farm have seeped into the ground water. Water should be tested at both the well head and the calf facilities. Be sure to test the water that calves are actually drinking and is being used to mix milk replacer.

Annual water testing for dissolved solids provides insights into the mineral content of the water and potential issues calves might be facing. Elevated levels of sulfate and/or iron, for example, can cause a decrease in both water and starter consumption and can cause calves to scour.

Armed with the insights from water quality evaluations you can analyze your situation and if necessary, take informed corrective actions to remove stressors and reduce health challenges.

☑ ***Water Availability.*** Water should be made available within the first couple days of life. Access to water can help the calf maintain normal osmolarity in the digestive tract and helps stimulate grain intake, digestion and rumen development.

Estimated Water Intake Of Heifers

Body Weight (lb)	Gallons Per Day	
	at 40ºF	at 80ºF
100	0.7	1.1
200	2.0	3.3
400	3.7	6.1
600	5.0	8.4
800	6.3	10.6
1000	7.3	12.3
1200	8.0	13.4

Source: Extension Circular 385, Penn State

The general recommendation is to feed 4 pounds of water (2 qt) for every pound of dry feed consumed. The table shows the amount of water required as the calf grows.

Since the esophageal groove may still be present for a while after milk feeding, water fed immediately after milk usually passes directly to the abomasum. For water to enter the rumen and facilitate starter feed digestion and rumen development, it must be fed separately from milk and milk replacer. A minimum of 10 minutes has been suggested as the practical waiting period before offering water after milk feeding. Use a separate bucket for water. Water added to a bucket that still contains some milk or milk replacer may stimulate reformation of the esophageal groove.

☑ ***Group Size.*** Group feeding of calves is becoming more common and although there are many advantages, the size of the group is an important factor that causes stress on calves. Simply put, the larger the group, the more the stress with the potential for more disease challenges and reduced health and performance. Ideal group size for automated feeding is between 12 and 15 calves. With larger groups, allow calves to drink more at each visit to reduce stress associated with competition at the feeder.

☑ ***Feed deficiencies.*** Any protein, energy, vitamin and trace mineral problems should be identified. Nutrition of pregnant cows should also be considered.

☑ ***Feeding Equipment.*** Clean feeding equipment is essential. Bottles, nipples, pails and other equipment used in feeding must be cleaned to remove dirt, manure, milk and other substances. Any biofilm, which is made up of fat, protein and carbohydrates must be removed to prevent pathogens from becoming embedded on the equipment. Equipment should be sanitized before use.