Rumensin and Protein Bypass in Steers

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Story in Brief

Four 1100 lb Hereford steers equipped with ruminal and abomasal cannulas were fed a rolled corn 16 percent protein ration with or without monensin (30 g per ton) added. Monensin increased ruminal bypass of feed protein by 22 percent while microbial protein production was unchanged. Ruminal dry matter disappearance was reduced 16 percent with monensin addition. This "protein sparing" action of monensin should prove most useful for young steers fed rations marginal in protein.

Introduction

The "protein sparing" action of monensin (Rumensin) may be the result of propionate sparing certain amino acids, increased microbial protein production, enhanced bypass of high quality protein, increased digestibility of dietary protein or similar effects of added monensin and protein on nutrient digestibility. Monensin feeding increases propionate production (Richardson *et al.*, 1974). Since propionate is used for glucose synthesis (Leng *et al.*, 1967), this spares some glucose-yielding amino acids. Protein digestibility was increased 4 percent with monensin addition to a high concentrate diet (Thornton *et al.*, 1978).

Work from Nebraska (Poos, personal communication) indicated that monensin decreases microbial protein production in the rumen but increases bypass of protein to the lower gastrointestinal tract. The objective of this study, which was previously reported in abstract form (Owens *et al.*, 1978), was to determine the influence of monensin on ruminal protein digestion and microbial protein synthesis.

Materials and Methods

Four 1100 lb steers equipped with ruminal and abomasal cannulas were fed an 80 percent concentrate high protein ration (Table 1) with and without monensin in a crossover design. The steers were fed 6.6 lb of feed twice daily during the first four days of each period. To stabilize non-ammonia nitrogen passage, 500 g of the ration was fed manually every 2 hr the last three days of each period. Polyethylene glycol (75 g) and chromic oxide (30 g) were fed to each steer daily as flow rate markers.

The ration analyzed 16 percent crude protein and 90 percent dry matter. The ration contained extra soybean meal so that differences in protein bypass might be more easily detected. Monensin was added to each day's ration at a rate equivalent to 30 g of monensin per ton of feed. Abomasal and ruminal samples were taken the last two days of each period. The abomasal samples were separated into liquid and solid fractions by centrifugation.

Results and Discussion

Ruminal dry matter digestion was 10 percentage units greater with monensin addition (Table 2). Rumen liquid turnover rates were slightly reduced (24 percent) with monensin feeding (Table 3). The molar percentage of propionate was increased (Table 4) while acetate and isovalerate were decreased with monensin supplementa-

Table 1. Ration composition.

Ration	%
Dry rolled corn	57.0
Dehydrated alfalfa	5.4
Cottonseed hulls	12.6
Soybean meal	19.0
Cane molasses	4.5
TM salt	.5
Ground limestone	.5
Dicalcium phosphate	.5
Urea	.1

Table 2. Ruminal dry matter digestion.

	Monensin	
Item	0	33
Dry matter, g/day		
Feed	5386	5386
Abomasal	2089	2628
Ruminal digestion, %	61	51

Table 3. Rumen turnover %/hr.

	Monensin	
Items	0	33
Liquid	7.4	5.6
Solids	4.9	5.0

Table 4. Ruminal VFA composition.

		Monensin
Item	0	33
Volatile fatty acid		
Total acid, mM	94.4	100.3
Acetate, molar %	62.2[c]	51.4[d]
Propionate	22.0[c]	36.1[d]
Butyrate	9.7	7.6
Isobutyrate	1.5	1.2
Valerate	1.1	1.3
Isovalerate	2.2[a]	1.4[b]
Acetate/propionate ratio	2.8[c]	1.5[d]
Non-glucogenic ratio	3.8[c]	1.9[d]

[ab]Statistically significant (P<.075).
[cd]Statistically significant (P<.05).

Table 5. Abomasal protein passage.

Item	Monensin 0	33
Feed N, g	138.0	138.0
Abomasal N, g	136.1	157.2
Bacterial N, g	51.2	53.5
Feed N, g	84.9	103.7

Table 6. Ruminal parameters.

Item	Monensin 0	33
Rumen		
Ammonia N (mg / %)	14.2	12.4
α-amino N (mM)	22.7	18.6
Soluble protein (mg/m1)	5.0	4.9

tion. Abomasal protein passage was 15.5 percent greater with monensin supplementation (Table 5). Microbial protein outflow from the rumen was unchanged by monensin. Increased bypass of feed protein accounted for all of the increase in abomasal protein passage.

Ruminal nitrogen parameters are given in Table 6. The trend for lower ruminal ammonia and alpha-amino nitrogen suggests that monensin was inhibiting some step in protein breakdown before amino acids were formed. Because monensin decreased protein breakdown in the rumen, it should prove more beneficial with rations marginal in protein as a previous feeding trial (Martin *et al*., 1977) indicated.

Literature Cited

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