SARSAPONIN LEVEL AND DIGESTION WITH HIGH CONCENTRATE DIETS

A.L. Goetsch[1], F.N. Owens[2] and B.E. Brown[3]

Story in Brief

Three dairy steers (196 lb) were fed 92 percent concentrate rolled milo based diets, at 2.5 percent of body weight to provide 0, 300 or 500 mg sarsaponin (S). All diets contained 200 mg Rumensin per head per day. Ruminal fluid passage rate increased while volume decreased with addition of S. Ruminal organic matter digestion decreased while postruminal disappearance of organic matter increased as level of dietary S increased. Duodenal flows of both total N and nitrogen of feed origin were elevated by dietary S. Likewise, disappearance of feed nitrogen in the rumen decreased while nitrogen disappearance in the small intestine increased linearly with increasing dietary S level. In this study, sarsaponin shifted protein digestion of high concentrate, rolled milo based diet from the rumen to the intestines which could increase performance under certain feeding conditions.

Key Words: Sarsaponin, Digestion, Rumen, Protein Bypass.

Introduction

For lightweight feedlot animals, increasing ruminal protein bypass may be of benefit. Sarsaponin has been suggested to increase bypass of protein in moderately high concentrate feedlot diets (Zinn et al., 1983). However, with 50 percent concentrate rations, S tended to increase ruminal organic matter digestion (Goetsch and Owens, 1984). This trial investigated effects of S on digestion of a high concentrate, rolled milo diet, containing Rumensin.

Materials and Methods

Three cannulated dairy steer calves (196 lb) were fed the basal diet (Table 1) at 2.5 percent of body weight (dry matter basis) plus a special premix. Premixes were formulated and fed to supply daily to each animal: 200 mg Rumensin[4] (C), 200 mg Rumensin and 300 mg sarsaponin[5] (300) or 200 mg Rumensin and 500 mg sarsaponin (500). Periods lasted 21 days with sampling of feeds, duodenal and fecal materials on days 19 through 21. Digesta markers (CoEDTA, Yb-labeled forage) were used to determine passage rates. Samples were subjected to all or part of the following analyses: ammonia-nitrogen (NH_3-N), markers, dry matter, ash, nitrogen (N), starch, chromium, acid detergent fiber (ADF) and nucleic acid-N.

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[1]Former Research Associate [2]Professor [3]Lab Technician
[4]Eli Lilly, Greenfield, IN 46140.
[5]Chemical name for Sevarin, Distributors Processing Inc., 17656 Ave 168, Porterville, CA 93257.

Table 1. Basal diet composition.

Ingredient	% of dry matter
Rolled milo	86.49
Cottonseed hulls	5.00
Chopped alfalfa	3.00
Cane molasses	2.00
Ammonium sulfate	.10
Potassium chloride	.10
Urea	.90
Dicalcium phosphate	.66
Limestone	.95
Trace mineralized salt	.50
Chromic oxide	.30

Results and Discussion

Ruminal NH_3-N concentration decreased linearly with increasing S level at 11 hours postfeeding (8.6, 7.5 and 5.9 mg NH_3-N/dl for C, 300 and 500 steers, respectively). It has been suggested that S depresses ruminal urease activity. Urea influx from the blood into the rumen would be expected to be highest at later periods in the feeding cycle. These data support the concept that S affects ruminal wall transfer of urea, possibly through slowing urea hydrolysis and thereby reducing the concentration gradient of urea between the rumen lumen and bloodstream.

Increasing S linearly increased ruminal fluid passage rate and decreased volume markedly (Table 2). Fluid passage rate and ruminal volume were negatively related (r=-.90). Particulate passage rate was tended to increase with addition of S to the diet (Table 2).

Table 2. Digesta kinetics.

Item	Treatment		
	0	300	500
Ruminal fluid dilution rate, %/h	6.7	7.6	9.7
Ruminal fluid volume, liters	29.2	21.1	18.6
Particulate passage rate, %/h	4.6	6.4	5.6

Organic matter (OM) digestion linearly decreased in the rumen and increased in the small intestine with increasing S (Table 3). Hindgut OM digestion tended to decrease with increasing S so that total tract OM digestion was similar for all treatments. Ruminal fluid dilution rate may be a reflection of altered ruminal OM digestion. With high concentrate diets in which ruminal fill does not limit intake, changes in transient volume of undigested material in the rumen could affect dilution rate. As digestion was decreased with S, undigested material might stimulate greater ruminal motility, accelerate ruminal passage rate and decrease ruminal fluid volume. Soluble fluid markers used to estimate fluid dilution rate, however, describe kinetics of total

Table 3. Digestion measures.

Item	Treatment 0	300	500
Organic matter digestion, % of intake			
Ruminal, true	57.9	51.3	45.9
Small intestinal	10.5	16.1	28.4
Hindgut	8.2	5.6	0
Total	76.6	73.0	74.2
Starch digestion, % of intake			
Ruminal	69.4	69.6	58.5
Small intestinal	11.2	11.2	27.9
Hindgut	5.6	4.3	-1.0
Total	86.2	85.2	85.4
Total acid detergent fiber digestion, % of intake	23.5	30.7	31.7
Nitrogen, g/day			
Intake	44.9	44.8	45.0
Duodenal			
Total	40.9	55.0	58.7
Microbial	26.2	25.9	24.0
Feed	11.6	25.7	31.4
Ammonia	3.0	3.4	3.4
Fecal	9.0	12.6	10.9
Microbial efficiency, g microbial nitrogen/kg organic matter fermented	22.1	24.1	26.7

ruminal liquids and do not partition fluid into the amounts associated with particles or free in the rumen.

Ruminal starch digestion tended to be lowest and small intestinal starch disappearance tended to be greatest for 500 diet (Table 3). Total tract digestion of ADF tended to be greater for 300 and 500 diets (Table 3).

Entry of total N and feed N into the duodenum increased linearly with increasing S (Table 3) similar to a previous report by Zinn et al. (1983). Ruminal fluid dilution rate was related to duodenal passage of N. Ruminal and small intestinal N disappearance varied linearly with S level and microbial efficiency tended to increase with increasing S level. The decrease in ruminal OM digestion increased microbial efficiency and protein bypass may be due to the large reduction (36 percent) in rumen volume with 500 S. Sarsaponin shifted site of N disappearance in the presence of an ionophore. Hence, sarsaponin must act differently from or in addition to the ionophore used in this study. However, in feeding studies an interaction between Sarsaponin and ionophores might be detected as both could improve protein status of cattle but alter ruminal volume or passage in opposite directions.

Literature Cited

Goetsch, A.L. and F.N. Owens. 1984. Sarsaponin and site of digestion and passage rates in dairy cows. Okla. Agr. Exp. Sta. Res. Rep. MP-116:79.

Zinn, R.A., et al. 1983. Salinomycin influence on characateristics of rumen fermentation and site and extent of digestion. California Feeders Day Report p. 74.