

Diarrhea in Dairy Calves: Role of Supportive Therapy



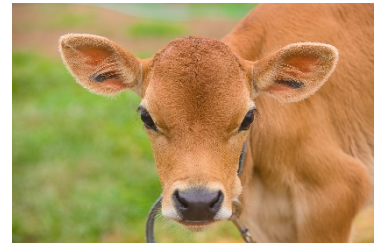
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Diarrhea in dairy calves can result in not only reduced growth, but also death if not recognized early and adequate supportive therapy given when and as needed. Most cases of diarrhea occur within the first two weeks of a calf's life. Depending on the severity and cause of the diarrhea, calves can become dehydrated and, consequently should be given supportive electrolyte therapy.

These electrolytes can help the calf cope with the extreme fluid loss resulting from the diarrhea and get them back on the road to recovery.

The key is to know when and how to intervene and provide not only needed fluids, but also electrolytes (minerals) and energy to the calf. The immune system requires energy to help combat diseases. Dr. Jesse Goff, retired Iowa State Vet School professor and veterinarian, recently explained what happens in the gut of a scouring dairy calf and how electrolytes work. From his discussion, we can draw some practical advice on how and when to intervene and help calves best deal with the resulting diarrhea.



Severely dehydrated calves that have lost the suckle reflex and do not stand on their own, suffer not only from dehydration, but also blood acidosis. These calves may have an increased blood concentration of potassium which can negatively affect the heart muscle. In addition, these recumbent calves may suffer from hypothermia (low body temperature). These calves may need additional therapy besides electrolytes to correct the pH of the blood and is beyond the scope of this article.

Various bacteria (i.e. *E.coli* and *Salmonella*), viruses (i.e. Rotavirus and Coronavirus), and parasites (i.e. Crypto.) can cause diarrhea in calves. All of these causes of diarrhea can result in damage to the cells within the small or large intestine. Some of these cause a more localized area of cell damage in the small intestine. This results in the massive excretion of water and electrolytes (sodium and chloride), thus the observed loose or watery feces.

Whereas other bugs destroy cells or groups of cells (known as the villi) throughout the small intestine. The cells within these villi are important in the absorption of nutrients (energy and proteins) in the small intestines. Once damaged, the cells making up the villi must be regenerated, thus extending recovery time and often decreasing the pre-weaning weight gain of the calf. The bacteria or virus also may invade the underlying blood vessels resulting in a calf with bloody diarrhea. Some strains of *E.coli* produce a toxin which in turn causes a severe watery diarrhea.

Irrespective of the cause of the diarrhea, supportive electrolyte therapy can help the calf survive the resulting dehydration. The amount of electrolytes needed is governed by the degree of dehydration in the calf. Electrolytes can be administered orally when the calf is less than 8 to 10% dehydrated. With an extremely mild case of diarrhea (~4% dehydration), 2 quarts of reconstituted electrolytes, in addition to a normal amount of milk, may be adequate. But, as the calf becomes more dehydrated, 2 quarts of electrolytes will not be adequate to replace the fluids and electrolytes lost by the scouring calf. These calves may need 3 to 4 quarts of electrolytes. Ideally, electrolytes are provided at a separate feeding 2 to 3 hours post milk feeding. Once the calf is recumbent and dehydration is greater than 8%, the calf will need IV fluids. Death can occur when dehydration is greater than 12%.

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Table 1: Assessing Dehydration

Clinical Sign	Percent Dehydrated
Few clinical signs	<5%
Sunken eyes, skin tenting for 3-5 seconds	6-7%
Depression, skin tenting for 8-10 seconds, dry mucous membranes	8-10%
Recumbent, cool extremities, poor pulse	11-12%
Death	>12%

Four-State Nutrition Conference Presentation by Dr. Goff; sourced from Drs. McGuirk, and Ruegg, University of Wisconsin-Madison

Table 2: Amount of electrolytes needed by a 100 lb calf with diarrhea varies by dehydration status.

Calf Health	% Dehydrated	Five Quarts of Milk plus listed Oral Fluids Daily
Healthy calf	0%	0 qts
Mild diarrhea	2%	1 qt
Mild diarrhea	4%	2 qt
Depressed	6%	3 qt
Very ill	8%	4.5 qt
Recumbent	>10%	Need IV fluids

Four-State Nutrition Conference Presentation by Dr. Goff; sourced from Dr. Geof Smith, NCSU Vet School

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To estimate on-farm the degree of hydration of scouring calves, the space between the eye ball and lower eyelid can be assessed. A healthy calf will have a minimal amount of space between the lower eyelid and eyeball, usually less than 2 mm or a little more than 1/16th of an inch (see figure 1). As the calf becomes dehydrated, the amount of space between the eyeball and lower lid increases and is often described as “the eyes are sunken”.

Another simple test relates to how quickly a pinched area of skin in the neck area returns to a flat position (see figure 2.) Normally, skin once tented will return to a flat position within 2 seconds. The longer the skin stays tented, the more dehydrated the calf. As shown in table 1 and 2, once the skin stays tented for more than 3 to 5 seconds, that young, 100-pound calf will need 3+ quarts of electrolytes plus 2 small bottles of milk or reconstituted milk replacer. Thus that calf consumes 8 quarts of fluid or 2 gallons per day. Of course replacement fluid needs to change based on body weight. (To calculate amount needed: Body weight in kg (lbs/2.2) times % dehydration = fluid deficit in liters (1 liter is about 1 quart).)

Milk provides the needed energy for the calf as well as fluids. No scientific evidence supports discontinuing the feeding of milk in a scouring calf.

When selecting an electrolyte product, adequate, but not excessive, amounts of key electrolytes and nutrients should be found and noted on the product label. Dr. Goff compiled a listing of what he would like to see in an electrolyte powder. By comparing the label with those listed in table 3, one can select the best product to purchase and provide as needed.



Figure 1. As the calf becomes dehydrated the space between the lower eyelid and eyeball increases. Pictured is a healthy calf.



Figure 2. Tenting of the skin on the neck. Pinch the skin and twist slightly and then release. In a healthy calf skin should return to normal within 2 seconds.

Table 3:

Oral Rehydration Therapy

Na, K, Cl—Electrolytes to restore circulation if absorbed.

- Water
- Sodium (4-5%) (100 meq/L) - as NaCl and either sodium bicarb, sodium citrate, sodium acetate
- Potassium (2-3%) (20-25 meq/L) - KCl
- Chloride (4-5%) (70-75 meq/L) - provided NaCl and KCl

Glucose (60-70 g/L) & Amino Acid (glycine) (30-60 g/L)

Takes advantage of transport mechanisms to get Na and chloride (and water) back into circulation and also provides energy.

Needs to have an alkalinizer to combat acidosis of blood

Sodium Bicarbonate or sodium acetate or sodium propionate.

Should be mildly Hypertonic—400-450 mOsm

Adapted from Four-State Nutrition Conference Presentation by Dr. Jesse Goff.

Another cause of diarrhea results from the overfeeding of milk within a single feeding. When calves are overfed milk in a single feeding (i.e. ≥ 4 qt/feeding twice daily), the absorptive ability of the intestines can be overwhelmed and water gets drawn into the large intestine, resulting in softer feces. During colder weather, calves need more energy to stay warm and the recommendation is to feed more milk. So instead of feeding 3 qts of milk they are fed 4+ qts and scours may be the result. Usually, this is not a problem for the calf, but would be better managed by feeding the calf the same amount of milk three vs two times daily. By spreading the milk out over the day resulting in smaller meals, absorption is more consistent and more complete in the intestines. Adding more powder than recommended on the replacer feed label also can cause a similar type of diarrhea and should be avoided.

By assessing the degree of dehydration in a calf, one can better determine the amount and need for electrolytes. Essentially, electrolytes help the scouring calf with the resulting dehydration by providing fluids and sodium, potassium, and chloride needed. The minerals are necessary for maintaining blood pH as well as to allow for the absorption of energy and protein—nutrients for the calf. If you are going to error, it is best to feed too much (within reason) versus too little electrolytes. Milk or reconstituted milk replacer should continue to be offered to the scouring calf as she needs the energy and other nutrients found in her milk.