DUODENALLY INFUSED CASEIN OR UREA-GLUCOSE FOR STEERS FED A HIGH CONCENTRATE DIET

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Story in Brief

The influence of post-ruminal protein on feed intake of eight crossbred steers (784 lb) with ruminal, duodenal and ileal (T-type) cannulas was studied. Steers received duodenal infusions (4 doses/day; 750 ml at 8:30 am, 12:30 pm, 4:30 pm and 8:30 pm) of either casein or urea-glucose solutions both mixed with a B-vitamin complex. Animals had free choice access to an 80% corn-soybean-cottonseed hull concentrate diet; feed intake was measured daily throughout the 57-day trial. Steers infused with the urea-glucose mixture, tended to eat more feed (17.3 vs 15.0 lb/day) drink more water (7.2 vs 6.3 gal/day) and have higher ruminal dry matter digestibility (52 vs 47%) than steers infused the casein. Composition of nutrients infused post-ruminally may alter ruminal function and site of digestion. Daily gain of steers also tended to be greater (3.3 vs 2.66 lb) with post-ruminal urea-glucose than post-ruminal casein. These results suggest that benefits attributed to increased escape protein with adequate protein diets may be due to an increased supply of glucogenic materials.

(Key Words: Beef Cattle, Duodenal Infusions, Protein.)

Introduction

Understanding the role that ingested nutrients play in controlling feed intake in ruminants under confined-feeding operations may improve economics of production. In general rate of gain increases as the level of feed intake increases; therefore if feed intake increases, rate and efficiency of gain are improved. Amino acid imbalance or B-vitamin deficiencies can reduce feed intake in non-ruminant animals. Effects of supplementation of these nutrients on feed intake in beef cattle fed high grain diets have not been examined. Most feed intake studies have been conducted with sheep or goats fed high or all-forage diets. Data presented by Egan and Moir (1965)

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Table 2. Composition of casein and urea-glucose solutions infused per duodenum to beef steers.

	Daily dose per animal (g DM)	
	Solutions	
Item	1	2
Casein	294.0	-
Urea	-	92.5
Glucose	-	319.7
DL methionine	3.0	-
Sodium bicarbonate	16.0	16.0
Water (liters)	3.0	3.0

Calculated analysis:

Item	Casein	Urea	Glucose
DM, %	91.0	99.0	95.0
N, %	14.2	46.0	-
CP, %	89.0	288.0	-
DE, Mcal/kg[b]	3.9	-	3.7

[a] Steers were dosed with 750 ml of either the casein or the urea-glucose solution four times daily.

[b] Estimated (Nurient requirements of swine, NRC 1988).

duodenal digesta and fecal grab samples were collected (8:00 am, 12:00 pm and 8:00 pm) on day 14 and 15 of each experimental period. Ruminal fluid pH was recorded immediately and individual samples were acidified for later ammonia-N (NH_3-N) analysis. Duodenal, fecal grab samples and an aliquot of ruminal fluid within each animal and period were composited, dried and ground prior to chromic oxide determinations.

Total ruminal contents were removed mechanically on day 16 of each period to measure total rumen liquid volume, ruminal dry matter and density of the fluid. Amounts of free liquid, and the association of the fluid with solids (bound liquid) in the rumen were calculated.

Data were analyzed including animal, period and treatment as variables. In addition, data from ruminal and duodenal pH and NH_3-N were analyzed as repeated measures using the treatment x animal x period interaction as the main plot error term. Means were compared using least squares procedures.

Table 4. Effect of duodenally infused casein or urea-glucose mixtures on feed and water intake and ruminal parameters in beef steers fed a high concentrate diet (n=8).

	Treatments		
	Casein	Urea-glucose	SE
Intake:			
Feed, lb DM/day	15.0[a]	17.3[b]	.64
Water, gallons/day	6.3[c]	7.2[d]	.32
Rumen contents:			
Total contents, lb	55.0	58.0	4.14
Ruminal DM, %	13.9[a]	16.7[b]	.54
pH	6.1	5.9	.02
Liquid:			
Total volume, gallons	5.7	5.8	.38
Free, gallons	4.4[a]	3.7[b]	.17
Bound to feed, gallons	1.3[c]	2.0[d]	.27
Solids:			
Total solids, lb	7.6	10.1	1.01

[a,b] Means in the same row with different superscript differ ($P<.05$).
[c,d] Means in the same row with different superscript differ ($P<.10$).

ruminal NH_3-N levels found in our study, suggest that microbial degradation of the soluble portion of the feed protein was large or that recycling was extensive.

Total tract DM digestibility was not altered by type of solution infused (69 vs 70%) but animals receiving the urea-glucose mixture had higher (52 vs 47%, $P<.01$) ruminal DM digestibility (Table 5). Results from this study indicate that post-ruminal infusions of urea-glucose increased voluntary feed intake more than infusions of casein. The urea-glucose mixture increased extent of ruminal digestion. The fact that intake was not greater with casein than urea plus glucose imply that postruminal supply of amino acids was not limiting feed intake with these steers gaining 2.9 lb/day when fed this diet. Steers consumed an average of 903 g daily of dietary crude protein compared to an estimated need (NRC, 1984) of 917 g, so the greater response to urea-glucose than casein is surprising. Benefits ascribed to increased escape protein with higher feed intake of a concentrate diet may be due to an increased supply of glucogenic material, not to the amino acids themselves.

Literature Cited

Egan, A.R. and R.J. Moir. 1965. Nutritional status and intake regulation in sheep. I.- Effect of duodenally infused single doses of casein, urea, and propionate upon voluntary intake of low-protein roughage by sheep. Aust. J. Agric. Res. 16:437-439.

Johnson, A.B. et al. 1980. Postruminal protein for growing steers. Okla. Agr. Exp. Sta. Res. Rep. MP-107:120.

MacLeod, N.A. et al. 1982. Intragastric infusions of nutrients in cattle. Br. J. Nutr. 47:547.

NRC. 1984. Nutrient requirements of beef cattle. National Research Council. Washington D.C.

NRC. 1988. Nutrient requirements of swine. National Research Council. Washington D.C.

Scott, R.R. and C.A. Hibberd. 1990. Incremental levels of supplemental ruminal degradable protein for beef cows fed low quality native grass hay. Okla. Agr. Exp. Sta. Res. Rep. MP-129:57.