



Oral Rehydration Therapy

From Electrolyte & Water Balance in Calves
 Developed by Rob Costello, Technical Specialist

Overview. *The amount and timing of electrolyte replacement therapy is critical for rapid recovery from dehydration. This section describes the relationship between the degree of water loss and the amount of electrolyte solution required to offset the loss. An overview of the effect of different pathogens on water loss and rehydration therapy, regulation of voluntary intake and effects of tube-feeding are presented. The importance of regular milk replacer feedings on the hydration status of the animal and in maintaining nutrient intake is also explored.*

The timing of electrolyte replacement therapy is critical. A common mistake is waiting too long before administering electrolyte solutions to affected calves. Table 2 shows that calves can lose as much as 6% of their body weight before showing visible signs of dehydration. Giving fluids too little, too late allows progressive fluid loss. As a result, the calf's condition continues to deteriorate. Most calves that die of scours usually die from loss of water and electrolytes, not from direct action of pathogenic organisms. The focus of any treatment plan should be on replacing lost fluids and restoring acid base balance.

Good candidates for oral rehydration therapy are those calves that can stand and suckle. Weak calves with a poor suckle reflex may need to be

tube-fed. Calves that have lost the suckle reflex and are recumbent and unable to rise, are poor candidates for oral rehydration therapy. Subcutaneous and/or intravenous infusions are indicated in more advanced stages of dehydration and acidosis. The calf's ability to recover declines as the severity of dehydration and acidosis increases.

The amount of supplemental fluids a calf needs each day depends on its rate of dehydration. Table 2 shows the minimum amount of electrolyte solution required daily by a 100# calf. The amount of fluid indicated at each level is the amount of electrolyte solution that needs to be fed in addition to regular milk replacer feedings. Substituting electrolyte feeding for milk replacer feeding does nothing to correct the fluid loss.

Table 2. Electrolyte Solution Requirements For Rehydration Therapy (100 lb calf)

<u>Weight Loss</u>	<u>Clinical Signs</u>	<u>Minimum Electrolyte Solution Required</u>
4-6%	no clinical signs, stands without assistance strong suckling reflex	3 qt
6-8%	weak but able to stand, weak suckling reflex, dry mouth and nose, tight skin, sunken eyes and depression	4 qt
8-10%	calf resting on its sternum, above signs more pronounced, depression more severe	5 qt
10-14%	calf in lateral recumbency, cool extremities, poor peripheral pulse, comatose	6-7 qt

Consider a 100 lb calf that is scouring, but shows no other clinical signs. The calf is alert and attentive and has a strong suckle reflex. We can assume the calf has lost about 5% of its body weight due to diarrhea. For this calf, a 5% weight loss equals 5 pounds. If a gallon of water weighs 8 lb, each quart weighs 2 lb and each pint weighs 1 pound. Therefore, this calf has lost 5 pints or 2½ qt of water. Since absorption is not likely to be 100%, the calf should receive at least 3 qt of electrolyte solution daily while scouring.

Table 3 shows the electrolyte solution requirements of 60 and 80 lb calves. A 5% weight loss is about 3 lb and 4 lb respectively. In this case the 60 lb calf requires a minimum of 1½ quarts while the 80 lb calf needs a minimum to 2 quarts of electrolyte solution to replace the water lost through diarrhea.

Electrolyte solutions should be fed between milk replacer feedings at least two hours after the milk replacer. This routine provides a more even distribution of liquid consumption throughout the day. A properly formulated electrolyte solution is designed to maximize the absorption and utilization of both the ingredients and water.

Efficacy of Treatment. Enterotoxigenic *E. coli* causes a hypersecretion type of water loss. In this situation only about 60% of the electrolyte solution is absorbed, so the frequency of administration needs to be increased. In this case, 40% of the electrolyte solution will pass through the calf’s digestive tract, adding to the calf’s fecal water loss. This makes the diarrhea appear to be worsening with electrolyte therapy even though the treatment is effective.

Rotavirus, coronavirus and cryptosporidia invade and damage the intestinal villi causing an increased permeability type of water loss. These organisms tend to affect calves over a week old causing a somewhat slower rate of water loss and a more prolonged infection than with Enterotoxigenic *E. coli*. Electrolyte therapy reduces the metabolic acidosis associated with these infections. As a result, the suckling reflex increases, helping the animal to recover without other treatments.

Voluntary Intake. Mammals regulate their sodium intake. As sodium loss increases, calves preferentially consume sodium-containing fluids.

Table 3. Electrolyte Solution Requirements For Rehydration Therapy (60 and 80 lb calves)

<u>Weight Loss</u>	<u>Clinical Signs</u>	<u>Minimum Electrolyte Solution Required</u>	
		<u>60 lb</u>	<u>80 lb</u>
4-6%	no clinical signs, stands without assistance strong suckling reflex	1.5 qt	2 qt
6-8%	weak but able to stand, weak suckling reflex, dry mouth and nose, tight skin, sunken eyes and depression	2.5 qt	3+ qt
8-10%	calf resting on its sternum, above signs more pronounced, depression more severe	3 qt	4 qt
10-14%	calf in lateral recumbency, cool extremities, poor peripheral pulse, comatose	4 qt	6 qt

This is one reason why sodium is such an important component of an effective electrolyte solution. The solution should be made available at the onset of infection since calves that become acidotic cannot effectively regulate sodium intake. Free-choice electrolyte solutions have been shown to decrease mortality in baby pigs from 20% to 7% under naturally occurring diarrhea conditions.

Tube feeding. It may be necessary to tube-feed calves with a weak suckle reflex. In this situation, there is little or no stimulation for closure of the esophageal groove causing the electrolyte solution to enter the rumen rather than the abomasum. Some solution overflows into the abomasum and is absorbed as efficiently as nursed solutions, but rumen bacteria may be washed away.

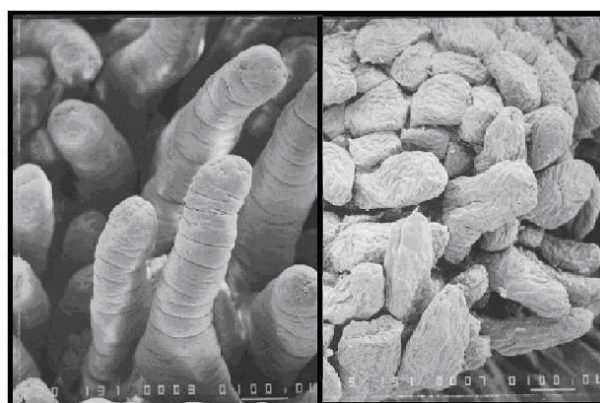
Although it is critical to rehydrate scouring calves, the possibility of negative effects of tube feeding on rumen microflora does exist. These effects depend on the calf's age and degree of rumen development. Most electrolyte solutions, for example, contain glucose. In the developing rumen glucose is fermented to volatile fatty acids and lactate causing a decrease in rumen pH. This lower pH can destroy certain rumen bacteria, slowing the calf's return to normal feed digestion and absorption.

Milk/Milk Replacer Feeding. Dehydration is reported as the primary reason that scouring calves die. Second place goes to starvation. When normal digestive and absorptive functions of the intestine are impaired, calves cannot absorb adequate nutrients from the diet. Since young calves have precious little in the form of stored nutrients to sustain them, digestive and absorptive problems can progressively lead to

rapid weight loss, weakness and death. This situation is made worse when milk replacer is withheld during the treatment process.

Withholding milk replacer does reduce nutrients available for gut pathogens, but also reduces nutrients for the calf. This reduction in nutrients not only compromises the normal gut flora, it also reduces nutrients available for immune function and contributes to intestinal villi atrophy. The villi on the left of Figure 15 are healthy intestinal villi of a pig at weaning. The picture on the right shows villi two days later before the pig has adjusted to the new diet, and clearly shows the severe effects of withholding nutrients.

Figure 15. Intestinal Villi



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The digestive tract requires more energy to keep it going than any other organ in the body. If the inflow of nutrients is greatly reduced, the digestive tract begins to shut down, conserving energy by reducing functions. Villus atrophy reduces nutrient absorption and compromises the protective barrier function they provide against pathogens. There is strong evidence that withholding nutrients also prolongs the duration of diarrhea and slows recovery.

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