Oral Fluid Therapy for Adult Dairy Cattle

Water is an essential nutrient for dairy cows. A healthy, non-lactating, 1500-pound Holstein cow has a minimum water requirement of approximately 8 to 10 gallons per 24-hour period, but environmental conditions, ration composition, and physical activity can all affect a cow's water needs. Testing an animal's skin elasticity and examining mucous membrane surfaces as well as the position of eyes in relation to sockets are effective ways to determine whether a cow may be dehydrated. Oral fluid therapy can be an effective treatment for dehydrated cows.

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Water is required for all bodily functions and is considered the most essential of all nutrients (1). A dairy cow’s ration that is perfectly balanced for all other nutrients, but ignores the quality, quantity, and accessibility to water, may result in decreased milk production, or even death. In fact, a loss of approximately 20% of the body’s water is usually fatal (1, 2).

About 56 to 81% of an adult dairy cow’s body weight is water. For a 1500-pound cow, the portion of her body weight that is water ranges from 840 to 1215 pounds (2). The rumen, besides having a digestive function, also serves as a water reservoir that can protect an animal against temporary water insufficiencies (lack of access to palatable, clean water), an increased loss of body water (diarrhea, respiratory or urinary tract disease), or an increased demand for water (fever, high environmental temperature, milk production, or pregnancy). However, this protection is short lived if water supplementation is not provided. Loss of body water leading to severe dehydration and possibly death can happen rapidly.

A healthy, non-lactating, 1500-pound Holstein cow has a minimum water requirement of approximately 8 to 10 gallons per 24-hour period. This is an adequate amount if environmental temperatures are ideal, that is between 40 and 77 degrees F (3), the mineral content of the water is not high, the ration is not unusually dry, and the cow is not experiencing a high level of activity or increased physiological demand such as milk production. Milk is about 87% water. A cow producing 80 pounds of milk per day will require an additional 8 to 10 gallons or more of water to replace the water used to produce milk. That is, for each 10 pounds of milk produced, a cow requires an additional gallon of water over her baseline requirements.
As the temperature/humidity index increases above 72 degrees F, a cow’s normal water consumption may increase by 50% (3). A cow whose body temperature rises above the normal range of 101.5 to 102.5 degrees F, will require an additional 1.5 to 2 gallons of water above her 24-hour baseline requirement for each 1-degree increase in her temperature (4). Many conditions can cause an abnormal amount of body water loss through diarrhea, respiratory or urinary tract disease. Also, a sick cow often does not feel well enough to drink and will become dehydrated. This cow will need even more water above her normal requirements to meet her metabolic needs.

Assessment of Hydration

An assessment of hydration (or, conversely dehydration) can be made by testing an animal’s skin elasticity (skin tent test), assessing the position of the eyes in relationship to their sockets, and by examining a mucous membrane surface. The skin tent test is performed by pinching an area of skin, usually over the eyelids (Figure 1) or neck, and estimating the time it takes to return to its normal position. In a well-hydrated animal, this should be instantaneous. With dehydration, the fluid content of the skin decreases and the pinched skin will “tent” (see Table 1).

As an animal becomes more dehydrated, the eyeballs tend to recess into their sockets leaving a gap between the eye and eyelids. This is especially noticeable on the lower eyelids. Keep in mind that there is a fat pad behind the eyes that begins to disappear as an animal losses body condition. Cows with poor body condition, but otherwise well hydrated may have eyes that appear sunken from loss of the ocular fat pad.

Lastly, in a normally hydrated cow, the mucous membrane surfaces should look shiny and feel moist. With dehydration, the surface of the gums of the mouth, inside the eyelids, and inside the lips of the vulva (Figure 2) will appear dull and feel tacky or dry. Since the back end of the cow is usually more easily examined than the head region, the vulvar mucous membranes are commonly used for this assessment. If the gums are examined, because of saliva production in the mouth, mild to moderate signs of dehydration may be masked.

Table 1 provides information for assessing an animal’s hydration status and estimating the degree of dehydration. The following formula, along with Table 1, can be used to

<table>
<thead>
<tr>
<th>Category</th>
<th>Skin Tent</th>
<th>Eye Position</th>
<th>Mucous Membranes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild¹ (4-7%)</td>
<td>Slightly prolonged (2 to 3 seconds)</td>
<td>Slightly recessed</td>
<td>Moist, shiny, not tacky</td>
</tr>
<tr>
<td>Moderate² (8-10%)</td>
<td>Prolonged (3 to 6 seconds)</td>
<td>Obviously sunken</td>
<td>Dull and tacky</td>
</tr>
<tr>
<td>Severe² (&gt;10%)</td>
<td>Prolonged indefinitely (&gt;6 seconds)</td>
<td>Severely sunken</td>
<td>Dry surface</td>
</tr>
</tbody>
</table>

¹ Estimated percent dehydration based on the Assessment Tests.
² An animal with severe dehydration is often unable to stand, depressed and will have cool extremities (legs and ears), similar to a cow with milk fever.

Photo courtesy Michelle Kopcha

Assessing Hydration in a Holstein cow by examining the vulvar mucous membrane surface.
determine the amount of fluid needed to correct an animal’s water deficit based on an estimation of dehydration.

Formula to determine the amount of fluid needed to correct an animal’s water deficit based on an estimation of dehydration

\[
\text{Body weight in kg's} \\
\times \text{Estimated % dehydration} \\
= \text{Fluid deficit in liters}
\]

**EXAMPLE:**

Estimated percent dehydration from Assessment Test in Table 1 = 7%

<table>
<thead>
<tr>
<th>Body weight (1500 pounds)</th>
<th>(1500 pounds/2.2 kg = 682 kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>682 kg x 7% = 47.4</td>
<td>48 liters ≈ 1 gallon</td>
</tr>
<tr>
<td>Fluid to correct the deficit = 48 liters/4 = 12 gallons</td>
<td></td>
</tr>
</tbody>
</table>

OR

1500 lb cow x 7% = 105 lbs of water needed

105 lbs/8 lbs per gallon = 13 gallons

Cattle that are mildly to moderately dehydrated usually respond well to administration of fluids given orally either by placing a stomach tube through the mouth, or through the nose and into the rumen. Cattle that fall into the severely dehydrated category need more intense fluid therapy (intravenous) than can be achieved by oral therapy alone.

The commonly encountered diseases of adult cows such as severe mastitis, metritis and displaced abomasum usually are accompanied by decreased feed and water intake, which leads to dehydration and electrolyte imbalances. Typically, decreases occur in sodium, potassium, calcium and chloride concentrations, plus the body may become alkalemic (the blood pH increases). Occasionally, an adult cow may become acidicemic (decreased blood pH), but this is a more likely occurrence with rumen acidosis (grain overload) than the other more commonly encountered conditions listed above. Mildly to moderately dehydrated cows will benefit from chloride, potassium and, possibly, calcium salts (especially important in older cows) added to water for oral fluid therapy administration. Alkalizing agents such as sodium bicarbonate, sodium acetate, or sodium propionate generally should be avoided because these products increase the blood pH above normal levels. Most of these cows already will be alkalemic. Pushing their blood pH even higher may cause additional problems.

Many commercial electrolyte solutions are available. These products, however, should be avoided if they contain the alkalizing agents discussed above. The following items may be added to tap water to create a nonalkalizing therapeutic solution for treatment of dehydrated adult cattle. Per 5 gallons of water add:

- 140 grams (approximately 5 ounces) of sodium chloride (NaCl)
- 25 grams (approximately 1 ounce) of potassium chloride (KCl)
- 10 grams (approximately 0.4 ounce) of calcium chloride

Each type of salt may be weighed and stored in plastic zip lock-type bags that are labeled with the type of salt, the amount, and the date. These salts will keep indefinitely, and if packaged individually, can be mixed to address each cow’s specific needs (5). For example, a base recipe for oral fluid therapy for first-and second-calf cows may include NaCl and KCl. If an older cow is being treated, it may be appropriate to add calcium chloride salts to the mixture if hypocalcemia (milk fever) is a concern.

The approximate amount of the above solution to administer may be determined by using the following example for a 1500-lb (682 kg) cow determined to be mildly dehydrated.

**Example of amount of solution outlined above to administer to 1500-lb. (682 kg) cow**

| Base 24-hour water requirement | = 8 to 10 gallons |
| Milk production | = 50 pounds/day = 5 gallons |
| Temperature | = 103.5°F (1 degree increase over normal) |
| Estimated % dehydrated | = 1.5 to 2 gallons |
| 682 kg x 5% = 34 liters/4 = 8.5 gallons |
| TOTAL estimated water requirement | = 23 to 25.5 gallons per 24 hours |

Assume that the above-described cow will probably drink some water, and will also derive water from some of her feed if she is not completely off-feed. Therefore, administration of about one-half to two-thirds of her 24-hour requirement, using the larger figures for each category would require giving her about 13 to 17 gallons of electrolyte solution per 24-hour period. Most cows can tolerate treatment with about 10 gallons of water with or without electrolytes at a time. Therefore, if the target volume is 17 gallons, half can be given immediately with the remainder given 6 to 8 hours later. The administration of electrolyte solutions by mouth is very safe, provided that the stomach tube is properly placed into the rumen and not into the trachea. Before attempting administration of fluids via a stomach tube, it is recommended that a person be trained by their veterinarian or another experienced health technician. A stomach tube mistakenly passed into the trachea and fluid deposited in the lungs is usually fatal. Also, before initiating
this type of treatment, it is recommended that a veterinarian examine the animal, establish a diagnosis and recommend a course of therapy, which may include oral fluids.

References