

# THE RUMINAL DIGESTION OF FIBER OF GRASS AND LEGUME HAYS IN VARIOUS RATIOS OF CONCENTRATE TO HAY

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## Introduction

One of characteristics in ruminants is the digestion of fiber through the fermentation in the rumen. The composition of fibrous fractions has been suggested to be responsible for the difference in digestibilities of fiber between first-cut and second-cut hay rations (Sekine et al., 1986). Thus, the origin of fiber may affect on the digestion of fiber.

The present study was to determine digestion kinetics of fiber of Italian ryegrass hay or cubed alfalfa hay in the rumen of animals given rations with different ratios of concentrate to hay.

## Materials and Methods

Rations consisting of commercial formula feed for fattening beef cattle and Italian ryegrass hay mixed with ratios of 0:100, 30:70, 60:40 and 85:15 on air dry matter basis were given to 2 mature Saanen castrated male goats fitted with rumen cannula (av. weight, 45.2 kg) and 2 Suffolk x Corriedale rams with rumen cannula (40.4 kg) (ryegrass diet) and cubed alfalfa hay was used in place of ryegrass in next trial (alfalfa diet). Experimental period consisted of three equal parts; first 7-day part was preliminary period, the second, the period for *in situ* technique and the third, for determination of ruminal retention time. The bags with duplicates containing samples of ground hay through 2 mm screen and cellulose powder were incubated in the rumen for 3, 6, 12, 24, 48 and 72 hours. The chromium mordant cell wall constituents were administered through the rumen cannula. Fecal collections were done at 4-hour intervals for 5 days.

## Results and Discussion

Data of one goat that died with aspiration pneumonia was discarded. The results were pooled to determine parameters for neutral detergent

fiber (NDF) digestion and the ruminal retention time ( $1/k_p$ ). Table 1 shows digestible fraction (D), digestion rate constant (k), discrete lag time (LT) and degradability for 24-hour incubation (D24) of NDF of Italian ryegrass and cubed alfalfa hays, and of cellulose together with  $1/k_p$ . Changes in D, k and LT were not consistent with those in the

TABLE 1. DIGESTIBLE FRACTION (D), DIGESTION RATE CONSTANT (k), DISCRETE LAG TIME (LT) AND DEGRADABILITY FOR 24-HOUR INCUBATION (D24) OF NEUTRAL DETERGENT FIBER (NDF) AND CELLULOSE, AND RUMINAL RETENTION TIME ( $1/k_p$ )

Diet given to animals		D	k	LT	D24	$1/k_p$
		%	hr <sup>-1</sup>	hr	%	hr
Ryegrass diet		NDF of Italian ryegrass hay				
Conc.:	Hay					
0	100	48.1	0.130	9.5	40.8	40.0
30	70	52.8	0.031	3.3	25.1	29.4
60	40	44.3	0.049	4.5	27.3	31.3
85	15	25.6	0.081	20.3	6.6	29.4
		Cellulose				
0	100	100.0	0.027	0.0	47.2	40.0
30	70	100.0	0.026	2.0	43.5	29.4
60	40	87.7	0.029	-0.9	45.4	31.3
85	15	100.0	0.014	-7.9	35.2	29.4
Alfalfa diet		NDF of cubed alfalfa hay				
Conc.:	Hay					
0	100	41.1	0.066	6.0	28.6	27.0
30	70	53.3	0.028	6.0	21.3	32.3
60	40	34.1	0.106	20.5	10.7	38.5
85	15	100.0	0.009	13.5	8.6	45.5
		Cellulose				
0	100	87.2	0.059	-2.1	68.4	27.0
30	70	100.0	0.022	-11.9	53.8	32.3
60	40	100.0	0.010	-41.2	49.0	38.5
85	15	100.0	0.016	-22.3	51.2	45.5

ratio of concentrate to hay of ryegrass and alfalfa diets. Thus, the results of the present study were not able to clarify the effect of ratios of concentrate to hay on D, k and LT of NDF of ryegrass and alfalfa hays. The values of D24 markedly lowered in the feeding of ryegrass diet with concentrate ratio of 85 and alfalfa diets with the ratios of 60 and 85. The contents of NDF in those diets were 207, 226 and 170 g/kg DM for ryegrass diet with concentrate ratio of 85 and alfalfa diets with the ratios of 60 and 85, respectively. The lower contents of NDF in those rations may have caused a markedly lower D24 of those hays. The values of D24 were higher in NDF of ryegrass hay than alfalfa hay. A higher content of acid detergent lignin in alfalfa hay may have affected to the NDF digestion. Ruminal retention time was longer in the feeding of ryegrass hay alone, but concentrate ratio appeared to have no effect on  $1/k_p$ . In alfalfa diet, however,  $1/k_p$  increased as concentrate ratio increased. In the feeding of both ryegrass and alfalfa diets, digestion of cellulose was potentially 100% in the rumen. Discrete lag time

appeared to be essentially none. The cellulose was highly digestible than NDF of ryegrass or alfalfa hay. Thus, degradation of NDF may have limited by the composition of NDF other than cellulose. The rates of degradation markedly lowered in the feedings of ryegrass diet with concentrate ratio of 85 and alfalfa diets with the ratios of 60 and 85. The lower contents of NDF in those rations may be responsible for lowered K. Therefore, NDF content less than 230 g/kg DM in a ration is inferred to have an adverse effect on fiber digestion in the rumen.

(Key Words: Neutral Detergent Fiber, Cellulose, Ruminal Digestion)

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