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EFFECT OF FEEDING RUMEN-PROTECTED LYSINE WITH DIFFERENT LEVELS OF SOYBEAN MEAL TO GROWING STEERS

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Summary

To test the efficacy of rumen-protected lysine and methionine, six steers (486 lb) were used in a 6 4 incomplete Latin square design and fed corn-urea diets (85% concentrate) alone or supplemented with 2 or 4% soybean meal to give dietary crude protein levels of 12.5, 13.2, and 14.0% (as fed-basis). Each diet was fed with or without 5 g/day Smartamine-ML (rumen-protected lysine and methionine). Steers were fed to gain 2.6 lb/day. Nitrogen retention increased linearly, from 30.7 g/day (0% soy) to 35.5 g/day (4% soy) as the level of soybean meal and, thus, crude protein, increased in the diet. Suppl ementing steers with lysine had no effect on n itrogen retention. Total tract organic matter digestibility was similar for all treatments. No protein level lysine interaction occurred. We conclude that lysine was not the first limiting amino acid in the corn-urea-soybean meal diets used in this study.

(Key Words: Rumen-Protected Lysine, Soybean Meal, Steers.)

Introduction

Lysine often is identified as the amino acid most likely to be limiting in feedlot diets because cereal grains, especially corn, contain relatively low levels of lysine. A dietary deficiency of an essential amino acid will cause cattle to use metabolizable protein less efficiently. Rumen-protected amino acids may afford the opportunity to correct amino acid deficiencies without having to increase the quantity of metabolizable protein. Alternately, it may be possible to decrease protein levels while still maintaining current levels of performance. Thus, our objectives were to investigate whether we could supplement steers with rumen-protected lysine to 1) increase steer nitrogen balance at a given level of dietary protein or 2) feed lower levels of crude protein without compromising performance.

Experimental Procedures

We used six steers (5 Hereford and 1 Angus; 486 lb average body weight) implanted with Compudosefi 200 (25.7 mg estradiol; Elanco Animal Health). Steers were housed in an environmentally controlled room (constant temperature, humidity, and lighting) in metabolism crates. We collected all feces and urine excreted. By subtracting nitrogen excreted in the urine and feces from nitrogen intake, we calculated nitrogen retained in the body. Steers were adapted to a high grain diet before the start of the first experimental period. The experiment was designed as a 6 4 incomplete Latin square. Each of the four 14-day periods contained a 9-day adaptation phase followed by a 5-day collection phase. Six dietary treatments (arranged in a 3 2 factorial structure) were evaluated: three levels of crude protein (the basal corn-urea diet alone or supplemented with 2 or 4% soybean meal), each level with and without 5 g/day of Smartamine-MLfi (Rh ne-Poulenc), which provided 2.5 and .75 g of rumen-protected lysine and methionine, respectively. Dietary compositions of the three crude protein level treatments are given in Table 1. Feed intake was programmed to achieve an average daily gain (ADG) of 2.6 lb/day. Feed allocated to each steer was fed in equal portions twice daily (7 AM and 7 PM). Feed allocations were adjusted for projected changes i n body weight at the start of each new period.

Results and Discussion

No interaction occurred between level of dietary crude protein and rumen-protected lysine. Therefore, results of only the main effects are presented in Table 2. Retained nitrogen increased linearly (P=.12) as crude protein level increased via the addition of soybean meal. If we assume that live weight gain contained 18% protein, retained nitrogen values translate into gains of 2.35, 2.57, and 2.71 lb/day for the 0, 2, and 4% soybean meal levels, respectively. The increase in gain with dietary crude protein level resulted in better feed efficiencies, because feed intakes were similar, by design, between treatments. Thus, even though ration cost increased as more soybean meal was fed, economic return increased as well, making the 4% soybean meal ration the most profitable in this study.

Adding rumen-protected lysine had no effect on nitrogen balance. Surprisingly, even adding lysine to the diet containing only urea as a protein source did not enhance nitrogen retention. Possibly, those diets were not deficient in lysine. However, it is more probable that other amino acids may have been co-limiting with lysine, thereby inhibiting use of the supplemented lysine by body tissues. In a related study reported in this publication (previous paper), supplementing Holstein steers with a mixture of six amino acids increased nitrogen balance. Because the dietary regimen was very similar to that of the corn-urea diet in the present study, we expect that the same amino acids would have been limiting in both studies. The lack of response to lysine on its own suggests that one or more of the other amino acids were also limiting in the basal diet. Consequently, feeding rumen-protected lysine or lowering dietary crude protein level had no benefit in this study.

Table 1. Composition of Experimental Diets [1] Containing Three Different Levels of Soybean Meal Fed to Steers

	Level of Soybean Meal (%)		
Item	0	2	4
Ingredient	% (dry matter basis)		
Rolled corn	79.65	77.47	75.29
Alfalfa	15.39	15.39	15.39
Soybean meal	--	2.18	4.36
Urea	.90	.90	.90
Rumensin premix [2]	2.11	2.11	2.11
Trace mineral salt [3]	.50	.50	.50
Limestone	1.20	1.20	1.20
Dicalcium phosphate	.20	.20	.20
Vitamin ADE premix [4]	.05	.05	.05
Composition			
Organic matter	95.1	95.1	94.9
Crude protein	14.0	14.8	15.7
Calcium	.73	.73	.74
Phosphorus	.36	.37	.38
Potassium	.57	.61	.65
	Mcal/lb		
NEm	.92	.92	.92
NEg	.62	.62	.62

[1]Each diet was fed with or without 5 g/d Smartamine-ML (rumen-protected lysine) . [2]Contained (as-fed) 94.7% ground milo, 3.0% molasses, 1.4 % Rumensinfi 80, and .9% Tylanfi 40, to provide 275 mg monensin/hd/d and 90 mg tylosin/hd/d . [3]Composition (%): NaCl (95 to 99); Mn (> .24); Cu (> .032); Zn (> .032); I (> .007); Co (> .004). [4]Provided 1,000 IU of vitamin A, 500 IU of vitamin D, and 3 IU of vitamin E/lb of diet.

Table 2. Nitrogen Balance of Steers Fed a Corn-Urea Diet with Three Levels of Soybean Meal with or without Rumen-Protected Amino Acids

	Soybean Meal				Smartamine-ML[a]		
Item	0%	2%	4%	SEM	0 g/day	5 g/day	SEM
Nitrogen, g/day							
Intake	106.4	111.8	120.4	3.8	113.8	111.9	3.1
Fecal	29.5	29.0	30.5	1.1	29.7	29.7	.9
Urine	46.2	49.2	54.4	2.5	49.7	50.2	2.0
Retained[b]	30.7	33.6	35.5	2.0	34.4	32.1	1.7
Digestibility, %							
Dry matter	77.3	78.5	78.3	1.2	79.2	76.9	1.0
Organic matter	78.1	79.5	79.1	1.2	80.0	77.8	1.0

[a]Supplied 2.5 g/day lysine and .75 g/day methionine.
[b]Linear response of nitrogen retention to level of soybean meal (P=.12).