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Increasing dietary Rumensin concentration to 45g/ton (90% DM Basis) reduced the effects of imposed acidosis challenge in steers fed a corn-based finishing diet.

Summary

Nine ruminally fistulated yearling steers were used in a 9 x 2 Incomplete Latin square to evaluate benefits of an increase in dietary Rumensin level during an imposed acidosis challenge. Feeding Rumensin, at either 30 or 45g/ton reduced acidosis on the challenge day. However, increasing the dietary Rumensin concentration to 45g/ton was required to reduce acidosis for the five days following that challenge. Feeding 45g/ton reduced ruminal pH area below 5.6 when compared to the normal level of 30g/ton during the five days following the challenge.

Introduction

Feed intake variation by cattle fed high-grain finishing diets is presumed to predispose animals to digestive disturbances such as acidosis. Subacute acidosis causes reductions in gain and efficiency, which can add up to a substantial economic cost for a pen of cattle. These costs become even more evident if cattle experience a more severe case known as acute acidosis which results in almost total feed aversion and possibly even death. Rumensin is commonly used in high-grain finishing diets to improve feed efficiency. However, in recent research at Nebraska, Rumensin has been shown to reduce the incidence of acidosis by reducing the area of ruminal pH below 5.6 and ruminal pH variance without affecting feed intake when cattle are fed ad-libitum (1997 Nebraska Beef Report pp. 49). It has also been shown at the University of Nebraska that there is an even greater advantage of using Rumensin to control acidosis without affecting intake in clean bunk management systems (1999 Nebraska Beef Report pp. 41). Considering previous research, increasing dietary Rumensin levels during times when feedlot cattle might experience intake variation may reduce incidence and severity of acidosis. The objective of our study was to evaluate the effects of increasing dietary Rumensin concentration from 30 to 45 g/ton during and for five days following an imposed acidosis challenge on ruminal pH and feed intake.

Procedure

Nine ruminally fistulated steers were used in a 9 x 2 Incomplete Latin square, six observations per treatment, to determine if there were responses to increasing levels of Rumensin in the diet during an imposed acidosis challenge. Steers were adapted to the finishing ration using four step-up rations decreasing in roughage level (45, 35, 25, and 15 %), over a 21-day period. Steers were randomly assigned to one of three Rumensin treatments and allowed seven days to adjust to the finishing diet before the start of the first period. The final diet consisted of 63.4 % high moisture corn, 21.1 % dry-rolled corn, 7.5 % ground alfalfa hay, 3 % molasses and 5 % supplement, (DM basis). The diet was formulated to contain 12 % CP, .7 % Ca, .3 % P, .6 % K, .95 Mcal/lb NEm, and .65 Mcal/lb NEg, (DM basis).

Rumensin was fed at 0g/ton for the entire period (CON), 30g/ton dietary Rumensin for the entire period (NOR),or 30g/ton fed prior to the challenge, then changing to 45g/ton day of the challenge and for the next five days (EXP), followed by a seven-day period of feeding 30g/ton. Dietary Rumensin levels were formulated on a 90 % DM basis.

Bunks were managed using a clean bunk management strategy (approximately 15-hour feed access). Bunks were read at 730 hrs and steers were fed once daily at 800 hrs. Individual feed bunks suspended from load cells were connected to a computer equipped with continuous data acquisition that allowed feed amounts to be recorded at one-minute intervals. By retrieving the feed weights at 2100 hrs, 2300 hrs and 100 hrs from the previous night, the feed amounts were adjusted so steers would consume their feed by approximately 2300 hrs.

Submersible pH electrodes were suspended in the rumen through the ruminal cannula. Each electrode was encased in a weighted four wire metal shroud and suspended about 5-10 inches above the ventral floor of the rumen, allowing ruminal contents to flow freely around the electrode. Ruminal pH was continuously recorded at one-minute intervals.

Periods were 35 days in length and consisted of six different phases. Days 1-14 were a diet adaptation phase. Submersible pH electrodes were placed in the rumen on day 14. On days 15-21, pre-challenge data were collected (intake and ruminal pH). On day 22, steers were fed only 50 % of day 21 intake in order to make steers eat more aggressively the following day. On day 23, the acidosis challenge was imposed by offering steers 175 % of day 21 intake, four hours late (1200 hrs). The dietary Rumensin level for EXP was increased from 30 to 45g/ton. Days 24-28 were a recovery period in which the Rumensin level on EXP remained at 45g/ton, and all cattle were returned to their normal clean bunk management. To determine if there were any negative effects of switching back from 45 to 30g/ton, days 29-35 steers on EXP were switched back

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to 30g/ton of Rumensin. In a two-week rest period between periods of the Latin squares, steers were placed on their second period diets to allow extra time for recovery from the previously imposed acidosis challenge. Steers fed Rumensin and switched to CON for the second period were reinoculated with rumen fluid from a donor steer that was maintained on a diet similar to CON.

Statistical analyses used the Mixed model procedure of SAS. Results were divided into four phases: pre-challenge (days 15-21, seven days in length); challenge day (day 23, one day); recovery 45g (days 24-28, five days following the challenge); and recovery 30g (days 29-35, seven days following first recovery phase). Pre-challenge data were analyzed separately from the other three phases since this occurred before the Rumensin treatment was imposed. Contrasts were used to compare CON vs the average of NOR & EXP. Challenge day, recovery 45g phase and recovery 30g phase were analyzed together. Treatment means were separated within each phase using the LS MEANS procedure with a protected F-test (P<.10)

Results

Pre-Challenge Phase

Results from the pre-challenge phase are reported in Table 1. During the pre-challenge phase, steers on Rumensin ate at a faster rate (P<.05) compared with control. Steers fed diets containing Rumensin had less pH variance when compared with CON (P<.05). This would suggest steers not fed Rumensin were experiencing some cases of subacute acidosis and had altered their consumption patterns to be less aggressive when eating. Total feed intake, number of meals per day , average meal size, time spent eating and ruminal pH below 5.6 were not influenced by treatment.

Challenge Day Phase

Results from the challenge day are reported in Table 2. Overall feed intake and intake rate were not affected by treatment. Steers fed CON and EXP ate fewer meals (P<.05) and consumed more

Table 1. Effects of increasing Rumensin level on intake behavior and ruminal pH of steers fed a corn-based finishing diet during the pre-challenge phase.

	Rumensin Level[a]			
Item	CON	NOR	EXP	SEM
Intake				
Lb/day, Asfed	28.9	28.4	28.4	1.8
Rate[b], %/hour	25.6	36.4	34.0	2.8
Meals				
Number/day	7.7	6.5	5.7	.75
Avg, lb	3.7	5.1	6.3	.78
Time spent eating				
Total, min/day	491	451	456	31.6
Avg. meal, min	63	78	91	8.6
Ruminal pH				
Average[b]	5.75	5.64	5.67	.11
Variance[b]	.21	.18	.16	.01
Area < 5.6[c]	192	249	223	23.8

[a]CON = 0 g/ton Rumensin, NOR = 30 g/ton Rumensin, EXP = (30 g/ton Rumensin pre-challenge, 45 g/ton Rumensin challenge day and for 5 days following, 30 g/ton Rumensin for the remainder of the period).
[b]Con vs Average of NOR & EXP differ (P < .05).
[c]Area = (magnitude of ruminal pH below specified pH) * (minutes below specified pH).

Table 2. Effects of increasing Rumensin level on intake behavior and ruminal pH of steers fed a corn-based finishing diet during the challenge phase.

	Rumensin Level[a]				
Item	CON	NOR	EXP	SEM	F-test
Intake					
Lb/day, Asfed	43.2	42.7	42.2	2.3	.95
Rate, %/hour	29.7	24.2	32.5	3.1	.17
Meals					
Number/day	4.9[d]	6.7[e]	4.0[d]	.49	<.01
Avg, lb	10.1[b]	6.5[c]	10.9[b]	.89	<.01
Time spent eating					
Total, min/day	489	573	528	29.4	.15
Avg. meal, min	106[d]	89[d]	136[e]	9.1	<.01
Ruminal pH					
Average	5.53[d]	5.63[d,e]	5.76[e]	.06	.06
Variance	.57[f]	.49[g]	.48[g]	.03	.10

[a]CON = 0 g/ton Rumensin, NOR = 30 g/ton Rumensin, EXP = (30 g/ton Rumensin pre-challenge, 45 g/ton Rumensin challenge day and for 5 days following, 30 g/ton Rumensin for the remainder of the period).
[b,c]Means in a row with different superscripts differ (P < .01).
[d,e]Means in a row with different superscripts differ (P < .05).
[f,g]Means in a row with different superscripts differ (P < .10).

Table 3. Effects of increasing Rumensin level on intake behavior and ruminal pH of steers fed a corn-based finishing diet during the recovery 45g phase.

	Rumensin Level[a]				
Item	CON	NOR	EXP	SEM	F-test
Intake					
Lb/day, Asfed	24.5	28.4	26.6	2.3	.48
Rate, %/hour	18.3[b]	30.2[c]	22.2[b]	3.1	.03
Meals					
Number/day	8.3	7.7	7.5	.49	.59
Avg, lb/meal	2.8	4.2	3.8	.89	.53
Time spent eating					
Total, min/day	515	543	503	29.4	.62
Avg. meal, min	61	75	71	9.1	.53
Ruminal pH					
Average	5.56	5.54	5.71	.06	.11
Variance	.12	.11	.12	.03	.95

[a]CON = 0 g/ton Rumensin, NOR = 30 g/ton Rumensin, EXP = (30 g/ton Rumensin pre-challenge, 45 g/ton Rumensin challenge day and for 5 days following, 30 g/ton Rumensin for the remainder of the period).
[b,c]Means in a row with different superscripts differ (P < .10).

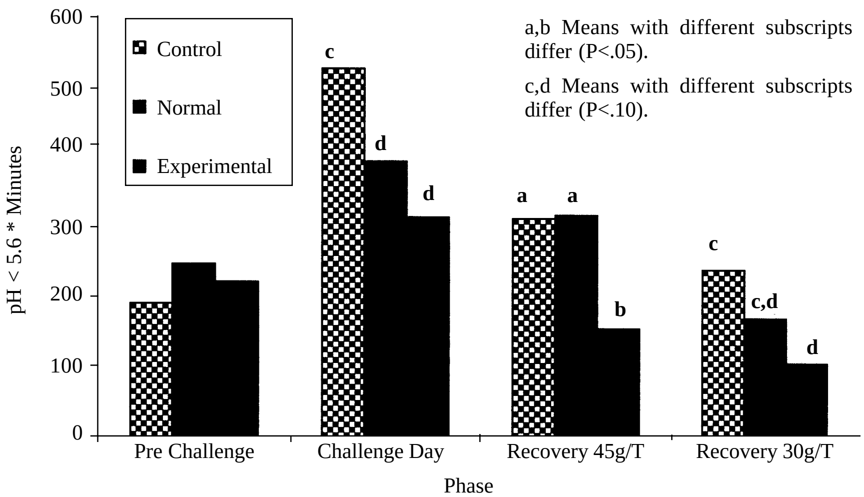

Figure 1. Ruminal pH area below 5.6 for pre-challenge, challenge and recovery phases.

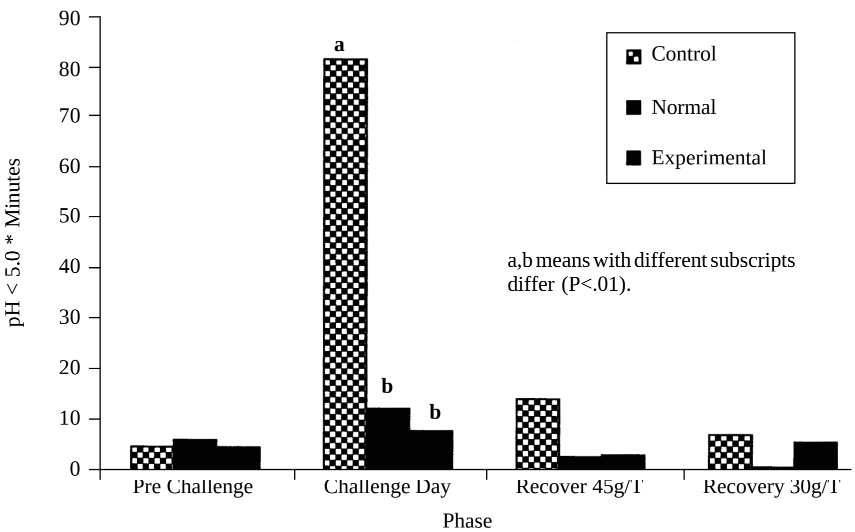

Figure 2. Ruminal pH area below 5.0 for pre-challenge, challenge and recovery phases.

feed per meal (P<.01) compared with those fed NOR. Steers fed EXP spent more time eating each meal (P<.05) compared with steers fed NOR and CON. Average pH for steers fed EXP was higher (P<.05) compared with steers fed CON, and pH of steers fed NOR was intermediate. These data would suggest increasing Rumensin concentration is beneficial. Rumensin fed steers had less ruminal pH variance (P<.05), ruminal pH area below 5.6 (P<.05; Figure 1) and ruminal pH area below 5.0 (P<.01; Figure 2) when compared with CON.

Acidosis Recovery Phase

Results from the acidosis recovery phase are reported in Table 3. Ruminal pH area below 5.6 was less (P<.05) for steers fed EXP when compared with CON and NOR (Figure 1). The EXP also tended to increase average ruminal pH (F-test, P=.11) when compared with CON and NOR (Figure 1). Intake rate was slower (P<.10) for steers fed CON and EXP compared with NOR. The increased level of dietary Rumensin for steers fed EXP probably caused this slower rate of intake, and effects of acidosis caused the slower rate of intake for steers fed CON. The steers fed CON ate 11 % less feed than the steers on Rumensin during this five-day acidosis recovery phase. No differences were observed in number of meals/day, average meal size or time spent eating.

Changing the dietary Rumensin concentration back to 30g/ton from 45g/ton had no effect on feeding behavior (data not shown). Average ruminal pH (5.97) of steers fed EXP was higher (P<.10) than those fed CON and NOR (average 5.75). This is most likely because the steers fed 45g/ton during the acidosis challenge and acidosis recovery phases had a higher average ruminal pH. This suggests that feeding 45g/ton of dietary Rumensin during an imposed acidosis challenge and for five days following may be beneficial throughout the entire feeding period as well.

Fanning (1999 Nebraska Beef Report pp. 41) showed steers fed Rumensin during the pre-challenge and recovery phases ate more meals/day when compared with steers receiving no dietary Rumensin. We observed steers fed Rumensin ate fewer meals/day during the pre-challenge and recovery phases when compared with steers receiving no dietary Rumensin. The ration used in our study could predispose steers more to acidosis due to its higher level of high moisture corn, which has a faster rate of fermentation compared to dry rolled corn. It would be possible that the steers receiving no dietary Rumensin may have altered their eating behavior to more meals/day, because during the acidosis challenge, they experienced severe cases of acidosis.

Feeding Rumensin at either 30 or 45g/ton reduced incidence of acidosis on the imposed challenge day. However, increasing dietary concentration to 45g/ton was required to reduce the incidence of acidosis during the five days following challenge. This would be beneficial after an event that disrupts the normal eating pattern of feedlot cattle. No adverse effects of switching the dietary Rumensin levels back to 30g/ton from 45g/ton six days after the imposed acidosis challenge were observed.

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