

GROWTH AND DIGESTION COMPARISONS BETWEEN RUMEN CANNULATED AND NONCANNULATED LAMBS¹

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Nutrition studies of the ruminant are complicated by the complex stomach and the presence of microorganisms in the rumen which benefit the host through breakdown and synthesis of various compounds. Rumen fistulas fitted with plugs and permanently installed rumen cannulas have enabled the research worker to have access to the rumen to study functions and requirements of the rumen microorganisms. Experimental techniques can be used which permit studies on functions of the animal's rumen at the same time data are gathered on its growth rate and digestion of feeds.

The question that arises in such experiments is how normal these animals are when fitted with fistulas or permanent rumen cannulas. Data were obtained on this problem during an experiment to study the effects of various feed additives on the activity of rumen microorganisms. Growth rate and digestibility of rations were compared in lambs fitted with permanent rumen cannulas and noncannulated lambs.

PROCEDURE

Twenty wether lambs were stratified according to weight and randomly assorted into two groups of ten lambs each. Ten of these lambs were fitted with rumen cannulas by a local veterinarian. The instructions of Dougherty (1) were followed for the surgery and in making the rubber cannulas.

The cannulas were made from automobile heater hose and closed with rubber stoppers. The stoppers and the outside rubber washers were held in place with plastic tape. This type of cannula does not appear to cause any discomfort to the animal after healing from the surgery. Some leakage occurs around the cannula which may require some attention to prevent maggot infestation.

When the cannulas were installed, each lamb was given an intramuscular injection of penicillin daily for three days. Some

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lambs refused to eat the first feeding, but some ate normally from the beginning. The lambs appeared to be completely recovered after ten days, but they were allowed about a six-week preliminary period before being placed on experiment.

The experiment was divided into two phases, with digestion studies being conducted during each phase. A high concentrate ration (75% concentrate and 25% roughage) was fed during the first phase, and a low concentrate ration (25% concentrate and 75% roughage) was fed during the second phase. The high concentrate ration contained 74.2% ground oats, 25.0% ground alfalfa hay, and 0.8% bone meal and trace mineral salt mixture. The low concentrate ration contained 75.0% ground alfalfa hay, 24.2% ground oats, and 0.8% bone meal and trace mineral salt mixture. Penicillin, tetra alkylammonium stearate, a dried rumen product, and a drench of a concentrated solution containing high gas-producing microorganisms were used with each ration to test their effects on the activity of rumen microorganisms. Two cannulated and two noncannulated lambs received each treatment with the high concentrate and low concentrate rations.

The lambs were confined to individual pens and fed all they would consume, without waste, twice daily. The concentrates and roughage were kept in the desired ratios. The oats, bone meal, and salt were mixed in batches of a few hundred pounds prior to feeding, and the mixture was combined with the roughage at time of feeding. Water was available at all times.

Each phase of the feeding trial was designed for two fecal collection periods, starting after the lambs had been on the rations about three weeks. However, periods between collections had to be shortened to about two weeks during the low concentrate phase because of a shortage of hay. Weekly samples of rumen contents were taken from the cannulated lambs during the experiment to study the effects of the rations and the feed additives on activity of the rumen microorganisms.

Five-day fecal collection periods were used after the lambs had been given about three days to become accustomed to the collection bags. Previous work at the South Dakota Experiment Station (2) showed that daily dry matter excretion by sheep and cattle was rather constant when feed intake was constant. Collection periods in excess of five days did not appear to improve accuracy of digestion trials when feed intake was constant.

A three percent sample of feces was saved daily and kept frozen until the end of the collection period. The feces for each lamb were then thawed and thoroughly mixed. Feed and feces were subjected to proximate analyses by AOAC methods (3).

The wethers were brought to a full feed quickly at the beginning of each phase of the feeding trial. Feed consumption during the collection periods was about the same as shown for the feeding trials in Table I, there being two collection periods during each phase of the feeding trial. Feed offered during the collection periods was held constant and any refused was dried, weighed, and deducted from the amount offered.

TABLE I
RATE OF GAIN AND FEED EFFICIENCY BY CANNULATED AND NONCANNULATED LAMBS

	Low Concentrate ¹		Low Concentrate ¹	
	Control	Cannulated	Control	Cannulated
No. of animals	10	10	10	10
No. of days	56	56	32	32
Av. initial wt., lb.	89.8	84.1	107.0	103.9
Av. final wt., lb.	108.9	104.9	113.5	112.6
Av. daily gain, lb.	.341	.371	.203	.272
Av. daily ration, lb.	2.80	2.73	3.91	3.91
Feed/100 lbs. gain, lb.	820	736	1923	1437

¹The low concentrate ration was fed following the high concentrate phase using the same lambs.

RESULTS AND DISCUSSION

Results of the feeding trial are presented in Table I. The rate of gain for all lambs appears satisfactory for the type of rations fed. The cannulated animals gained slightly faster on both the high and low concentrate rations. The differences are not statistically significant, but they show the rumen cannulas did not reduce the rate of gains. Feed efficiency data show the fastest gaining lambs were the most efficient in feed utilization.

There were only small differences in apparent digestion coefficients for each nutrient between the two groups when fed either the high or low concentrate rations (Table II). The cannulated animals had a slight, but not significant, advantage in most cases. Apparently the cannulated lambs digested the rations as well as the noncannulated lambs. Drori and Loosli (4) recently reported non-

TABLE II
DIGESTION COEFFICIENTS OF THE VARIOUS NUTRIENTS
BY CANNULATED AND NONCANNULATED LAMBS¹

	Dry Matter	Crude Protein	Ether Extract	Nitrogen-Free Extract	Crude Fiber
High Concentrate Ration					
Control	62.01	74.10	57.48	72.69	23.51
Cannulated	63.92	74.80	59.52	74.39	26.78
Low Concentrate Ration					
Control	65.79	76.73	44.38	77.87	38.40
Cannulated	66.47	76.75	42.46	78.43	39.91

¹Each value represents an average of 20 determinations using 10 lambs. Collection periods were 5 days in length preceded by about a 3-week preliminary period.

significant differences in digestibility of rations by fistulated and intact steers. They used only three animals in each group, but the results obtained are in agreement with those reported here.

SUMMARY

Twenty wether feeder lambs were used to compare the growth and digestion data between cannulated and noncannulated animals. The lambs were divided into two groups of ten lambs each. The experiment was run in two phases with a high concentrate and low concentrate ration being fed.

The results of the experiment show that the cannulated lambs gained as rapidly and just as efficiently as the normal lambs. The average apparent digestion coefficients for all nutrients show that the cannulated lambs digested the ration as well as the normal animals. The results indicate that lambs fitted with a permanent rumen cannula can be used satisfactorily in growth and digestion trials. This may be advantageous to workers who wish to study functions of the rumen in conjunction with collecting data on growth and digestion.

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