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The effect of sodium bicarbonate level on rumen metabolism in steers with induced subacute acidosis

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The effect of sodium bicarbonate level on rumen metabolism in steers with induced subacute acidosis

Abstract
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.

Keywords
Cattlemen's Day, 1994; Kansas Agricultural Experiment Station contribution; no. 94-373-S; Report of progress (Kansas State University. Agricultural Experiment Station and Cooperative Extension Service); 704; Beef; Cattle; Sodium bicarbonate; Rumen pH; 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 fed 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.
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 in Steers Induced with Subacute Acidosis

<table>
<thead>
<tr>
<th>Item</th>
<th>Control</th>
<th>1%</th>
<th>2%</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>5.72^a</td>
<td>6.06^b</td>
<td>5.98^b</td>
</tr>
<tr>
<td>Total volatile fatty acids, mM</td>
<td>87.07</td>
<td>79.60</td>
<td>86.72</td>
</tr>
<tr>
<td>Acetate, %</td>
<td>52.97</td>
<td>55.22</td>
<td>55.36</td>
</tr>
<tr>
<td>Propionate, %</td>
<td>28.95</td>
<td>26.25</td>
<td>27.98</td>
</tr>
<tr>
<td>Acetate:propionate ratio</td>
<td>2.04</td>
<td>2.23</td>
<td>2.16</td>
</tr>
<tr>
<td>Lactate, mM</td>
<td>0.09</td>
<td>0.08</td>
<td>0.07</td>
</tr>
<tr>
<td>Hours below pH 5.6</td>
<td>6.54^c</td>
<td>1.47^d</td>
<td>1.82^e</td>
</tr>
</tbody>
</table>

^aMeans without a common superscript differ (P<.05)
^bMeans without a common superscript differ (P<.01)

Figure 1. Effect of Sodium Bicarbonate Level on Ruminal pH