FrontLine
Information for Today's Agri-business Professional

Electrolyte Therapy is Critical for Scours Survival

Diarrhea (scours) claims the lives of more preweaned dairy calves in the United States than any other disease.[1a] More than 60% of dairy heifer calf deaths in the U.S. are caused by scours.[1]

Affected calves' health declines quickly from the condition, because loose stools cause loss of water and electrolytes (body salts). The result is dehydration and alteration of the acid-base balance of body fluids. Inflammation of the intestinal lining also can impair the calf's ability to digest and absorb nutrients, causing weight loss and the potential for hypoglycemia (low blood sugar).[2] Young calves have few body reserves in terms of excess fluids or energy, so death can occur as quickly as 24 hours after the onset of scours.[3]

Oral rehydration therapy with commercial electrolyte products is the quickest way to help calves recover from scours by correcting dehydration, restoring normal acid-base balance and replacing salts in the calf's bodily fluids.[4]

When Do Calves Need Electrolytes?

Young calves may begin to exhibit signs of illness even before stool consistency changes. If calves are lethargic, slow to rise and reluctant to drink their milk feeding, they should be watched carefully for signs of scours. Calves can lose 5 to 10% of their bodyweight in water loss within one day of scouring.[5]

"Skin tenting" is a quick, on-farm method of evaluating a calf's degree of dehydration. Pinch a fold of skin on the calf's neck and count the seconds it takes to flatten. If the skin takes 2 to 6 seconds to flatten, the calf is about 8% dehydrated (see Table 1).[6a] Oral electrolyte therapy should be administered immediately to such calves. If the skin takes longer to flatten, the calf is likely dehydrated beyond the point at which oral electrolytes can help, and a veterinarian should be consulted for intravenous fluid therapy (see Table 1).[6]

Table 1. Clinical symptoms that help evaluate level of dehydration in calves[7]

Dehydration level	Symptoms
5-6 %	Diarrhea, no clinical signs, strong suckling reflex
6-8%	Mild depression, skin tenting 2-6 seconds, calf still suckling, sunken eyes, weak
8-10%	Calf depressed, lying down, eyes very sunken, dry gums, skin tenting >6 seconds
10-14%	Calf will not stand, cool extremities, skin won't flatten when tented, comatose
Over 14%	Death

Sunken eyes are another telltale sign of dehydration. In a healthy calf, the eye should press directly against the eyelid. If there is a gap between the eyelid and the eyeball, the eye has sunken due to dehydration.[8]

Some veterinarians also recommend fecal scoring to evaluate the need for electrolyte therapy. Following is the fecal scoring system developed at the University of Wisconsin[9a]:

1) Fecal score 0 or 1 -- Usually considered normal and depend on the type and amount of milk or milk replacer being fed.
2) Fecal score 2 -- Diarrhea that is loose but has enough consistency to form a pile on top of the bedding.
3) Fecal score 3 -- Diarrhea that is so watery it sifts through bedding.

A calf with a fecal score of 2 or higher will be dehydrated and in need of electrolyte therapy.[9] Scouring calves may or may not exhibit a fever. But rectal temperature of greater than 103˚F – or lower than 100˚F – is indicative of an infective source of scours that should be treated with a veterinarian-prescribed antibiotic in addition to electrolyte therapy.[10]

Electrolyte Components

Most commercial electrolyte solutions contain minerals, carbohydrates (sugars) and amino acids.[11] Oral rehydration with electrolyte solution can address scours recovery by:

1) Restoring lost fluids;
2) Replenishing electrolytes, like sodium chloride and potassium;
3) Correcting metabolic acidosis that frequently occurs with scours, by raising blood pH; and
4) Providing supplemental nutrients.[12]

When treating scouring calves, it is important to select a product that is intended for *treatment* versus supplementation. The product's label should clearly indicate its purpose, but electrolyte supplements usually are intended for older animals or as a preventative measure during periods of stress. If mixing instructions call for small amounts of powder added to gallons of water, it is likely that product is an electrolyte supplement.[13]

An effective electrolyte therapy product should contain:

1) Enough sodium to correct extracellular fluid losses that have occurred;
2) Neutral amino acids (glycine, citrate, acetate, alanine or glutamine) to promote intestinal absorption of sodium and water;
3) An alkalinizing agent (acetate, propionate, bicarbonate) to correct metabolic acidosis;
4) Energy (glucose) to correct hypoglycemia and negative energy balance;
5) An excess of strong cations (sodium, potassium, calcium, magnesium) relative to the concentration of strong anions (chloride, bicarbonate, D-lactate, organic acids).[14, 15]

Table 2 shows the recommended ingredient levels for electrolyte treatments.

Ingredient or characteristic	Recommended level	Purpose
Sodium	90 to 130 mEq/L	Water absorption
Potassium	10 to 30 mEq/L	Replace loss
Chloride	40 to 80 mEq/L	Replace loss
Strong Ion Difference (SID)	60 to 80 mEq/L	Correct acidosis
Osmolality	300mOsm/L to 600 mOsm/L	Supply sodium and glucose at adequate yet safe levels

Table 2. Optimal ingredient content and purpose in electrolyte products.[16, 17]

Other Important Characteristics of Electrolyte Products

An oral electrolyte solution also should promote a healthy gut environment, versus an environment that harbors greater bacterial growth. Recent studies have shown that electrolyte products containing sodium bicarbonate as the alkalinizing agent have the potential to promote the survival of disease-cause bacteria by raising pH in the digestive tract. They may increase or promote the growth of infections caused by harmful, scours-causing bacteria such as *E. coli* and *Salmonella.*[18] Thus it is recommended that oral electrolyte solutions containing acetate or propionate are better choices to help heal the digestive tract and prevent further enteric infections.[19]

Osmolality is the concentration of particles in a solution. The osmolality of commercial electrolyte solutions is determined mainly by their concentration of sodium and glucose.[20] Most products range in osmolality from 300 mOsm/L ("isotonic") to 750 mOsm/L ("hypertonic"). The higher the number, the more sodium and glucose the product contains. However, concentrations that are too high can cause bloat and damage to the digestive tract. For this reason, a maximum osmolality of 600 mOsm/L is recommended.[21] Deciding the correct volume of electrolyte to feed is another important consideration. To determine the correct dose, estimate the calf's level of dehydration and its weight. Then:

- Multiply weight of calf by (dehydration percent/100). This will give you the pounds the calf needs to drink **in addition to its milk or milk replacer feeding**. Then divide by 2 to get quarts of liquid needed.

- Example: A 100-lb calf is dehydrated 6%.100×0.06=6lb. 6lb/2=3quarts need to be fed per day *in addition* to her usual milk (which would be 5 quarts if calf is fed at 10% of body weight). The total amount of fluids the calf needs (milk plus the rehydration solution) is 8 quarts per day.[22]

Whether or not to continue feeding milk or milk replacer during electrolyte therapy has been a debated topic. At one time, the theories of "starve the bugs" and "rest the gut" were popular. However, more recent recommendations are to keep calves on their milk diet. Calves need enough energy to maintain their weight to keep their immune system functioning, especially when they are sick. Electrolyte solutions do not provide enough energy to do this alone, because they are limited in the amount of glucose that can be added in order to keep the osmolality of the solution at safe levels. Continuing to feed milk or milk replacer delivers more energy and protein, allowing calves to maintain weight.[23]

Feeding electrolytes separately from milk feedings, with at time differential of at least 2 hours, is advised to avoid disrupting curd formation in the digestive tract.[24] Researchers are exploring methods to make electrolyte therapy more convenient by feeding electrolytes concurrently with milk and free-choice water. But more supportive data are needed before this practice can be recommended.[25]

Finally, new additives to electrolyte formulations, including fiber, gelling agents and probiotics recently have been included in some electrolyte product formulations. While added fiber and gelling agents may slow the passage of intestinal contents and/or give feces a firmer appearance, no research has proven that any of these substances improve nutrient absorption or speed recovery from scours.[26, 27] Likewise, no research has proven any significant benefit from feeding probiotics/direct-fed microbials in electrolyte solutions.[28]

Prevention of scours through vaccination of dams; successful passive transfer of immunity via excellent colostrum delivery; nutrition and sanitation is the most economical and rewarding way to manage the disease. But when calves do experience scours, high-quality oral electrolyte therapy is a critical element in their recovery.

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