1991

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EFFECTS OF CRYPTOSPORIDIOSIS ON FEED UTILIZATION BY YEARLING STEERS

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CATTLE 91-20

Summary

Four 18-month-old Angus steers were used to study the effects of chronic cryptosporidiosis on feed utilization. Two of the steers tested positive for shedding *Cryptosporidium* and two noninfected steers were used as controls. The steers were offered a high concentrate diet. Digestibilities of dry matter (85.66 vs 80.33 $\pm$ 3.49%), crude protein (80.12 vs 73.47 $\pm$ 5.18%), ADF (72.88 vs 70.92 $\pm$ 2.32%) and NDF (86.28 vs 84.40 $\pm$ 1.99%) were similar for control and *Cryptosporidium* infected steers, respectively. The mean abomasal chyme pH was 4.72 $\pm$ .016. Abomasal weight was 3.72 lb for the control steers and 6.50 lb for the infected steers. Although the infected abomasa were heavier, dry matter intake was similar between groups (27.69 lb control steers and 25.92 lb infected steers). The infected steers had higher average daily gains (3.76 lb vs 2.17 lb, respectively).

(Key Words: Cryptosporidia, Steers, Digestibility.)

Introduction

Cryptosporidiosis, a protozoal parasite infection, has been diagnosed in an increasing number of beef and dairy herds. *Cryptosporidium parvum* and *Cryptosporidium muris* are two *Cryptosporidium* species reported in ruminants. *C. muris* averages 2 to 6 μm in diameter and usually infects the abomasum of the ruminant. The infected abomasum becomes enlarged, folds thicken, depth of glands increases, glands dilate and the pepsinogen concentration is often above normal. *C. parvum* is smaller and infects the intestinal tract. Cryptosporidiosis has been frequently diagnosed by the South Dakota State University Diagnostic Laboratory from calves under 1 month of age exhibiting diarrhea.

The entire life cycle of *Cryptosporidium* species can be completed in one host. Cryptosporidiosis is transmitted through ingestion of infected fecal material. About 80% of the oocysts are thick walled and pass through the animal via the feces. The remainder are thin walled and rupture, releasing the sporozites into the host animal causing reinfection. These animals may become reinfected and chronically shed *Cryptosporidium*.

Not all animals exposed to oocysts develop cryptosporidiosis. Abomasal cryptosporidiosis was produced in only 1 of 18 calves exposed 2 hours precolostrally to millions of fresh oocysts. The infection was confirmed by histologic examination of abomasal biopsies.

Two Angus steers out of 120 freshly weaned steers were found to shed *C. muris*. Both steers were asymptomatic. These steers, along with two noninfected steers, were used to study the effect of chronic abomasal cryptosporidiosis on feed utilization while being fed a high concentrate diet.

Materials and Methods

Four Angus steers, approximately 18 months old from the same ranch, were used in a digestion trial to determine the effect of chronic cryptosporidiosis on feed utilization. Two steers were diagnosed with cryptosporidiosis prior to the start of the study. At the

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beginning of this trial, body weights were 955, 1,098, 1,153 and 1,214 lb. The steers had been penned as noninfected and infected groups and were fed a high concentrate diet ad libitum (Table 1).

TABLE 1. DIETS FED DURING THE DIGESTION TRIAL[ab]

Ingredient	%
Whole shelled corn	26.65
High moisture corn	58.98
Mixed grass hay	7.00
Molasses	2.00
Ground corn	3.00
Soybean meal, 44%	.40
Urea	.46
Limestone	1.01
Potassium chloride	.25
Trace mineralized salt	.25

[a] All values dry matter basis.
[b] Diet provided 30 g/ton Lasalocid and 1,000 IU per lb supplemental vitamin A.

To start this trial, steers were weighed, separated into individual pens and offered 45% of the feed provided for the pens of two head. The steers were fed once daily. The level of feed offered was increased steadily to appetite over a period of 4 weeks. Intake was then held constant during a 3-day collection period. During the fecal collection period, feed was sampled daily. Fecal grab samples were collected at 0700, 1500 and 2300 hours each day. The samples were frozen at -20° C pending laboratory analysis. Samples were dried at 60° C for 72 hours and ground through a 1-mm screen before ADF, NDF, macro Kjeldahl N and AIA levels were determined. The acid insoluble ash (AIA) procedure was modified as follows: Feed samples (5 g) and fecal samples (10 g) were weighed out and placed in 250-ml Nalgene centrifuge bottles. An amylase phosphate buffer was added at the rate of 30 ml per gram of sample for starch predigestion. The samples in the Nalgene bottles were then placed on a vortex mixer and mixed for 3 minutes to assure adequate starch digestion. Samples were centrifuged at 4000 rpm for 30 minutes, the buffer solution separated and the pellet removed by rinsing with 100 ml of 4 N HCL. The pellet-acid solution was refluxed for 30 minutes and filtered through a coarse grade scintered glass crucible. The residue in the crucible was dried, weighed, ashed, and weighed again. Percent AIA was then calculated. The AIA level was used as a marker to determine digestibility coefficients.

Following the fecal collections, three steers were slaughtered at the SDSU Meat Lab. The abomasa were removed, trimmed of fat, rinsed, weighed, and submitted for histological examination. A sample of chyme was recovered for pH determination.

Results and Discussion

Animals chronically infected with *C. muris* have been shown to have an enlarged abomasum and altered pH level of the chyme. The infected abomasa were enlarged, but the pH of chyme was similar to the control steers (Table 2). The results of the histological examination revealed chronic multifocal lymphocytic abomasitis with yeasts compatible with *Candida* species. At this point, the abomasa were *Cryptosporidium* negative. Test results on the final fecal samples taken prior to slaughter detected low numbers of *Cryptosporidium* oocytes. Although *Cryptosporidium* species are considered autoinfective, there have been cases where oocyst shedding has declined and ceased over a period of months. These steers may have reached the point where oocyst shedding ceased.

The diet component digestibilities were similar for all four steers used in this study (Table 2). Results indicate that, even though the infected abomasa were enlarged, there was little difference in the ability to utilize feed. The dry matter intake was also similar (Table 2).

TABLE 2. PERFORMANCE OF INFECTED VS NONINFECTED STEERS

	Control	Infected	SEM
DMI, lb per head per day	27.69	25.92	1.77
Digestibility, %			
Dry matter	85.66	80.33	3.49
Crude protein	80.12	73.47	5.18
ADF	72.88	70.92	2.32
NDF	86.28	84.40	1.99
Initial wt, lb	1156.0	1053.5	80.83
Final wt, lb	1265.0	1360.5	52.75
ADG, lb	2.17	3.74	.35
Abomasal wt, lb	3.72	6.50	.385
Chyme pH	4.80	4.69	.09

At this point, average daily gain tended to be higher ($P<.10$) for the infected steers than noninfected steers (Table 2). However, the noninfected steers were gaining at a faster rate 63 days prior to the start of this trial (4.18 and 4.18 lb vs 3.00 and .923 lb per day for the infected steers). Possibly cryptosporidiosis caused a delay in peak growth rate until the disease was suppressed.