DUODENAL DOSES OF CASEIN OR GLUCOSE AND RUMINAL FLUID PASSAGE RATE

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Story in Brief

To study the impact of supply of protein to the small intestine on passage of material from the rumen, two dairy calves (364 lb) were fed an 80 percent concentrate diet at 1.8 percent of body weight and were dosed with hydrolyzed casein or glucose into the duodenum twice daily. Ruminal fluid dilution rate outflow and volume were slightly greater with glucose administration to the duodenum.

Key Words: Protein, Ruminal Passage Rate, Rumen Volume.

Introduction

In an earlier report (Goetsch et al., 1985) protein supplementation of a marginal protein diet decreased ruminal digestion of the dietary protein. Such an effect could be due to changes either in the rumen directly or by postruminal feedback to the rumen. Perhaps, increasing the amino acid supply to the small intestine could speed flow of digesta from the rumen. This study was designed to examine the effect of duodenal administration of casein hydrolysate or glucose on ruminal fluid kinetics.

Materials and Methods

In this pilot study, two dairy steer calves (364 lb) were used in a a crossover design with two 14 day periods. Steers were fed an 80 percent concentrate diet (Table 1) twice daily at 12 hour intervals at a level of 1.8 percent of body weight. The diet contained 11.1 percent crude protein on a dry matter basis.

Table 1. Diet composition.

Ingredient	% of dry matter
Ground corn	75.0
Prairie hay	20.0
Urea	1.6
Dicalcium phosphate	.5
Limestone	.94
Molasses	1.96

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Steers were dosed with casein hydrolysate or glucose solutions two hours before each meal. Each dose consisted of 65 or 70 ml volume of fluid. With casein hydrolysate, this provided additional crude protein equal to 10 percent of the daily N intake or about 33 grams of casein. The amount of glucose was equal in weight of dry matter. Ruminal samples were obtained at various times after dosing a water soluble marker. Fluid passage rate, volume and outflow rate were calculated from concentration of this marker in rumen samples.

Results and Discussion

Ruminal fluid dilution rate, volume and outflow were 14, 21 and 38 percent greater with duodenal doses of glucose than of casein (Table 2). The diet should have been adequate to support ruminal fermentation though lower than needed for a rapid growth rate. Based on the earlier study, we had reasoned that an improved amino acid status in the intestine might have an influence on ruminal function via hormonal or neural paths and increase ruminal motility or emptying. Results from this study were opposite to that expected and suggest that the added amino acid supply to the small intestine slowed flow of liquid from the rumen or that glucose administration increased flow.

Table 2. Ruminal fluid kinetics.

	Treatment	
Item	Casein	Glucose
Fluid passage rate, %/h	8.48	9.65
Rumen volume, liters	18.53	22.33
Rumen outflow, liter/h	1.57	2.16

An increased energy to protein ratio in duodenal digesta from infused glucose may have signaled the rumen to enhance fluid passage from the rumen in order to 1) increase the amount of protein from feed which would escape from ruminal destruction, 2) increase ruminal outflow of microbial protein or 3) increase rumen microbial efficiency. Each of these could increase protein supply and depress the ratio of energy to protein in duodenal digesta. Conversely, infused casein hydrolysate would depress the energy:protein ratio in the intestines and could signal the rumen to hold materials longer. With high grain diets, particle size may limit intestinal utilization of starch. A longer ruminal retention time usually increases the quantity of energy liberated in the rumen and in the total digestive tract. Ruminal volume and passage rates may be controlled to regulate site of digestion of energy and protein. These results warrant further exploration of the influences of body energy:protein status on rumen function and suggest that bypassed nutrients might be employed commercially to influence retention time and site of digestion by ruminant animals.

Literature Cited

Goetsch, A.L. and F.N. Owens. 1985. Nitrogen source and digestion in dairy cows. Okla. Agr. Exp. Sta. Res. Rep. MP-117: