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Why high-quality water matters for calf success

Contributed by Ellan Dufour Published on 30 May 2018

Often overlooked, **water is the most important nutrient for dairy calves**. It is required for all of life's processes including the transport, digestion and metabolism of nutrients, the elimination of waste materials and excess heat from the body, and the maintenance of a proper fluid-ion balance in the body.

The role of water in young calves

Offering calves free-choice water is critical for stimulating rumen development, improving grain fermentation and promoting starter intake. **The quality of water offered can play a major role in calf health and nutrient utilization.**

Rumen development: Unlike milk and milk replacer, water consumed by young calves is transported to the rumen rather than the abomasum. Water in the rumen provides a medium for ruminal bacteria to ferment starter feed, grain and hay. Rumen development is slowed in the absence of water.

Improved growth: Calves offered free-choice water in addition to their liquid diet are shown to gain weight faster and consume dry feed quicker than calves only receiving water through their milk or milk replacer.

Calf health: Calves are about 70 to 75 percent water by bodyweight and need to consume fresh water in order to maintain normal cellular functions. Dehydration can lead to weakness, severe weight loss and even death. Signs of dehydration include sunken eyes, dry mouth and nose, tacky gums, depressed demeanor, irregular pulse and cold legs and ears.

How much and when?

- **Pre-weaning:** On average, calves consume 1 quart of water per pound of dry matter intake.
- **Post-weaning:** Calves should consume 2 quarts of water per pound of dry matter intake. This ratio should extend through the heifer growing period.
- **Hot weather:** Expect water consumption to increase by 33 percent or more as temperatures reach the high 70s, and anticipate it may double as temperatures pass 90°F.

Factors affecting water quality

Offering poor-quality water to the young calf may impact water consumption and starter intake, calf health, rumen development and the value of milk replacer and electrolytes. There are many criteria involved in assessing water quality. These include organoleptic properties (odor and taste), physiochemical properties (pH, total dissolved solids [TDS], total soluble salts and hardness), presence of toxic compounds, presence of excess minerals or compounds (see **Table 1**), and presence of bacteria.

Hardness: Calves are very sensitive to sodium and struggle to tolerate excess sodium levels. Soft water or hard water that has passed through a water softener can have very high concentrations of sodium and should not be used to mix milk replacer or be offered as drinking water unless tested. High sodium levels can lead to neurological diseases and central nervous system derangement in young calves.

Osmolarity: In situations where total solids are high in milk or milk replacer (over 15 percent), offering high-quality water can sustain the osmotic equilibrium in a calf. High total solids can force water out of cells in an effort to find osmotic balance within the gut and can result in diarrhea and severe dehydration. Water provision is especially important for calves fed an accelerated milk replacer program to ensure proper hydration.

Bacteria: Coliform bacteria like *E. Coli* and salmonella may be present in poor-quality water or water contaminated by feces and can quickly and exponentially increase to dangerous levels in a calf if consumed. In both cases, calves may suffer from severe dehydration and diarrhea. Salmonella may also result in pneumonia and septicemia in infected animals. Water with high iron content is at an increased risk of salmonella contamination.

Minerals: Calves are more sensitive to elevated mineral levels than adult cattle, making excessive mineral concentrations in drinking water a particular concern. Upper concentrations and maximum tolerable concentrations of minerals for dairy cattle are shown in **Table 1** (below). Minerals of particular concern when in high concentrations include cobalt, copper, iron, hydrogen sulfide, manganese and sulfur.

Take-home messages

- Ensure calves are consistently provided with clean, fresh, and readily available water.
- Keep water buckets clean and free of contamination from starter feed and feces.
- Know the least expensive and most efficient method available to modify mineral and microbial concentration of water offered to calves.
- Check your water quality frequently. At minimum, water fed to calves should be tested annually.

TABLE 1		Guidelines for youngstock water quality	
Item	Upper levels	Maximum tolerable limit	
Aluminum, ppm	5.00	10.00	
Arsenic, ppm	0.20	0.20	
Barium, ppm	1.00	1.00	
Bicarbonate, ppm	1000	1000	
Boron, ppm	5.00	30.00	
Cadmium, ppm	0.01	0.05	
Calcium, ppm	100	200	
Chloride, ppm	100	300	
Chromium, ppm	0.10	1.00	
Copper, ppm	0.20	0.50	
Fluoride, ppm	2.00	2.00	
Iron, ppm	0.20	0.40	
Lead, ppm	0.05	0.10	
Magnesium, ppm	50.0	100.0	
Manganese, ppm	0.05	0.50	
Mercury, ppm	0.01	0.01	
Molybdenum, ppm	0.03	0.06	
Nickel, ppm	0.25	1.00	
Nitrate-nitrogen, ppm	20.00	100.00	
pH	6 to 8.4	8.5	
Phosphorous, ppm	0.70	0.70	
Potassium, ppm	20.00	20.00	
Selenium, ppm	0.05	0.10	
Silver, ppm	0.05	0.05	
Sodium, ppm	50.00	300.00	
Sulfates, ppm	50.00	300.00	
TDS, ppm	960	3000	
Vanadium, ppm	0.10	0.10	
Zinc, ppm	5.00	25.00	
Coliform, #/100 mL	0.50	0.50	
Fecal coliform bacteria, #/100 mL	0.1	0.1	
Total bacteria, #/100 mL	1000	1000	

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<https://www.progressivedairy.com/topics/calves-heifers/why-high-quality-water-matters-for-calf-success>