CHANGES IN THE MICROBIAL ACTIVITIES IN THE RUMEN OF CATTLE AFTER FEEDING HAY

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Introduction

Cattle fed with herbage acquires most of its energy from the fibrous component degraded by the microorganisms in the rumen. It is possible to improve animal production by increasing rumen microbial activity. The control of rumen microorganisms and their fermentation are interesting as a means of increasing feed utilization. However, a complex ecosystem exists in the rumen. It is important to investigate the kinetics of the rumen microorganisms. This study was conducted in order to investigate changes in the microbial activities in the rumen of cattle after feeding hay.

Materials and Methods

Two rumen fistulated steers were fed with orchardgrass and white clover mixed hay at a level of 1.4 % of body weight twice a day (7:00 and 19:00). Following the two-week period of adaptation, the rumen contents were taken at 0 (before the feeding), 0.5, 1, 2, 4 and 8 hours after the morning feeding. The rumen contents were strained and used immediately for following analyses. Each analysis was repeated three times.

Ammonia concentration and deaminase activity; The strained rumen fluid (SRF) was incubated with casein for 0, 2 and 4 hours to measure the rate of ammonia production by a modified procedure of Erfle et al. (1982).

Cellulase activity; The cellulase activity was measured through the incubation of 10 ml SRF with 0.5 g cellulose (avicell) and 0.1 g casein in 40 ml McDougall's saliva. After 24 or 30 hours, the residue was boiled in a neutral detergent solution to remove the microorganisms and DM disappearance was determined.

In vitro disappearance of DM, cellulose and hemicellulose of hay; The hay using for feed was incubated with SRF for 10 or 24 hours using the two-stage technique of Tilley and Terry (1963). The effect of nitrogen supplement (6 mg N-urea) to the culture on the DM disappearance by the rumen microorganisms was investigated. Furthermore, the residual hay after the first incubation with SRF was analyzed for the NDF, ADF and lignin contents. The disappearance of cellulose and hemicellulose was calculated.

Results and Discussions

The ammonia concentration and deaminase activity in SRF are shown in table 1. The values given are the mean values for the three days. The values of ammonia concentration were low at all times because the content of crude protein in the hay was low. After feeding, the ammonia concentration and deaminase activity increased for 2 4 hours and then decreased. The deaminase activity after feeding maintained a higher level for 8 hours than before feeding, although the ammonia concentration after 8 hours had a lower value than before feeding. It is assumed that the greater amount of ammonia utilized by the microorganisms caused the lower ammonia concentra-

TABLE 1. AMMONIA CONCENTRATION AND DEAMINASE ACTIVITY IN RUMEN FLUID

Cattle No.	Post feeding time (hr)					
	0	0.5	1	2	4	8
Ammonia concentration mM						
1	4.91	7.04	9.67	10.15	7.84	3.50
2	4.82	7.17	8.99	9.92	6.60	3.40
Deaminase NH_3 μg/ml·h						
1	10.79	16.27	14.53	20.30	23.08	17.11
2	8.22	13.37	16.59	21.30	17.98	18.31

TABLE 2. CELLULASE ACTIVITY IN RUMEN FLUID AND THE DISAPPEARANCE OF IN VITRO DM, CELLULOSE AND HEMICELLULOSE

Cattle No.	Post feeding time (hr) 0	0.5	1	2	4	8
Cellulase %						
1	62.9	69.7	71.6	64.4	65.7	69.8
2	62.9	70.7	73.5	67.6	64.2	56.9
In vitro disappearance %						
Cellulose						
1	28.5	42.0	54.0	48.2	54.8	49.8
2	36.6	48.1	40.0	34.5	31.0	18.2
Hemicellulose						
1	49.3	56.1	58.7	56.5	59.6	58.3
2	50.2	59.2	53.27	52.1	47.3	39.9
DM N supplement						
1 –	46.5	57.4	58.5	47.2	49.5	44.8
+	62.7	60.2	62.4	58.3	59.0	56.1
2 –	57.8	61.2	63.8	59.7	46.8	56.7
+	63.3	65.3	66.4	65.6	61.4	64.8

tion in the rumen 8 hours after feeding than before feeding.

The cellulase activity in SRF and the in vitro disappearance of DM, cellulose and hemicellulose with SRF are shown in table 2. These values are the results from the incubation for 24 hours. The cellulase activity (percentage of cellulose degraded by the microorganisms) increased from 60 % to 70 % for 1 hour after feeding. After 2 hours, the cellulase activity decreased. The values from the incubation for 30 hours were higher than those from the incubation for 24 hours, but changed in a similar way after feeding. The difference for the 24-hour incubation was neither greater nor smaller for the 30-hour incubation. The degradation rate of cellulose from 24 hours to 30 hours seemed to be almost equal during the post feeding time. In addition, the in vitro disappearance of cellulose or hemicellulose in the hay increased after feeding. The disappearance of cellulose and hemicellulose for the No.1 cattle maintained a high value for 8 hours. But for the No. 2 cattle, it decreased 1 hour after feeding. The disappearance of hemicellulose from the incubation for 10 hours were 20-35 %, although the disappearance of cellulose was lower than 20 %. So the degradation rate of cellulose from 10 to 24 hours were higher than that of hemicellulose. It may take longer than hemicellulose to start the degradation of cellulose. The in vitro disappearance of DM changed in a similar way to cellulase after feeding. The supplement of nitrogen to the culture improved the in vitro disappearance to a significant extent and made the variation smaller during the post feeding time. Any remarkable differences were not observed in the disappearance of DM for 48 hours with the supplement of nitrogen. From these results, it is assumed that the cellulase activity was affected by the ammonia concentration in the rumen.

(Key Words: Cattle, Rumen Microorganisms, Activity)

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