COBACTIN II FOR FEEDLOT STEERS

M.T. Van Koevering[1], D.S. Secrist[2] and F.N. Owens[3]

Story in Brief

Effects of Cobactin II supplementation were studied using eight steers (900 lb) fed a 92% concentrate diet and six steers (1200 lb) fed a 55% concentrate diet in 21-day crossover trials. With both diets, Cobactin II supplementation tended to increase dry matter intake (6.4 and 5.9%). Although digestibilities tended to be reduced, digestible dry matter intakes were increased slightly (2 and 3.8%, respectively). With the higher roughage diet, day-to-day variation in dry matter intake was reduced when Cobactin II was fed. In situ digestion of cellulose also tended to be reduced. Cobactin II-induced changes in ruminal concentrations and proportions of VFA, pH and ammonia were small for the roughage diet. In contrast, ruminal concentrations of propionate were reduced consistently when Cobactin II was fed with the high energy diet. Ammonia and branched chain VFA concentrations were consistently greater when Cobactin II was fed in both diets. These may reflect the increased number of ruminal protozoa noted in the ruminal samples from steers fed Cobactin II. Ruminal concentrations of lactate tended to be lower in the steers fed Cobactin II. Results indicate that feeding Cobactin II may improve performance by increasing intake of digestible energy and by increasing the protozoal population in the rumen.

(Key Words: Probiotics, Cobactin II, Protozoa.)

Introduction

Despite intense commercial interest in supplementing diets for ruminants with microbes (bacteria, yeasts), responses to the feeding of probiotics have been inconsistent. This may be attributed partly to the low doses of viable microbes, to insensitivity of the measurement procedures and to the overwhelming persistency of the microbial population innate to the rumen. Improvements in the strain selection and viability of inocula should enhance the potential to alter ruminal fermentation and thereby to enhance productive efficiency.

Cobactin II, produced by Bio Techniques Laboratories Inc., Redmond, WA, consists of *Lactobacillus acidophilus* BT1389. The objectives of this study were to examine the impact of daily supplementation with Cobactin II on

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[1]Research Associate [2]Graduate Assistant [3]Regents Professor

intake, digestion and ruminal fermentation by steers fed diets containing either 92 or 55% concentrate diets.

Materials and Methods

Animals and Diets: Eight ruminally cannulated Angus steers (900 lb) were used in a crossover design (four steers per treatment per period), with two 21-day treatment periods and 7 days between periods in the first experiment. Treatments consisted of a control (bacterial suspension media only) and $6x10^8$ colony forming units (cfu)/animal Cobactin II sprayed daily on the morning feeding. Steers were allowed ad libitum access to a high concentrate diet (Table 1) with no ionophores or antibiotics. Steers were allowed 14 days for adaptation to the control diet prior to initiation of treatments. Diets were fed twice daily; feed and water intakes were recorded daily.

In the second experiment, six ruminally and duodenally cannulated mature crossbred steers (1200 lb) were used in a crossover design (three steers per treatment per period), with two 21-day treatment periods and 14 days between periods. Treatments consisted of a control (bacterial suspension media only) and $1.1x10^9$ cfu/animal Cobactin II sprayed daily on to the morning feeding. Steers were allowed ad libitum access to a moderate energy diet (Table 1) with no ionophores or antibiotics present. Steers were allowed 14 days to adapt to the control diet prior to initiation of treatments. Feed and water intakes were recorded daily.

Table 1. Composition of diet dry matter.

Ingredient	Experiment 1[a] (%)	Experiment 2[b] (%)
Corn, rolled	73.30	41.11
Alfalfa hay, pelleted	0	20.00
Cotonseed hulls	8.00	25.00
Molasses, cane	5.42	4.00
Pelleted supplement	13.28	9.89

[a] Supplement composition: Soybean meal, 82.8%; calcium carbonate, 11.1%; urea, 3.46%; salt, 2.56%; vitamin A, 30,000 IU/animal/day. Calculated diet composition: 14.3% CP; 2.05 mcal NEm/kg; 1.30 mcal NEg/kg; .83% K; .75% Ca; .32% P.

[b] Supplement composition: Soybean meal, 83.4%; calcium carbonate, 8.39%; urea, 5.06%; salt, 3.03%; vitamin A, 30,000 IU/animal/day. Calculated diet composition: 12.6% CP; 1.48 mcal NEm/kg; .85 mcal NEg/kg; 1.0% K, .71% Ca, .24% P.

Rumen and Duodenal Sampling: In Exp. 1, ruminal samples were collected via cannula from each steer approximately one hour after the morning feeding on day 7, 14 and 21 of each period. In the second experiment, ruminal samples were collected on days 14 and 21. Duodenal samples in experiment two were obtained from each steer three times daily (8 hours apart) on days 14 and 21.

Digestibility: In Exp. 1, chromic oxide (an indigestible marker) was added via the rumen fistula on days 11 through 19. Fecal grab samples were obtained three times daily from each steer on days 19 and 20 of each period. Digestibility of dry matter, starch and protein were calculated from the relative concentrations of chromium to these materials in fecal samples.

In experiment two, digestibility data were collected as in experiment one. The chromic oxide was added via the fistula on days 9 through 20 with fecal samples taken on days 14 and 21 on each period. Total tract digestibility of dry matter, fiber (ADF and NDF) and protein were calculated. Ruminal digestibilities were determined from duodenal samples taken of days 14 and 21. These samples were analyzed for ADF, NDF and chromium to determine fiber digestion in the rumen. Within each experiment, data were analyzed as a crossover experiment including period and animal as class variables in treatment analysis by GLM procedures in SAS.

Results and Discussion

Concentrate Diet: Performance and digestion characteristics for steers fed the concentrate diet with and without Cobactin II added are presented in Table 2. Dry matter intake tended to be increased (6.4%; P<.13) by addition of Cobactin

Table 2. Cobactin II effects on steers fed a 92% concentrate diet.

Item	Control	Cobactin II	P<
DMI, lb/d	15.7	16.8	.13
Daily variation in DMI, SE	.82	.86	.73
Digestibility, %			
Dry matter	88.4	84.3	.11
Starch	97.9	97.2	.07
Protein	85.6	81.6.	.06
Intake of digestible DM, lb/d	13.9	14.1	.63
Ruminal			
Ammonia, mg/dl	7.0	8.7	.10
Protoza, log	3.1	6.3	.03
pH	5.49	5.60	.16
Lactate, day 7; mM	4.7	3.9	.02
Propionate, % of VFA	43.2	37.6	.27

II to the diet. Daily variation in feed intake was not altered by treatment. Digestibilities of dry matter, starch and protein tended to be reduced (P<.06 to .11) by addition of Cobactin II. However, intake of digestible dry matter, starch and protein all were numerically increased by Cobactin II supplementation because of greater feed intake. If half of the digested energy were used for maintenance, this should increase production rate by about 4%, a difference difficult to detect statistically in studies with limited numbers of animals but similar to that observed with Cobactin II in many field trials. A 4% increase in performance should be important economically for a feedlot.

Ruminal samples taken on day 7, 14 and 21 after the steers were first fed Cobactin II were used to determine the effects of adaptation to Cobactin II. The tendency for pH to increase and total lactate to decrease (day 7 only) is an indication that Cobactin II may reduce the incidence of acidosis. By day 21, protozoa had disappeared from seven of the eight steers not fed Cobactin II, but remained present in all eight steers fed Cobactin II. Higher ruminal ammonia values often are associated with increased numbers of protozoa in the rumen. Protozoa generally are considered to digest protein in the rumen and to liberate ammonia. Protozoa also may play a role in acidosis prevention by accumulating carbohydrate and delaying fermentation. This may explain the pH and lactate differences. There was a trend for increased acetate and decreased propionate proportions when Cobactin II was fed, resulting in calculated increases in methane loss and less energy retention from VFA. A decrease in propionate might reduce efficiency of feedlot steers, but an increase in acetate may increase fat content of milk. The addition of ionophores to the diet typically increases the proportion of propionate.

Roughage Diet: Performance and digestion characteristics for steers fed the 55% concentrate diet are presented in Table 3. Similar to effects with the concentrate diet, Cobactin II increased (5.9%; P<.01) dry matter intake by

Table 3. Cobactin II effects on steers fed a 55% concentrate diet.

Item	Control	Cobactin II	P<
DMI, lb/d	33.9	35.9	.01
Daily variation in DMI, SE	.86	.71	.02
Digestibility, %			
Dry matter	65.3	64.0	.62
Protein	63.0	61.1	.45
Intake of digestible			
DM, lb/d	22.1	22.8	.41
Ruminal.			
Ammonia mg/dl	9.9	10.9	.57
pH	6.62	6.60	.93
Propionate, day 21; % of VFA	42.2	37.0	.76

steers. In this case, day-to-day variation in dry matter intake (day-to-day variation within animal) was reduced by Cobactin II. Reduced daily variation in intake usually is related to reduced fluctuations in ruminal fermentation and more constant acid production in the rumen. Cattle that experience acidosis usually make wide swings in daily feed intake. Digestibility tended to be reduced by addition of Cobactin II to the diet. Increased feed intake and reduced time for digestion may in part be responsible for the decrease in digestibility. When one considers changes in both intake and digestibility, Cobactin II feeding increased digestible dry matter intake by 3.8%, an increase which could translate in to an increase in production rate of 7%.

Ruminal samples obtained on days 14 and 21 showed little effect of Cobactin II supplementation on VFA, pH or ammonia. Protozoa numbers were higher than in Exp. 1 as would be expected with a higher roughage diet but were not significantly affected by treatment.

The more definitive effects of Cobactin II supplementation seen with the concentrate diet may be due to an effect on the population of ruminal protozoa not seen with the higher roughage ration. With a roughage diet, protozoa normally remain present at moderately high levels where they attenuate fermentation and enhance acetate production and ammonia release. The concentrate diet may have provided an environment inhospitable for large protozoa populations and Cobactin II apparently enhanced the milieu for protozoa. However, whether protozoal differences are directly involved in the observed benefits from Cobactin II remains to be determined.