EVALUATION OF WATER OXYGENATION ON MILK PRODUCTION: MILK COMPOSITION AND SOMATIC CELL CONCENTRATION IN MILK[1]

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Summary

Forty Holstein cows in mid-lactation were utilized to evaluate the effects of water oxygenation on milk production, milk composition, and somatic cell count. Cows were fed a total mixed ration consisting of 25% alfalfa, 25% corn silage, and 50% corn-soy concentrate on a dry matter basis. Treatments included a 7-day preliminary period followed by two 28-day periods in which the treatments were reversed.

Water consumption, milk production, milk composition, and somatic cell count were not different between treatments. Cows receiving oxygenated water were more docile and easily managed than control cows. Ozone introduced into water forms hydrogen peroxide, nitrous oxide, and increases the redox potential of the water.

Introduction

The ruminant animal survives by providing an environment suitable for the anaerobic fermentation of feedstuffs. The end-products of this process are predominantly volatile fatty acids (acetic, propionic, and butyric), methane, and microbial cells. Any process that alters ruminal dynamics can influence the production of these end-products and, ultimately, animal efficiency.

The process of oxygenation of drinking water may impact animal production by a number of mechanisms. Since the majority of the ruminal microbes are strict anaerobes, increasing the supply of oxygen to the rumen would be detrimental to these organisms. The most sensitive of these organisms would be the methane-producing bacteria. Any process that reduced methane production would potentially improve the efficiency of fermentation and, ultimately, improve animal performance. An analysis of fermentation end-products is needed to evaluate these effects.

Alternatively, the effects may be mediated through altered water consumption, which would alter ruminal fluid dynamics and fermentation.

The purpose of this study was to analyze critically the production traits of lactating cows offered only oxygenated water for drinking.

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Materials and Methods

Forty Holstein cows were utilized to evaluate the effects of water oxygenation on milk production, milk composition, and somatic cell count.

Treatments were balanced for production, parity, days in milk, and body weight. Cows were fed a total mixed ration consisting of 25% alfalfa, 25% corn silage, and 50% corn-soy concentrate on a dry matter basis. Forage:concentrate ratio was changed during the trial in accordance with milk production. Forty percent of the daily ration was fed in the A.M. and 60% in the P.M. Daily feed consumption per treatment group was recorded.

Cows were weighed on two consecutive days at the beginning and end of each treatment period. Individual milk weights were recorded daily, and milk samples (A.M. + P.M.) were collected weekly for analysis of milk fat, protein, lactose, total solids, and somatic cells (SCC).

Water intake per group was monitored with an in-line meter and recorded daily. Water intake per cow was calculated by dividing daily intake per group by the number of cows per group.

Treatments included a 7-day preliminary period, a 28-day period, and a second 28-day period, in which the treatments were reversed (switchback design).

Results and Discussion

Cows offered oxygenated water (O group) as their sole source of drinking water consumed similar amounts per day (23.9 gal) as control (C group) cows (24.4 gal) and did not require a significant adjustment period. Body weights increased over the 56-day experimental period (1,468 lb in period 1 vs 1,497 lb in period 2) and were not different between groups (1,489 lb for O vs 1,481 lb for C). Cows consuming the treated water were more docile and easier to manage than control cows after approximately 1 wk on treatment. This difference was observed in both groups of cows in the switchback design used. Theoretically, the system used to increase the oxygen content of water produces hydrogen peroxide and nitrous oxide. Although these were not measured in this experiment, increased amounts of nitrous oxide could produce the animal behavior effects observed when the cows were exposed to the oxygenated water.

Treatment effects on milk production and composition (Table 1) were not different for any traits measured.

Table 1. Treatment Effects on Milk and Milk Composition

Treatment	Milk, lb	Fat, %	Protein, %	Lactose, %	Total solids, %	SCC[a] (x1000)
Control	57.8	3.44	3.32	4.74	12.08	345
Oxy. water	58.1	3.47	3.34	4.76	12.14	424
Standard error[b]	.18	.034	.015	.011	.044	56

[a]SCC = somatic cell count.
[b]Standard error for each measurement.

Cows utilized in this experiment were in midlactation and in positive energy balance, as indicated by an increase in body weight. They were well adjusted to the facilities and personnel, because all cows used were born at the unit. The cows were prescreened for health problems, and only those with a record of reasonable health were included in the study. Thus, they were relatively free from the most common stress factors. Beneficial effects of oxygenated water by the means used herein have been observed in the field with sick steers and heifers or cattle under stress. The lack of response in this study could be due to the absence of major stress conditions.

If the major benefit of the treatment is to reduce the effects of stress on performance, a suitable test of its effectiveness would be first-calf heifers during early lactation. The observed "calming" effect noted herein might be beneficial in adjusting heifers to the milking process.