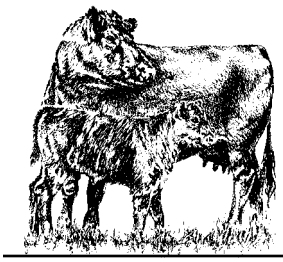

Western Beef Resource Committee *Fourth Edition*

Cattle Producer's Handbook

Animal Health Section 641

Fluid and Electrolyte Therapy in Calves

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Fluids and Electrolytes in Health and Disease

Fluids and electrolytes are necessary nutritional and functional components for all mammals and are required for normal cellular and organ function and for maintaining the acid:base balance with a blood pH >7.35 to 7.45. The normal animal maintains the balance of fluid, electrolytes, and acid:base (blood pH) within narrow limits by consuming water, minerals from supplements, feedstuffs, and salt.

Many diseases cause fluid, electrolyte, and acid:base imbalances that can result in death. Appropriate fluid and electrolyte therapy (rehydration, electrolyte, and acid:base balance) is necessary to restore normal activity (Table 1).

Table 1. Goals and treatments for fluid therapy.

Goal of fluid therapy	Treatment
Correct hydration and circulating blood volumes	Fluids
Correct acid:base balance to normal pH	Bicarbonate fluids
Correct mental depression	Fluids and electrolytes
Correct electrolyte imbalances	Electrolytes
Facilitate intestinal repair	Fluids and electrolytes
Restore suckle reflex	Glucose, fluids, electrolytes

Fluid and Electrolyte Requirements

Water represents the liquid portion of the fluid components of mammals and is one of the five major nutrients. Water provides the fluid medium in which the chemical reactions of the body take place. It also has an ability to absorb and give off heat with a relatively small change in its temperature; therefore, it is an ideal temperature-buffering system for the body.

Water is also the medium for transportation of nutrients and wastes within the body. *Fluid requirement for maintenance for cattle is approximately 45cc/lb/day; therefore, a 100-pound calf needs approximately 1 gallon of water a day, at 60° to 70°F*, just to maintain normal bodily functions.

Electrolytes are dissolved in both intracellular and extracellular fluid compartments of the mammalian system. Electrolytes are required for normal cellular metabolic functions. *The electrolytes of note in calf health are sodium (Na^+), potassium (K^+), hydrogen (H^+), chloride (Cl^-), and bicarbonate (HCO^-).* Electrolyte needs are generally met through consumption of feed and salt and mineral supplements (Table 2).

Causes of Fluid and Electrolyte Imbalances

Fluid and electrolyte imbalances are characteristic of scours, intestinal blockage (LDA), kidney disease, blood loss, salivation (VSV/FMD), persistent fever, or water deprivation. One of the most common causes of fluid/electrolyte/acid:base imbalance is diarrhea (scours). Fluid loss results in dehydration that results in decreased temperature, increased pulse and respiration, and other changes, such as sunken eyes and loss of skin elasticity. Loss of body fluid causes changes in the electrolyte and acid:base balance of the body.

Fluid loss routinely includes the loss of bicarbonate resulting in acidosis (blood pH <7.35). Clinically, dehydration, electrolyte imbalances, and acidosis are presented as weakness and downer animals. The body's mechanisms to correct dehydration can also result in electrolyte imbalances. Diseases such as scours can alter the integrity of the intestine resulting in further loss of fluids and electrolytes as well as decreasing the intestine's ability to absorb water and electrolytes.

Fluid and electrolyte deficits and imbalances require specific treatment protocols to correct imbalances. Oral and/or intravenous fluid therapy can be used to quickly correct imbalances often with favorable outcome. Any disease or environmental situation that results in fluid loss and/or decreased intake requires the lost volume (deficit) to be added to the maintenance needs when formulating a treatment program.

For example: *a scouring 100-pound (maintenance requirement: 45cc/lb x 100 lb = 4500cc [approx 1gallon]) calf that is 7% dehydrated needs an additional*

Table 2. Selected fluid and oral electrolyte supplements.*

Name	Use	Components	Administration	Notes
Sodium bicarbonate	Restore fluid volume Correct acidosis	$NaHCO_3$ (baking soda)	Intravenous	(4 oz) +1 gal distilled water**
Calf Quencher™	Correct acidosis and electrolytes, provide energy	Dextrose†, sodium and potassium chloride, bicarbonate	Oral therapy	1 qt/treatment every 4-6 hr
Enterolyte-HE™	Correct acidosis and electrolytes, provide energy	Dextrose, glycine, sodium and potassium chloride, bicarbonate	Oral therapy	As above
Deliver™	Correct acidosis and electrolytes, provide energy	Dextrose, sodium and potassium chloride, bicarbonate	Oral therapy	As above

*Representative electrolyte solutions only. No implied preference.

**Most calves requiring IV therapy can readily receive 2 to 3 liters of fluid in 2 hours. After the initial 2 to 3 liters, the fluids should run at a rate of 1 drop/sec for 12 to 24 hours.

†Dextrose and glycine are sources of energy.

NOTE: Nutritional support must continue in addition to the fluid therapy. Milk and commercial electrolytes cannot be mixed because the electrolytes will inhibit milk coagulation. Electrolytes and milk replacers (MR) can be administered simultaneously because MR does not clot or coagulate; however, it is advisable to administer the milk or MR 2 to 3 hours apart, thereby further enhancing fluid therapy.

Table 3. Guide to determination of fluid deficit and suggested route of administration.

Clinical presentation	Enophthalamia (mm)	Skin tent duration	% dehydration	100# calf, fluid deficit*	Administration route
Stands, suckle +	2-3 mm	4-5 sec	4-6%	2-3 qt	Oral
Stands with help, suckle decreased	4-6 mm	6-7 sec	8-10%	3-5 qt	Oral or IV
Unable to stand, no suckle	>7 mm	8-10 sec	>10%	5+ qt	IV

*A 100-pound calf also requires 1 gal/24 hours for general maintenance.

6 pints of fluid (replacement fluid needs [qt] = percent dehydration x weight in lb/2.2) added to the 4 quarts needed for maintenance to correct the fluid imbalance.

> *NOTE:* Fluid and electrolyte requirements change as environmental and health conditions change and as the animal grows and changes production phases.

Diagnosis of Fluid/Electrolyte Imbalances

Animals exhibiting signs of disease, such as scours, respiratory distress or depression, and recumbancy, routinely are dehydrated and their hydration status must be determined to initiate effective fluid therapy. The hydration status of calves can be estimated by the moisture and color of mucous membranes, capillary refill time, skin elasticity (skin-tent duration), degree of enophthalmos (the depth of the eyes within the socket), and temperature of the lower limbs. Severely dehydrated animals are routinely depressed and recumbant (down) often requiring intravenous therapy (Table 3).

In dehydration, the eye recesses into the socket (enophthalmia) and can be a useful measure of degree of dehydration. The lower eye lid is everted to its normal position even with the bone of the socket and the distance the eyeball is recessed is determined.

Skin-tenting is also a reliable measure of dehydration. When the skin over the neck/shoulders is lifted to a peak, it will rapidly return to its normal position in a hydrated animal; as dehydration worsens, the "tent" will remain for longer time periods.

Animals with >8 percent dehydration also will have cold extremities. Animals with >10 percent dehydration in addition to severe enophthalmos, prolonged tenting, and cold extremities are routinely down and depressed and will not remain standing when raised!

Electrolyte imbalances are diagnosed more subjectively without the availability of diagnostic equipment. Scouring calves are routinely acidotic due to the loss of water and bicarbonate from the intestine, and the degree of dehydration is an indicator of the amount of bicarbonate fluids to be administered, such as <6% dehydration required oral administration of 3 to 4 liters of a calf electrolyte solution every 4 to 6 hours.

Loss of potassium is routinely associated with scours. The severity of imbalance can be estimated by the ability of a calf to stand or not. Animals that are unable to rise or remain standing if assisted to standing require IV therapy with the administration of IV potassium, which is done under the direct supervision of an attending veterinarian—too much, too rapidly will kill!

Methods of Fluid and Electrolyte Therapy

The common methods of fluid administration are orally or intravenously. Oral administration of fluids is the safest in that it is more difficult to over treat an animal, but this method is most beneficial in treatment

Fig. 1. Orogastric tube feeding systems.

of fluid deficits in early disease or animals <6% dehydrated. Care must be used to avoid administration accidents, such as placing the fluids into the lungs or causing injury to the esophagus or trachea.

Intravenous administration requires moderate surgical skills and increased cleanliness to avoid introducing infectious agents through the needle. IV administration is generally used in down or recumbent animals. IV therapy requires close monitoring as excess fluids and electrolytes can be fatal.

Oral Fluid Therapy—Oral fluid/electrolyte solutions can be successfully administered by a nipple bottle for a calf that will suck or via orogastric intubation. Orogastric tube feeding systems consist of a bag or bottle reservoir attached to a rigid tube with protective bulbous end (Fig. 1).

Place the tube into the mouth over the tongue and direct it to the left side. The calf will usually swallow the tube, which can be seen and felt passing down the esophagus into the stomach (see video). The fluid is then allowed to flow via gravity into the stomach.

Since oral therapy is effective in early or less severely dehydrated animals, placing fluid into the lungs is rarely a problem, however, when withdrawing the tube with any fluid remaining in the reservoir, crimp the tube to prohibit inhalation of fluid during withdrawal.

Intravenous Fluid Administration—Intravenous (IV) fluid administration in calves and cattle requires the placement of a catheter into the jugular vein. IV catheterization is a minor surgical procedure that your attending veterinarian may provide instruction in the procedure. Briefly, a thorough scrubbing—important

Fig. 2. Setup for intravenous administration of fuids to a calf.

to decrease contamination of the site and equipment—of the site is made with a skin cleansing detergent. An 18ga x 1 1/2 inch catheter is placed into the jugular vein and secured with suture or tissue (super) glue. The appropriate fluids are placed into an administration setup (Fig. 2).

References

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