

PASSAGE RATE OF RICE STRAW IN THE DIGESTIVE TRACT OF BUFFALOES AND CATTLE

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Introduction

Buffaloes digest low quality roughage better than cattle, presumably because they have more ruminal microbes (Homma, 1983). Ponnappa et al. (1971) have shown that a slower passage rate of solid matter in buffaloes compared to cattle is one of the main reasons for better digestibility. The present report, however, shows that ruminal liquid flow rate and dry matter contents also seem to be closely related to the activity of the rumen microorganisms. Passage rates of the solid phase and the ruminal liquid phase in the alimentary canal of buffaloes were compared with those of cattle to clarify the differences of digestibility between the two species.

Materials and Methods

Three swamp buffaloes cows and three Holstein cattle cows, having average body weights of 520.3 and 623.5 kg, respectively, were fed only coarsely-chopped rice straw twice daily (09:00, 17:00). Digestive trials consisted of more than 14 days of preliminary feeding followed by 5 days of total feces collection. Rice straw marked with YbCl_3 was used as a solid marker and 5% of the marker to voluntary feed intake was given before morning feed at the beginning of the collection period. Grab samples of feces in the rectum were collected 32 times from 12 to 218 h postfeeding of the solid marker. Yb contents in grab samples of feces were determined by the polarized Zeeman atomic absorption spectrophotometer (Z-8000, Hitachi Co.). The passage rate of the solid phase was estimated according to the equation of Grovum and Williams (1973).

As a liquid marker, Co-EDTA solution (50 g/200 ml of distilled water) was dosed at 08:30 before feeding through a stomach tube. Ruminal digesta was collected at 2, 4, 8, 16, 24, 36, 48 and 72 h after dosing to estimate the rumen volume

and the rate of liquid passage. The concentration of Co in the rumen sample was analyzed by the atomic absorption spectrophotometer described above. Differences in digestibility and passage rates of liquid and solid phases between buffaloes and cattle were statistically treated by the t-test.

Results and Discussion

Table 1 shows digestibility coefficients of rice straw in buffaloes and cattle. Buffaloes digested all nutrient components more than cattle and it was reconfirmed that buffaloes utilized low quality roughage, like rice straw, more efficiently than Holstein cattle (Ichikawa and Homma, 1986). Passage rates and retention times of solid and liquid phases in the digestive tract are shown in table 2. In both the reticulo-rumen and the hindgut, no significant differences were found, either in the retention time or the passage rate of the solid phase between two species. This result indicates that better digestibility of low quality roughage in buffaloes is not due to a slower

TABLE 1. DIGESTIBILITY COEFFICIENTS OF RICE STRAW (% \pm SD)

Nutrients	Buffaloes	Cattle
DM	54.3 \pm 10.9	48.1 \pm 9.0
OM	61.7 \pm 3.5	54.7 \pm 9.4
CP	51.6 \pm 4.4	44.0 \pm 9.4
EE	58.6 \pm 5.0	57.8 \pm 9.6
NFE	54.1 \pm 4.2	47.6 \pm 11.0
ASH	26.8 \pm 6.5	20.6 \pm 8.9
CF	72.9 \pm 2.4	64.9 \pm 7.5
ADF	67.8 \pm 5.8	61.3 \pm 6.6
NDF	68.2 \pm 2.6	60.2 \pm 9.8

DM; dry matter, ASH; crude ash, OM; organic matter, CF; crude fiber, CP; crude protein, ADF; acid detergent fiber, EE; ether extract, NFE; nitrogen free extract.

TABLE 2. PASSAGE PARAMETERS, RUMEN VOLUME, RUMEN DM AND DM INTAKE IN BUFFALOES AND CATTLE

Items	Buffalo	Cattle
k_1 (%/h)	1.6 ± 0.2	1.9 ± 0.3
k_2 (%/h)	6.1 ± 1.6	5.6 ± 3.3
$1/k_1$ (h)	62.1 ± 9.2	53.0 ± 7.2
$1/k_2$ (h)	17.2 ± 5.3	21.4 ± 9.6
TT (h)	25.3 ± 12.2	22.7 ± 4.6
TMRT (h)	104.7 ± 7.6	97.3 ± 9.2
RLDR (%/h)	3.2 ± 0.8	5.5* ± 0.7
RV (l)	39.9 ± 11.1	78.4* ± 20.7
DM intake (g/bw ^{0.75})	34.8 ± 2.6	47.4* ± 20.7
RDM (g/100 ml)	0.9 ± 0.39	0.4** ± 0.04

k_1 ; ruminal turnover rate, k_2 ; hindgut turnover rate, $1/k_1$; rumen retention time, $1/k_2$; hindgut retention time, TT; transit time, TMRT; total mean retention time, RLDR; rumen liquor dilution rate, RV; rumen volume, RDM; rumen dry matter, ±; standard deviation, *; $p < 0.05$, **; $p < 0.01$.

passage rate or a longer retention time in the digestive tract. However, the dilution rate of the ruminal liquid phase was significantly higher in cattle than in buffaloes (table 2). This higher dilution rate in cattle could be attributed to a higher DM intake.

DM intake in buffaloes was significantly lower than those in cattle, because of the smaller rumen volume in buffaloes (table 2). The rumen dry matter concentration in buffaloes, however, was more than twice that of cattle (table 2). These results indicate that buffaloes ingest more forage

for their smaller rumen volume compared to the rather less feeding capacity of cattle for their larger rumen volume. Continuation of the higher dry matter concentration would act to reduce DM intake, but this condition would be preferable for rumen microorganisms to adhere to feed particles. Considering the importance of particulate-associated microorganisms in the rumen for digestibility of low quality roughage, more efficient utilization of low quality roughage in buffaloes may be attributable to the higher dry matter contents in the rumen.

(Key Words: Rice Straw, Passage Rate, Buffaloes)

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