INFLUENCE OF DIETARY BUFFER VALUE INDEX ON THE RUMINAL MILIEU OF LACTATING DAIRY COWS FED SORGHUM SILAGE AND GRAIN

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Story in Brief

The objective of this study was to evaluate the influence of dietary buffer value index on ruminal fluid pH, buffering capacity and buffer value index for 12 h postfeeding. Three lactating Holstein cows averaging 18 $\pm$ 10 days in milk were used in a 3x3 Latin square with 3-wk experimental periods. Treatments were diets with grain and sorghum silage (50:50, 60:40, and 70:30 ratio, dry matter basis) which provided buffer value indexes of 71, 78, and 81. Results indicate that the acid-base status of the diets fed in our study did not appear to influence the acid-base status of the rumen. Hence, dietary acid-base status may not be an accurate predictor of the need for buffers in the diet of lactating dairy cows.

(Key words: Buffer Value Index, Rumen pH, Buffering Capacity.)

Introduction

Recent studies have focused on the effect of dietary acid-base status on ruminal acid-base status. Jasaitis et al. (1987) found that forages and high protein feeds had a buffering capacity (BC) three to fourfold higher than concentrates. They suggested that evaluation of the pH and BC of the diet might allow prediction of the necessity for buffer supplementation.

Tucker et al. (1992) developed a buffer value index (BVI) to simultaneously evaluate ruminal fluid pH and BC; the index is directly related to BC and inversely related to hydrogen ion concentration (acidity). This index also has been used to estimate the acid-base status of diets containing sorghum silage or alfalfa. The objective of this study was to evaluate the

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effects of three different BVI on ruminal environment in cows consuming sorghum silage based diets with three different grain-to-forage ratios.

Materials and Methods

Three ruminally-cannulated Holstein cows were fed total mixed rations containing concentrate plus sorghum silage (Table 1; 70:30, 60:40, or 50:50

Table 1. Ingredient and nutrient composition of experimental diets (%, DM basis).

	Diets (G:F)		
	50:50	60:40	70:30
Ingredient			
Sorghum silage	50.01	40.03	30.02
Ground shelled corn	23.44	34.45	44.66
Soybean meal, 44%	23.95	22.87	22.58
Dicalcium phosphate	.90	.88	.82
Limestone	.75	.91	1.06
Trace mineralized salt	.53	.49	.42
Dynamate[a]	.39	.36	.41
Vitamin A premix	.01	.01	.01
Vitamin E premix	.01	.01	.01
Nutrient			
DM	39.52	44.42	50.74
CP	17.89	17.73	17.90
NE_l, Mcal/lb	.73	.76	.78
ADF	22.90	19.17	15.49
NDF	32.81	28.22	23.68
Ca	.76	.76	.76
P	.49	.49	.49
Mg	.39	.36	.34
K	1.18	1.09	1.02
S	.26	.25	.27
Na	.24	.23	.20
Cl	.41	.38	.34
pH	4.75	4.85	4.97
BC	.67	3.67	3.00
BVI	70.55	77.61	80.86

[a]Double sulfate of K and Mg.

Table 3. Mean squares for indicators of ruminal fluid acid-base status.

Source[a]	df	pH MS[b]	pH *P*	H^+, neq/L MS	H^+, neq/L *P*	BC, meq/L MS	BC, meq/L *P*	BVI MS	BVI *P*
Cow	2	.467	.855	1,413,574	.794	206.8	.359	212.7	.757
Period	2	1.170	.702	2,627,157	.675	81.7	.586	258.1	.719
Diet	2	2.074	.570	4,961,807	.524	116.8	.498	584.7	.531
Cow by diet	2	2.751		5,458,775		115.7		661.6	
Sample time	24	.464	<.001	603,768	.003	74.1	.002	80.9	<.001
Diet by sample time	48	.041	.980	186,528	.943	29.8	.673	19.4	.941
Residual	141	.069		277,464		33.5		28.8	

[a]Main plot variables (cow, period and diet) were tested against cow by diet interaction; sub-plot variables were tested against residual.
[b]Type I mean squares.

Ruminal Acid-Base Status

Jasaitis et al. (1987) suggested that dietary acid-base status may affect ruminal acid-base status. Our objective was to evaluate the effects of dietary acid-base status on ruminal acid-base status immediately after feeding. Although the mean effects of diets were not significant sources of variation, sample time was an important source of variation for pH, hydrogen ion (H^+), BC and BVI (Table 3). Ruminal fluid pH tends to be lowest 4 to 6 hr after feeding. All three diets tended to follow this general acidity pattern. Erdman (1988) reported that ruminal fluid pH decreases linearly as the amount of ADF content in the diet decreases. The 70:30 diet had the lowest ADF content and the lowest pH.

Denton (1957) showed that routine activities that precede feeding tend to increase salivary flow. The cows in this trial were milked at 9 hr and were fed 2.5 hr later. Buffering capacity increased drastically for the 70:30 and 60:40 diets at 9.5 hr. Salivary buffer secretion would first tend to neutralize ruminal fluid acid, increasing pH and decreasing H^+ concentration. Additional buffer would then contribute to the BC of the fluid.

In summary, the acid-base status of the diets fed in our study did not appear to influence the acid-base status of the rumen. Hence, dietary acid-base status may not be an accurate predictor of the need for buffers in the diet of lactating dairy cows.

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