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Preventing abomasal bloat in dairy calves

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Introduction

Abomasal bloat is a disease that occurs within the first few weeks after birth and with more frequency between five-10 days of life of calves. It is characterized by accumulation of gas in the fourth compartment of their stomach (abomasum)[1]. This leads to abdominal distension, anorexia and often death within hours to two days[2]. This disease is different from the ruminal bloat that occurs in adult cattle. Typically, when dairy calves suckle from the bottle, milk is diverted directly to the abomasum of the calf, which is the most developed compartment and accounts for two thirds of the stomach complex at this age[3] (Figure 1). Therefore, for the first few weeks of life, the abomasum functions similarly to the simple stomach of other non-ruminant mammals[4]. This article will discuss what increases the risk and how to prevent abomasal bloat in calves.

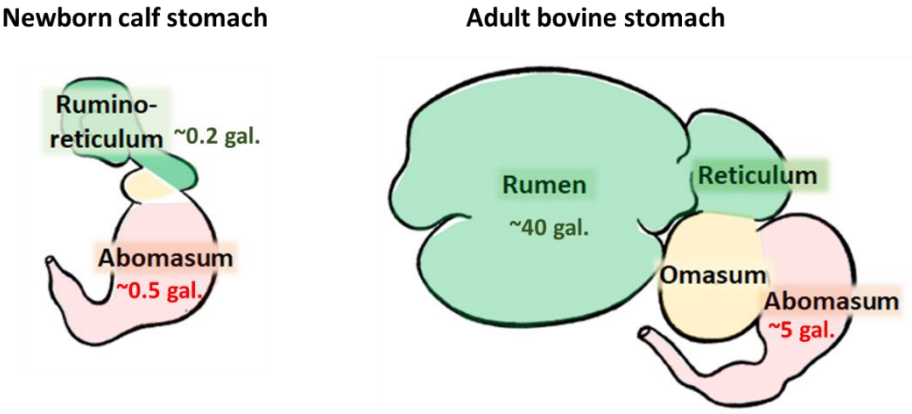

Figure 1. Schematic representation of the development of the bovine stomach. In neonatal calves the fourth and last stomach compartment (abomasum) is the most developed one. Modified from Nickel et al., 1979[4].

What causes abomasal bloat in calves?

The cause of abomasal bloat is not completely understood; however, some risk factors have been associated with the disease. Briefly, excessive amounts of fermentable content in the abomasum in the presence of gas-producing bacteria and with factors contributing to delaying the abomasal emptying increases the risk of abomasal bloat[5] (Figure 2).

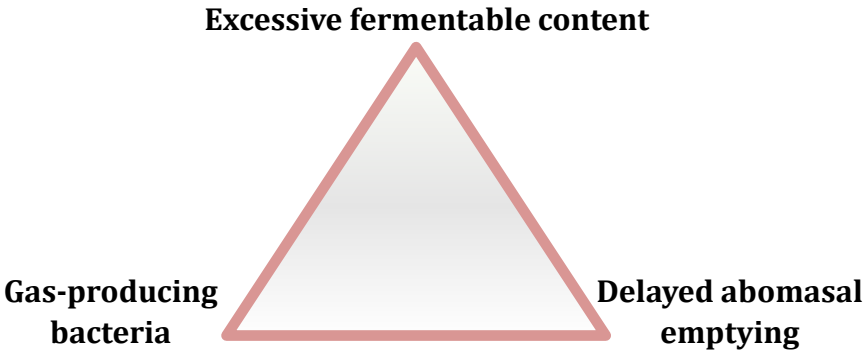

Figure 2. Proposed triad to explain the cause of abomasal bloat in young dairy calves. Adapted from Panciera et al., 2007[5].

Excessive fermentable content

Typically, milk has a total amount of solids between 12% to 13% and concentration of solutes (osmolality) of approximately 300 mOsm, similar (i.e., isotonic) to that of calf's blood. However, current industry accelerated calf-feeding programs add milk supplements, thus increasing these solids and osmolality. In addition, many calf-rearing operations now have increased their feeding program from 2 quarts to 3 quarts of milk or milk replacer twice or three times a day to newborn calves. While these accelerated calf-feeding programs have several advantages, personnel should be cautious when adding milk supplements to whole milk or preparing milk replacer in order to prevent errors in mixing and to not exceed 15% total solids in milk. One easy way to check this would be to routinely check milk samples at the beginning, middle and end of the feeding using a Brixx refractometer or sending samples to measure total solids.

Delayed abomasal emptying

Factors that delay abomasal emptying include feeding a large volume of meal, electrolyte solutions with high concentration of glucose or any solutions with high concentration of solutes[6] (i.e., hypertonic or solutions with high osmolarity). Electrolyte solutions are used primarily to re-hydrate calves with diarrhea and, less frequently, in some calf-rearing operations routinely between milk feedings. Some of these products may have high concentrations of glucose resulting in very hypertonic solutions[1] (>600 mOsm/L), which delays abomasal emptying (Table 1).

Table 1. Examples of factors that delay abomasal emptying rate.

Factors	Intervention	Effect
High volume[4]	Increase volume fed from 1 L to 1.9 L of a 10% glucose hypertonic solution (555 mOsm/L)	**1 L**: Abomasal emptying completed after 2 h. **1.9 L**: 30% of initial meal remaining after 2 h.
High osmolality[7]	Increase sodium bicarbonate from 150 mmol/L (isotonic) to 300 mmol/L (hypertonic)	Increased time to remove half of the initial volume by 127%
High osmolality and glucose[8]	Increase glucose from 56 mM to 405 mM (total osmalilty increase from 360 to 717 mOsm)	Abomasal emptying rate decreased by 36%*
High osmolality and glucose[4]	Increase glucose concentration from 5% (278 mOsm/L) to 10% in 1 L of solution fed	Increased time to remove half of the initial volume by 70% (from 35-60 min)

* Estimated abomasal emptying rate using acetaminophen absorption.

Gas-producing bacteria

Several bacteria species are proven to cause enteric diseases in calves, and some of these have been reported to be found in abomasal diseases. The most common bacteria to be reported is Clostridium perfringes type A[9], which is suspected to be one of the main bacteria involved in abomasal bloat. Other species of Clostridium, Sarcina and Lactobacillus have also been suggested to play a role in this disease[10]. High fermentable sugars allow for quick proliferation of bacteria, which can result in gas production that might lead to bloat[11]. In addition, these bacteria, especially Clostridium species, have potential to produce toxins that will increase inflammation and may lead to shock[9], increasing mortality risk.

Conclusion

Abomosal bloat occurs when enough substrates (fermentable carbohydrates), gas-producing bacteria reside sufficient time in the abomasum to allow excessive gas and acid production. To prevent abomasal bloat in calves, control the following risk factors that increase fermentation in the abomasum and delay its emptying:

- Do not exceed 15% of total solids in milk or milk replacer.
- Reduce the amount of volume per meal by increasing the number of meals offered per day, especially if feeding milk or milk replacer with total solids content of almost 15%.
- Aim to be as consistent as possible. Deliver the same amount of milk at the same time with the same concentration of solids at the same temperature every day.
- Avoid feeding high osmolality fluids, with high concentration of carbohydrates especially when feeding high volume meals.
- Good hygiene practices are key to reducing the load of gas producing bacteria.

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