

What to do for that scouring calf

Make sure that your electrolyte solution has what diarrhea-drained calves actually need.

by Geof Smith, D.V.M.

CALF diarrhea or “scours” continues to be a major health problem. In fact, according to the last National Animal Health Monitoring System (NAHMS) dairy study, more than 60 percent of all death loss in calves less than 2 months of age is a direct result of scours.

Diarrhea has several profound metabolic effects on the calf. They include dehydration, a drop in the pH of its blood (referred to as an “acidosis”), and a loss of energy. Most calves with diarrhea are in a state of negative energy balance.

Electrolyte solutions are recommended for any scouring calf that has, at least, a partially functional gastrointestinal tract. If you give oral electrolytes to a calf with no intestinal motility, the fluid will just pool in the stomach resulting in bloat and rumen acidosis. In general, it is safe to give oral fluids to a calf with any sort of suckle reflex or that demonstrates any “chewing” action.

The quality of commercial oral electrolyte solutions varies greatly.

An oral electrolyte solution must satisfy the following four requirements: supply enough sodium to correct dehydration, provide agents (either glucose, acetate, propionate, or glycine) that facilitate absorption of sodium and water from the intestine, provide an alkalinizing agent (acetate, propionate, or bicarbonate) to correct acidosis, and provide energy.

Let's look at each of these factors in more detail:

- **Sodium concentration.** The loss of sodium in feces of a calf with diarrhea is the main cause of dehydration. Therefore, in order to improve the calf's hydration and restore proper blood flow, you must supply sodium. The ideal sodium concentration is 90 to 130 micromoles per liter of solution (mM/L). I don't recommend low sodium oral electrolyte solutions . . . those containing less than 90 mM/L. They cannot adequately resuscitate dehydrated calves. On the other hand, avoid solutions containing extremely high concentrations of sodium (greater than 150 mM/L). They likely would induce sodium toxicity (called “hyponatremia”) in calves.

- **Amino acids.** The calf must be able to absorb the sodium you provide. Even in calves that have diarrhea and intestinal damage, there are three major pathways for sodium absorption: glucose, volatile fatty acids (such as acetate or propionate), and neutral amino acids (such as glycine). Glycine is present in several commercially available oral electrolyte solutions sold in the U.S.

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- **Osmolality.** The term “osmolality” is a measure of the concentration of particles in a solution. Commercial oral electrolyte solutions for oral use in calves range from 300 mOsm/L (called “isotonic” because this is equal to the osmolality of blood) to 750 mOsm/L (which would be considered very “hypertonic” or concentrated). Simply stated, the higher the osmolality of a product, the more concentrated it is or, generally, the more electrolytes and energy (glucose) the product contains. However, too much concentration can cause problems.

Avoid any electrolyte solutions with values above about 600 mOsm/L. They could worsen the damage that already has been done to the digestive system. On the other hand, low osmolality fluids (less than 350 mOsm/L) generally don't have adequate energy because they have enough glucose.

Keep feeding milk or replacer . . .

Milk or milk replacer contains much more energy than any type of oral electrolyte solution. Therefore, it's important not to stop milk feeding for any prolonged period. However, if milk is to be withheld even for a single feeding, it is important to give a hypertonic oral electrolyte solution (500 to 600 mOsm/L). However, if oral electrolyte solutions are to be fed to a beef calf that still is suckling or in conjunction with milk replacer in dairy calves, you can use an isotonic solution (300 mOsm/L).

- **Alkalinizing agent.** The blood in virtually all calves with diarrhea becomes more acidic. This largely is responsible for the symptoms we see . . . loss of suckle reflex, depression, inability to stand, and so forth.

Acetate, propionate, and bicarbonate are all considered alkalinizing agents. Bicarbonate is commonly found in oral electrolyte solutions available in the U.S. Acetate and propionate are commonly a part of oral electrolyte solutions sold in Europe but are only found in one product sold in the U.S. (Hydra-Lyte, sold by Vet-A-Mix).

Recent research has shown that electrolyte solutions containing acetate and propionate are preferred over bicarbonate for several reasons:

- Acetate and propionate are volatile fatty acids and can aid sodium absorption in the calf's small intestine, whereas bicarbonate does not.

- Acetate and propionate do not increase abomasal pH, whereas bicarbonate does not.

- Acetate and propionate inhibit the growth of *Salmonella* species.

- Acetate and propionate produce energy when metabolized, whereas bicarbonate does not.



Several pathogenic bacteria are killed at low pHs. For example, both *E. coli* and *Salmonella* are killed at a pH around 3.0 and begin to multiply at a pH above 5.5. Normally, the stomach (abomasum) maintains a very low (acidic) pH. This is critical for reducing the number of pathogenic bacteria reaching the small intestine and adding to the resistance to intestinal colonization by bacteria. More simply stated, the calf needs to maintain a low (more acidic) abomasal pH to avoid infection and clinical disease.

Recent research has shown oral electrolyte solutions containing bicarbonate induce a marked abomasal alkalinization. In other words, they raise the pH in the abomasum above 5.5 for a prolonged period of time. This effect is not observed when using acetate-based oral electrolyte solutions. Therefore, abomasal and small intestinal alkalinization due to bicarbonate-containing electrolytes may promote bacterial growth and actually prolong or worsen the diarrhea. Even with the possible drawbacks associated with using bicarbonate, it still is critical that your oral electrolyte solution contain an alkalinizing agent.

While they may not be ideal, products containing bicarbonate have been used effectively for years. However, there are several products that do not contain any of the three alkalinizing agents listed above and should not be used in calves.

What about fiber?

Some people believe adding dietary fiber in the form of psyllium (or dialine) to oral electrolyte solutions would enhance nutrient absorption from the digestive tract and improve glucose absorption. The idea is that this would slow the rate at which the stomach (abomasum) empties. However, research has shown that the addition of psyllium actually causes less glucose absorption.

People sometimes like oral electrolyte solutions that contain psyllium (often referred to as “electrolyte gels”). That's because the manure will thicken somewhat, and it appears the diarrhea is resolving. However, these products actually reduce the calf's energy levels and are not recommended.

The table shows an analysis of six popular products. As you can see, not all of these products would be ideal. In fact, a couple would not be recommended at all. Work closely with your veterinarian to select the product that is most appropriate for your herd.

In general, I like to “add” an oral electrolyte solution as an extra meal while still feeding milk or replacer. For example, if you feed milk twice a day, administer an oral electrolyte in the middle of the day between milk feedings. Or, if the calf is initially found to be depressed with diarrhea and refuses milk, give oral electrolytes, but then milk should be resumed at the next scheduled feeding. Even “high energy” oral electrolyte solutions are not a substitute for milk.

In general, calves that cannot stand or cannot lift their head have a severe drop in blood pH (acidosis) that is best corrected with intravenous fluids. Many times oral fluids will work too slowly to save these calves. Either call your veterinarian to treat these calves, or work with them to come up with protocols for intravenous fluids you administer.

Analysis of several oral electrolyte solutions commercially available in the U.S.

	Sodium (mM/L)	Amino acid	Osmolality (mOsm/L)	Alkalinizing Agent	Comments
Product A	80	Glycine	315	None	Sodium concentration is too low; no alkalinizing agent present — not a good choice.
Product B	184	Glycine	577	Bicarbonate 110 mM/L	Sodium concentration too high — might cause sodium toxicity in calves.
Product C	142	None	731	Bicarbonate 86 mM/L	Although this product could be used in calves, it has a very high osmolality (hypertonic) and may worsen diarrhea.
Product D	105	Glycine	739	Bicarbonate 80 mM/L	Osmolality is too high which can worsen diarrhea. High osmolality solutions also slow stomach (abomasal) emptying and can lead to bloat.
Product E	90	Glycine	377	Bicarbonate 25 mM/L	This product could be used in calves but would have a very weak alkalinizing ability (bicarbonate concentration is very low).
Product F	90	Glycine	614	Acetate 60 mM/L	Very good oral electrolyte solution for use in calves.