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Abstract

Tylosin feeding prevented the increase in Fusobacterium necrophorum population normally associated with the feeding of a high-grain diet. Also, tylosin appeared to moderate the ruminal fermentation during initial adaptation to a high-grain diet.

Keywords

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EFFECT OF TYLOSIN ON RUMINAL *FUSOBACTERIUM NECROPHORUM* POPULATION AND FERMENTATION PRODUCTS IN CATTLE FED A HIGH-GRAIN DIET

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Summary

Tylosin feeding prevented the increase in *Fusobacterium necrophorum* population normally associated with the feeding of a high-grain diet. Also, tylosin appeared to moderate the ruminal fermentation during initial adaptation to a high-grain diet.

(Key Words:Tylosin, *Fusobacterium necrophorum*, High-Grain Diet.)

Introduction

Fusobacterium necrophorum, a normal inhabitant of the rumen, is the primary causative agent of liver abscesses in cattle. It has been detected in or isolated from bovine ruminal contents and ruminal wall lesions by a variety of methods. The concentration in the rumen is in the range of 100,000 to a 1,000,000 cells per gram of ruminal contents.

Tylosin is used widely in the feedlot industry to prevent liver abscesses. The antibiotic is a macrolide and is primarily effective against gram-positive bacteria. Although, *F. necrophorum* is gram-negative, it is susceptible to tylosin. However, the effect of feeding tylosin on the population of *F. necrophorum* in the rumen has not been determined. Also, the antimicrobial activity of tylosin could moderate the rate of ruminal fermentation and, thus, contribute to a stable fermentation. Therefore, a study was conducted to determine the effect of dietary tylosin on the concentration of *F. necrophorum* and fermentation products in the rumen during adaptation to a high-grain diet.

Experimental Procedures

Six ruminally cannulated Holstein steers were used in a crossover design to determine the effect of tylosin on *F. necrophorum* counts in ruminal contents. Treatment groups were control and tylosin-fed (90 mg/head/day). Steers were adapted initially to an alfalfa hay diet and then stepped up rapidly (4-day step up) to an 85% grain diet. Steers were fed a 70% grain diet on days 1 to 3 and an 85% grain diet from days 4 to 32. The intention of rapid step-up was to promote lactic acid production and accumulation in the rumen. The grain portion of the diet was composed of cracked corn (87.8%); soybean meal (10.5%); salt (1.0%); dicalcium phosphate (0.3%); trace mineral mixture (0.2%); and vitamins A, D, and E (0.1%). Steers were fed daily at 2% of BW.

Ruminal contents were collected on 3 consecutive days before grain feeding (days -2, -1, and 0); after feeding the 70% grain diet (days 2, 3, and 4) and 85% grain diet (days 5, 6, and 7); and thereafter on 2 consecutive days weekly for 4 weeks. Ruminal samples were

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collected before feeding (time 0), transported to the laboratory, and processed for enumeration of *F. necrophorum* and analyses of pH and concentrations of lactate, volatile fatty acids (VFA), and ammonia. Also, on days 1 (70% grain diet) and 4 and 11 (85% grain diet), ruminal samples were collected at feeding and 3, 6, 9, 12, and 24 hours after feeding to monitor the effect of tylosin on postfeeding feeding ruminal fermentation products. *F. necrophorum* was counted by the most-probable-number (MPN) technique using a selective culture medium.

Results and Discussion

Before grain feeding, *F. necrophorum* counts in ruminal contents averaged 8.8 and 10.0 x 10^5/g DM in the control and tylosin-fed groups, respectively. In the control, *F. necrophorum* counts increased in response to grain feeding (Table 1), possibly because of availability of lactate, an energy substrate for *F. necrophorum.* The increase peaked at week 2, and counts decreased somewhat following adaptation to the 85% grain diet. Including tylosin in the diet inhibited the increase in *F. necrophorum* associated with increased grain feeding. The counts throughout the grain feeding period remained similar to or less than the baseline counts during alfalfa feeding. Apparently, feeding tylosin did not induce resistance in *F. necrophorum,* because counts did not increase during the feeding period.

We observed a trend (P=0.08) for ruminal pH to be higher in tylosin-fed than in control steers during the initial step-up to the 70 and 85% grain diets. Once the steers were adapted to the 85% grain diet, ruminal pH was similar between both groups. Ruminal lactate VFA and ammonia concentrations were not affected by including tylosin in the feed (Table 2). A 24-hour profile of ruminal fermentation products was obtained on days 1, 4, and 11 to determine whether tylosin moderates ruminal fermentation. On day 1, when steers were switched abruptly to the 70% grain diet, the postfeeding ruminal pH and concentrations of fermentation products were not affected by tylosin (data not shown). However, on days 4 and 11, ruminal pH tended to be higher in tylosin-fed than in control steers (Figure 1). The postfeeding concentrations of ruminal VFA, lactate, and ammonia were not affected by tylosin in the feed.

Table 1. Effect of Tylosin on Ruminal *Fusobacterium necrophorum*[abc]

		Most-Probable Number x 10^5/g DM	
Diet	Sampling Days	Control	Tylosin
70% grain	2 to 4	27.5	10.7
85% grain	5 to 7	35.5	5.5
	11	56.0	4.1[d]
	18	23.3	2.5[d]
	25	32.7	5.8
	32	26.9	3.0[d]
SEM		1.4	

[a]Treatment effect P < .01.
[b]Sampling days effect P = 0.06.
[c]Treatment x sampling days interaction P = .09.
[d]Different from days 1 to 3 at P < .05.

Table 2. Effect of Tylosin on Ruminal Fermentation Products

Grain		pH[abc]		Lactate, mM		Total VFA, mM		Ammonia, mM	
Diet	Days	Control	Tylosin	Control	Tylosin	Control	Tylosin	Control	Tylosin
70%	2 to 4	6.18	6.43	0.03	0.02	87.3	85.5	0.7	0.7
85%	5 to 7	6.04	6.38	0.03	0.14	84.7	75.6	0.7	0.9
	11	6.08	6.53	0.16	0.10	71.4	73.0	0.7	0.8
	18	6.34	6.51	0.03	0.03	79.9	71.4	1.0	1.1
	25	6.60	6.53	0.03	0.03	77.8	78.6	0.7	0.8
	32	6.48	6.34	0.10	0.02	73.5	84.2	0.5	0.4
SEM		0.12		0.06		5.8		0.2	

[a]Treatment effect, P = 0.09.
[b]Sampling days effect, P < 0.05.
[c]Treatment * sampling days interaction, P < 0.05.

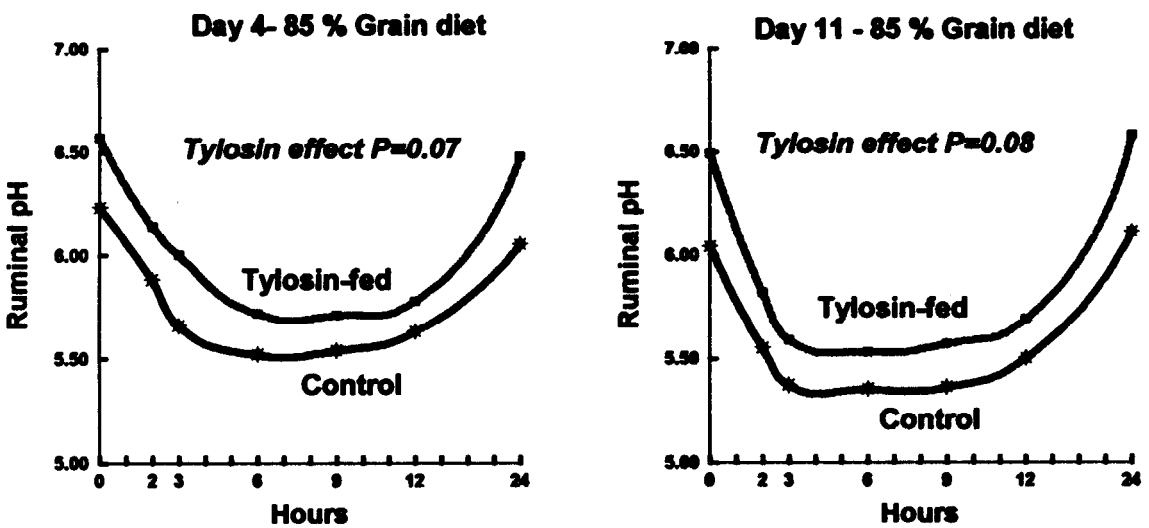

Figure 1. Ruminal pH Profile on Days 4 and 11 in Steers Fed High-Grain Diets with or without Tylosin.