Propylene Glycol and Feed Intake by Steers

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Story in Brief

Propylene glycol (PG), a compound which supplies glucose for tissues and is used to prevent ketosis, was added to a high concentrate diet for 14 finishing steers. Feed intake over 3 weeks was reduced by 36 percent and gain by 93 percent with the addition of 5 percent PG. In another trial, PG and other glucose and non-glucose forming compounds were fed to nonruminant animals (rats) at levels up to 20 percent of their diet. Feeding propylene glycol, triacetin, tributyrin, glucose or corn oil for one week had little effect on feed intake. However, feeding 14 percent acetic acid, a compound not used to form glucose, increased intake by 37 percent. Intake has not been depressed at PG levels over 15 percent in diets of dairy cows and nonruminant animals. Results suggest that supply of glucose-producing compounds like propionate limit feed intake of steers fed high concentrate rations.

Introduction

For treatment of ketosis of dairy cows, it is common to feed propylene glycol (PG), a compound which, like propionate, is used by the liver to form glucose. Some work has suggested that PG fed to dairy cows at 6 percent of the concentrate ration helps in prevention of ketosis, and a level of 9 percent is not detrimental. This experiment was conducted to determine the effect of this glucose-forming compound on feed intake of rats and steers.

Materials and Methods

Fourteen steers (mean weight 864 lb) in individual pens were fed a diet containing 89 percent whole shelled corn, 5 percent cottonseed hulls and 6 percent pelleted supplement, primarily soybean meal, with or without addition of 5 percent PG (industrial grade) for 21 days. Feed was available at all times, and PG was added each day to the new feed. Treatments were rotated and feed intake again was measured for 21 days. Feed intake the final 10 days of each period was used for calculations to remove the time period of adaptation to the diet. Steers were weighed on 2 consecutive days at the start and end of each period to calculate gain.

In another experiment, 56 rats (mean weight 325 g) were fed the diets shown in Table 1 over two periods. In each period, eight rats were fed diets containing either tributyrin (TB), propylene glycol (PG), triacetin (TA), acetic acid (AA), glucose (G) or corn oil (CO) as supplementary energy sources. All diets were formulated to be of equal digestible energy content and contain glycerol in amounts equivalent to the control diet (C). Bomb calorimetry was performed on all diets to determine gross energy content. Daily dry matter consumptions,

Table 1. Rat trial diet composition

Item	Diet[a]						
	C	TB	PG	TA	AA	G	CO
	% of dry matter						
Tributyrin		22.8					
Propylene glycol			21.4				
Glucose						24.2	
Triacetin				16.9			
Acetic acid					15.6		
Glycerol	5.9		5.7		5.7	5.8	5.7
Corn oil							11.6
Ground corn and SBM mixture	86.7	57.8	59.9	72.9	72.9	68.3	66.6
Polyethylene	5.7	17.8	11.4	8.5	4.1		14.5
Gross energy, kcal/g	4.1	3.9	3.6	4.5	4.0	4.2	4.2

[a]Diets included .6% vitamin mix and 1.1% mineral mix.

expressed as a percentage of each rat's average weight, were measured the final 5 days of each 14-day period.

Results and Discussion

Feed intake of these feedlot steers was decreased by 36 percent, and gain was decreased by 93 percent with addition of 5 percent PG to the diet. Dairy cows have been fed rations with 9 percent of the concentrate portion of their ration being PG. This was fed with oat silage so that 3.5 percent of dietary dry matter was PG. Intake was reduced by only 8 percent (Fisher et al., 1973). Levels up to 16 percent PG have not depressed intake of dairy cows (Emery, 1964). Propionate production in the rumen may be lower with the higher roughage diets normally fed to dairy cows than high concentrate diets usually fed to feedlot steers. The rat trial responses (Table 3) indicate no effect on intake of supplementary ketone-forming triglycerides (TB, TA) or corn oil. Even though the intake of the PG-fed rats was elevated 12 percent above the C-fed rats, the gross energy content of the PG diet was 12 percent less than the control diet, suggesting little effect by PG on energy intake. Glucose, as well, had little effect on feed intake. A 37 percent increase in intake was noted for rats fed acetic acid, a compound used for fat synthesis. However, a portion of this response may be due to slow evaporation of acetic acid from the diet in the feeders. An increase in intake with acetic acid is impressive considering its odor. This change might be expected if synthesis of fat from glucose is related to mechanisms which control feed intake.

Table 2. Intake and gain by steers

Item	Propylene glycol, %	
	0	5
Dry matter intake, lb	18.5[a]	11.7[b]
Daily gain, lb	4.45[a]	.29[b]

[ab]Means in a row with different superscripts differ statistically ($P<.05$).

Table 3. Rat trial dry matter consumption

Diet	Added energy source	Daily dry matter consumed as % of average rat wt
C	Glycerol	4.88[c]
TB	Tributyrin	4.60[c]
PG	Propylene glycol	5.47[b]
TA	Triacetin	4.92[bc]
AA	Acetic acid	6.56[a]
G	Glucose	4.84[c]
CO	Corn oil	4.40[c]

[abc]Means with different superscripts differ statistically ($P<.05$).

Species and diet differences suggest that supply of glucose-producing compounds may control intake of feedlot steers. Methods are under study to decrease propionate production and increase rate of metabolism of propionate in order to increase energy intake of feedlot steers.

Literature Cited

Emery, R. S. 1964. J. Dairy Sci. 47:1074.
Fisher, L. J. et al. 1973. Can. J. Anim. Sci. 53:289.