362-0736 Research project report - Abstract -

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Title: effect of drinking water salinity and hardness on water intake, rumen physiology, feed intake, milk yield and composition in lactating cows

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Abstract

The use of desalinated seawater in arid and semi-arid regions for domestic, industrial, and agricultural purposes is steadily increasing. Consequently, drinking water supplied to dairy cows in these regions contains lower concentrations of dissolved salts and minerals than in the past. In Israel, desalinated water currently accounts for up to one third of the freshwater supply. Total dissolved salts in water are commonly estimated through measurements of electrical conductivity (EC). Under Israeli conditions, drinking water EC typically ranges from approximately 900 μS/cm in water originating from wells or the National Water Carrier to approximately 400 μS/cm when mixed with desalinated water, with daily fluctuations in water composition being common. Although drinking water containing up to 1,500 ppm total dissolved solids (approximately 3,000 μS/cm) is generally considered safe for livestock consumption, unusually low mineral concentrations may influence rumen physiology, feed and water intake, and milk production. Therefore, we evaluated the effects of drinking water salinity within an EC range of 400–1,000 μS/cm on the performance of lactating dairy cows under controlled experimental conditions. Water treatments were prepared by the measured addition of concentrated sodium chloride solution. Following a two-week adaptation period to individual feeding and watering stations, four high-producing Israeli Holstein cows received drinking water at EC levels of 400, 600, 800, or 1,000 μS/cm in a 4 $\times$ 4 Latin square design, allowing each cow to receive all treatments. The actual mean EC measured daily in the drinking troughs was 418, 624, 811, and 1,016 μS/cm, respectively. Each experimental period consisted of 5 days of adaptation, 10 days of data collection for feed intake, water intake, milk yield, milk composition, and body weight, followed by 3 days of

milk, urine, feces, and rumen fluid sampling. A significant positive relationship was found between drinking water EC and both dry matter intake and energy corrected milk yield, with the greatest response observed when EC increased from 400 to 600 μS/cm. Drinking water salinity negatively affected nutrient digestibility; however, no significant effects were observed on ruminal volatile fatty acid concentrations, volatile fatty acid profiles, or ruminal ammonia concentration. Likewise, water intake was not affected by treatment and averaged 142 L/day. In the subsequent year, the effect of drinking water hardness was evaluated by supplementing drinking water with calcium and magnesium. Similar trends were observed, including increased feed intake and milk production accompanied by reduced fiber digestibility when water hardness reached the upper range commonly encountered under field conditions. The third year trial was conducted using a similar experimental approach to further evaluate the effects of drinking water hardness on lactating dairy cow performance with major difference as first trial was under three milking per day regime and the second trial under two milkings per day regime. Overall, the results indicate that mineral concentrations in drinking water may influence milk production and rumen physiology in dairy cows. These findings justify further investigation into the role of drinking water composition as a management factor affecting dairy cow productivity and digestive function.