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EFFECT OF RUMINAL INFUSION OF OXIDIZED FAT AND AGRADO™ ON THE RUMINAL AND FECAL POPULATIONS OF COLIFORMS AND LACTOBACILLI

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Story in Brief

Previous experiments with swine and poultry have indicated that feeding oxidized fat can increase the intestinal prevalence of coliforms relative to lactobacilli and that feeding an antioxidant can prevent this change. To examine whether oxidized fat or Agrado™ , an antioxidant, altered coliform populations in the rumen or feces of steers, nine ruminally cannulated heifers (974 lb) fed a concentrate finishing diet were randomly assigned to several treatments. Two served as controls and received no oxidized fat. Seven heifers received daily ruminal infusions of 150 ml oxidized fat from d 4 to 19 of the trial. On d 11, three of the heifers receiving oxidized fat and one of the control heifers received 1.2 ml of Agrado™ infused ruminally. Every second day, rumen and fecal samples were obtained and total coliforms and lactobacilli were enumerated. No statistical changes in microbial populations were detected from oxidized fat dosing or antioxidant feeding though ratios of coliforms to lactobacilli were much greater in fecal than ruminal samples.

Key Words: Coliforms, Lactobacilli, Oxidized Fat, Antioxidant, Beef Cattle

Introduction

Consumption of inadequately cooked ground beef containing one strain of *E. coli* found in feces and ruminal contents has been implicated in human disorders and deaths. Diez-Gonzalez (1998) indicated that switching cattle from concentrate to hay-based diets decreased fecal counts of acid-resistant *E. coli*. Dibner et al. (1993) observed that feeding oxidized fat to birds increased the small intestinal population *E. coli* populations at the expense of lactobacilli. This population change was avoided when birds received 125 ppm dietary ethoxyquin, the active ingredient in Agrado™ . A later study with broilers and swine indicated that feeding of oxidized fats increased cell turnover of the intestinal mucosa (Dibner et al., 1996). Although the incidence of "sudden death" in feedlots has been correlated in time with alterations in fat source and level, effects of feeding oxidized fat and antioxidants on ruminal and fecal populations of microbes have not been examined with ruminants. The objective of this experiment was to determine if dosing cattle with oxidized fat and an antioxidant would alter coliform and lactobacilli populations.

Materials and Methods

Nine cannulated heifers (974 lb) fed a finishing diet consisting of dry rolled corn (63.5%), dehydrated alfalfa pellets (6.05%), cotton seed hulls (14.15%), soybean meals 44% (10.1%) cane molasses (5.05%), ground limestone (.5%), dicalcium phosphate (.5%) and urea (.1%) were assigned randomly to several treatments. Two heifers received no oxidized fat and seven heifers received daily ruminal infusions of 150 ml of oxidized fat from d 4 to 19. From d 11 to 19, three of the seven heifers receiving oxidized fat and one of the control heifers received daily ruminal infusions of 1.2 ml of Agrado™ , an antioxidant. This is the equivalent of a dietary concentration of about 120 ppm.

To oxidize the fat, restaurant grease was held at 65° C and bubbled with oxygen for 7 d. It was maintained at 65° C in a crock-pot to keep it liquid for ruminal dosing. Ruminal and fecal samples were obtained from each animal every second or third day. Fecal samples were taken directly from the rectum to avoid contamination. Ruminal samples were collected into sterilized plastic tubes by putting the tubes inside the rumen via the cannula. The samples were kept in sterilized containers and refrigerated to 4° C within 1 h of sampling. Total coliform populations were enumerated using 3M Petrifilm. The lactic microbial populations were enumerated using the pour plate method with Difco Lactobacilli MRS agar. The ruminal fluid and fecal material samples were serially diluted (1:10) in 0.1% peptone water prior to plating. All samples were incubated for 48 h at 36° C before examination by the standard plate count method.

Data were analyzed within day as a completely randomized design using the GLM procedures of SAS (1988). Treatment was used as a class variable after the population counts were transformed using $\log_{10}$. Two comparisons were made: 1) control vs oxidized fat and 2) oxidized fat vs oxidized fat plus Agrado™ .

Results and Discussion

Mean values following the $\log_{10}$ transformation are presented in Table 1 and in Figures 1 and 2. Total coliform numbers were generally over 1,000 times (3 logs) greater in fecal than in ruminal samples. However, no statistical differences associated with dosing with oxidized fat ($P>.10$) that started on d 4 of the study were found in either coliform or lactic microbial populations, contrary to observations with poultry fed oxidized fat. Dosing Agrado™ into the rumen starting on d 11 of the study also failed to significantly alter the coliform population. Total counts were quite variable from day to day and from animal to animal, with certain animals having consistently lower coliform counts than other animals. This suggests that the number of cattle necessary to monitor dietary effects on ruminal and fecal coliform populations will need to be quite large.

Literature Cited

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Dibner J. J. et al. 1993. Arkansas Nutrition Conference. p 44.

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Table 1. *E. coli* and Lactics microbial populations among treatments (log_{10} scale).

Treatment	Agrado level (ml)			Day								
				1	3	5	8	10	12	15	17	19
Control	0	*E. coli*	Rumen	4.30	3.30	4.00	3.00	3.20	4.00	--	3.00	3.70
			Feces	6.00	7.96	7.91	6.00	6.60	4.48	6.48	3.74	4.30
		Lactics	Rumen	6.82	7.00	7.67	6.97	6.45	7.99	7.67	7.44	7.56
			Feces	4.69	7.23	6.46	5.64	6.64	5.64	5.05	5.98	5.50
	1.2	*E. coli*	Rumen	--	--	--	--	2.00	3.00	2.00	--	3.30
			Feces	6.00	6.65	6.42	7.82	7.57	6.90	6.40	6.49	6.70
		Lactics	Rumen	6.98	7.58	7.29	7.89	7.88	7.85	8.21	8.13	8.53
			Feces	7.00	8.96	9.11	8.07	8.70	8.81	8.94	8.34	6.48
Oxidized	0	*E. coli*	Rumen	2.11	2.65	2.68	2.70	2.61	3.21	3.00	1.92	3.08
fat			Feces	5.55	5.94	5.86	6.09	5.30	5.22	5.88	4.83	5.39
		Lactics	Rumen	7.26	7.73	7.38	6.81	7.29	7.64	6.98	7.68	7.57
			Feces	6.35	6.69	7.07	6.58	6.51	6.39	6.68	6.63	6.49
	1.2	*E. coli*	Rumen	1.78	2.29	2.66	2.49	2.52	3.71	2.85	3.37	3.00
			Feces	6.50	7.04	7.15	6.23	6.49	6.74	6.48	6.53	6.19
		Lactics	Rumen	7.09	7.63	7.32	7.54	7.63	7.64	7.85	8.00	7.94
			Feces	6.66	6.78	6.68	6.73	6.76	6.43	6.67	6.87	6.47

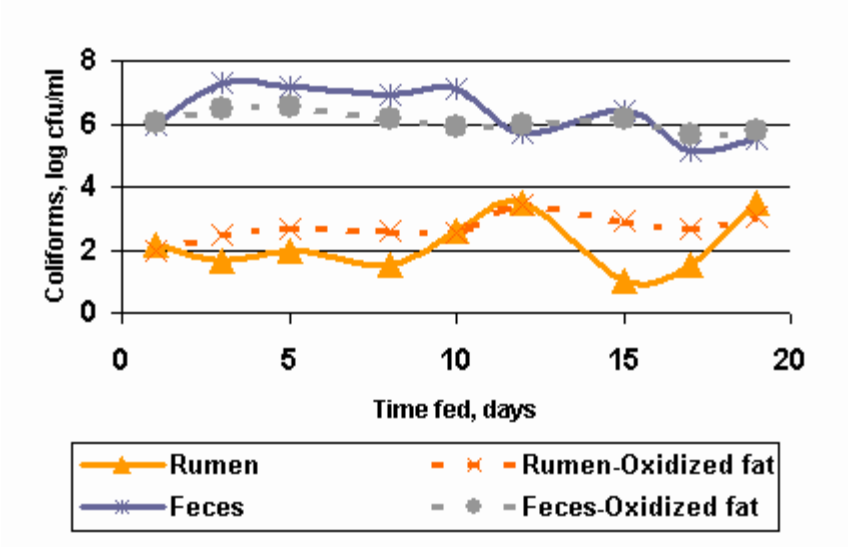

Figure 1. Effect of oxidized fat on coliform populations.

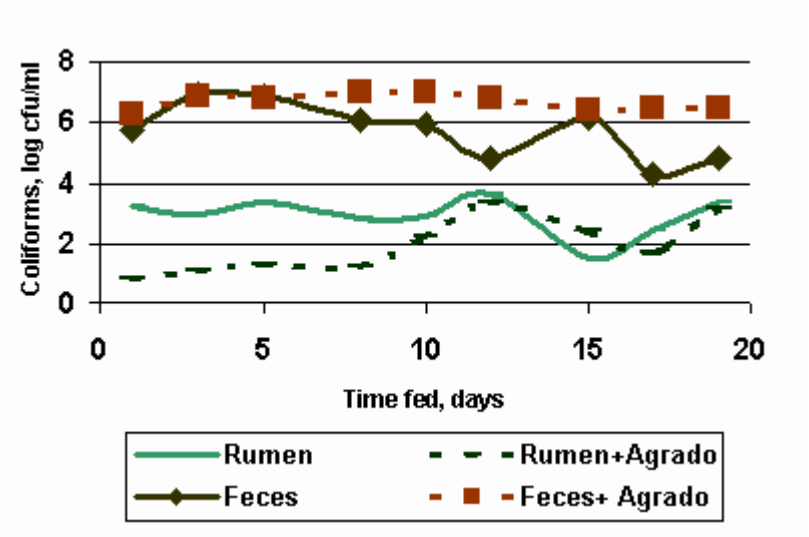

Figure 2. Effect of Agrado™ on coliform populations.

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