THE EFFECT OF SODIUM BICARBONATE LEVEL ON RUMEN METABOLISM IN STEERS WITH INDUCED SUBACUTE ACIDOSIS

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Summary

Sodium bicarbonate at 1 or 2% of dry matter intake was evaluated as a means of alleviating subacute acidosis, using six fistulated Holstein steers in a controlled acidosis challenge model. Steers were feed challenged by withholding an evening feeding and then feeding 2.5% of BW for two consecutive mornings. Postchallenge rumen pH for control steers (no sodium bicarbonate) was lower ($P<.05$) than for steers fed either 1% or 2% sodium bicarbonate, which were similar to each other. Hours below pH 5.6 were less ($P<.01$) postchallenge for steers fed sodium bicarbonate and were similar between the 1 and 2% levels. Although sodium bicarbonate reduced ruminal pH hours below 5.6, it did not appear to alter concentrations of volatile fatty acids or lactate in acidotic steers. Sodium bicarbonate appears to be beneficial in managing subacute acidosis in situations where wide intake fluctuations are common or expected.

(Key Words: Cattle, Sodium Bicarbonate, Rumen pH, Acidosis.)

Introduction

Conditions that cause fluctuations in intake, such as changes in weather or mechanical breakdown, can produce subacute acidosis, reduce finishing cattle performance, and increase cost of gain, even though the cattle are not visibly ill. Sodium bicarbonate (Bicarb) is sometimes included in finishing rations, because of its acid neutralizing characteristics, to prevent acidosis. In a controlled situation, we interrupted normal feed intake patterns and followed this by rapid compensatory consumption to evaluate the potential of sodium bicarbonate to alleviate induced sub-acute acidosis.

Experimental Procedures

Six ruminally fistulated Holstein steers (1050 lbs) were adapted to a high grain diet; randomly allotted within a replicated 3 × 3 Latin square; and fed a corn-based finishing diet at 2% of BW/day, unsupplemented or supplemented with 1 or 2% of Bicarb (dry basis). The basal diet contained 80% rolled corn, 10% chopped alfalfa hay, 8% supplement, and 2% molasses. Allotted amounts of Bicarb were mixed with the basal ration at feeding time. The basal diet in this study contained 12% crude protein, .59% Ca, and .30% P. Each 16-day period consisted of a 10-day treatment adaptation (1% of BW fed at 8 a.m. and 8 p.m.); a fasting period (no feed at the 8 p.m. feeding on day 11); consecutive feeding challenges on days 12 and 13 (1.5% of BW in a bunk plus 1% of BW via rumen fistula 1.5 hours after bunk offering; 8 a.m. feeding); and an intake recovery period in which the feeding schedule returned to the prechallenge regimen. Any feed uneaten at 1.5 hours postfeeding on the challenge days was given via the rumen fistula. Feed refusals were weighed and discarded each day prior to the 8 a.m. feeding. At the beginning of each period, steers were inoculated with 1 liter of ruminal fluid from a common donor. Ruminal samples were obtained (postfeeding) at 0, 3, 6, 9, 12 hours (day 10); 3, 6, 9, 12, 18, 24 hours (days 12 and 13); and 12 and 24 hours after the a.m. feeding on days 14-16. Ruminal samples were analyzed for pH and

concentrations of volatile fatty acids (VFA) and lactate.

Results and Discussion

Molar percentages of acetate and propionate, acetate:propionate ratio, total VFA, and lactic acid concentration were unaffected (P<.05) by level of Bicarb in the diet (Table 1). Ruminal pH for control steers was less (P<.05) than for steers fed either the 1 or 2% levels, which were similar. Hours below pH 5.6 were lower (P<.01) during the challenge period for steers fed Bicarb and were similar between the 1 and 2% levels. No treatment differences in intake occurred during the recovery period. Results of this study indicate that the addition of Bicarb altered the ruminal environment, resulting in a more favorable ruminal pH without changing the amounts or ratios of major fermentation end-products. Total VFA concentrations and ruminal pH reductions in this study were lower than observed for beef breeds using a similar model and basal diet. Higher ruminal capacity per unit of BW for Holsteins (previously documented) may be partially responsible. Nonetheless, sodium bicarbonate should be beneficial in situations where wide intake fluctuations are expected or common.

Table 1. Effect of Sodium Bicarbonate Level on Rumen Metabolism i nSteers Induced with Subacute Acidosis

		Sodium Bicarbonate, % of dry matter	
Item	Control	1%	2%
pH	5.72[a]	6.06[b]	5.98[b]
Total volatile fatty acids, *m* M	87.07	79.60	86.72
Acetate, %	52.97	55.22	55.36
Propionate, %	28.95	26.25	27.98
Acetate:propionate ratio	2.04	2.23	2.16
Lactate, *m* M	0.09	0.08	0.07
Hours below pH 5.6	6.54[c]	1.47[d]	1.82[d]

[ab]Means without a common superscript differ (P<.05)
[cd]Means without a common superscript differ (P<.01)

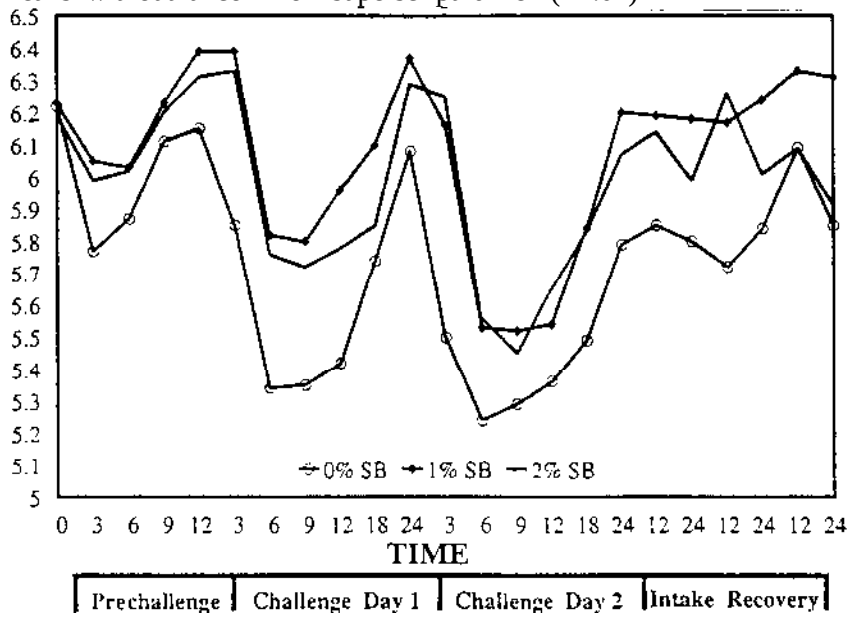

Figure 1. Effect of Sodium Bicarbonate Level on Ruminal pH