

EFFECT OF TIME AFTER FEEDING ON DISTRIBUTION OF DIGESTA IN THE GASTRO-INTESTINAL TRACTS OF SHEEP

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Summary

To determine effect of time after feeding on distribution of digesta in the gastro-intestinal tracts of sheep given orchardgrass hay once a day, a total of fifteen ewes (mean live weight 51 ± 12 kg) were slaughtered at 2, 8, 16 and 24 hours after feeding. Contents in the reticulo-rumen, omasum, abomasum, small intestine, cecum, and colon and rectum were totally collected and weighed. Weights of digesta in the reticulo-rumen were about 6 kg which contributed about 75% of the total in the whole tracts. Digesta on dry-matter basis totaled about 1 kg. The dry-matter concentration of digesta in the whole digestive tract was about 107 g/kg of fresh digesta. Distribution of moisture in the digestive tract changed in parallel with that of fresh digesta. There was no significant correlation observed between time after feeding and weights of digesta in the gastro-intestinal tracts. While, feed intake significantly correlated with digesta in the reticulo-rumen, cecum and whole tracts ($p < 0.01$). Thus, time after feeding was inferred to have no influence upon the content of digesta in the digestive tract, but feed intake influenced on the content of digesta in the digestive tract at a low level of feeding.

(Key Words: Sheep, Digesta, Gastro-Intestinal Tracts, Hay)

Introduction

Ruminants possess a large capacity of the gastro-intestinal tracts and thus, carry greater amounts of digesta in their body. Studies on nutritional or physiological status of animals have been based on live weight which includes contents of digestive tracts. Much work has been carried out to estimate the in vivo empty body weight since Brody (1945) has presented concept on metabolic body size. English standard for energy requirements adopts the coefficient of 1.08 to estimate fasting body weight (ARC, 1980). Sekine et al. (1985) have confirmed the figure on fasting calves with age of 4 to 6 months. The information is still limited for a method to predict an empty body weight in ruminants.

The present study was to determine effect of

time elapsed after feeding on distribution of digesta in the gastro-intestinal tracts of sheep given orchardgrass hay once a day and to obtain prediction equation for digesta contents of the digestive tracts in sheep.

Materials and Methods

Animals used were 15 ewes (mean weight, 51 ± 12 kg) selected from flocks kept in Takikawa Livestock Research Station in Hokkaido. Ewes were given first cut orchardgrass hay chopped in 2 cm length once a day at a level of 1.5% of live weight for seven days. Animals were allowed 2 hours of access to feed every day with free access to drinking water. On the 8th day, every four ewes were slaughtered at 2, 8, 16 and 24 hours after feeding except for 16-hour slaughtered group which had three ewes. After evisceration, the digestive tracts were ligated between the reticulo-rumen (RR), the omasum (O), the abomasum (A), the small intestine (SI), the cecum (C) and the colon and rectum (C + R) to avoid mixing contents in each digestive tract. Then, contents were totally collected and weighed. Aliquot samples were taken and frozen for further analysis.

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Moisture concentrations of digesta were determined by drying to a constant weight at 100 °C. Statistical analyses were carried out by the method described by Snedecor (1966).

Results

There was no statistically significant difference among slaughter time groups, but ewes in 16-hour slaughtered group tended to consume more feed than those in other groups. Feed intake averaged 0.36 kg/day ranging from 0.19 to 0.50 kg/day. Mean daily dry-matter intake was 320 ± 85 g with a range from 166 to 443 g.

Figure 1 shows distribution of dry matter and fresh digesta in the gastro-intestinal tracts of sheep slaughtered at 2, 8, 16 and 24 hours after feeding. Weights of digesta on dry-matter basis tended to decrease with time after feeding in the reticulo-rumen. While weights of digesta tended to increase with time after feeding in the other digestive tracts. There were, however, no statistically significant correlations observed between the time after feeding and weights of digesta in the whole gastro-intestinal tracts. Weights of digesta in the reticulo-rumen were the greatest among those in each tract and reached to about 6 kg on as is basis, which occupied about 75%

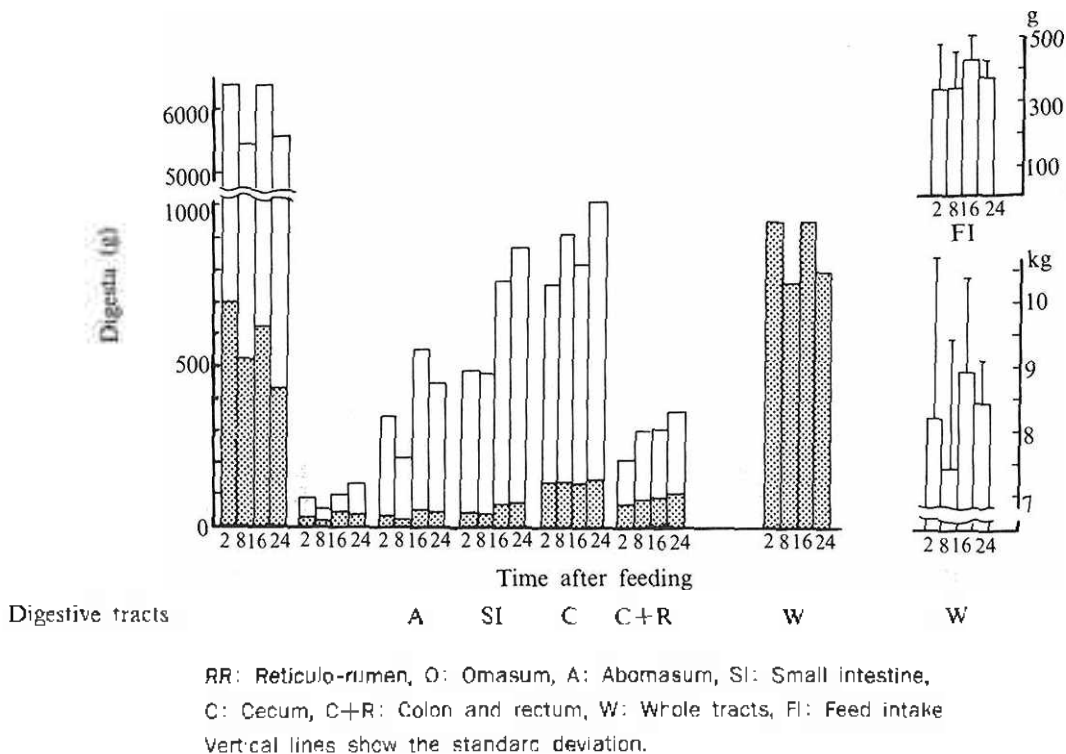


Figure 1. Changes with time after feeding in digesta on as is (□) and dry-matter basis (■).

of total digesta in the whole digestive tracts. Digesta in the cecum and small intestine followed to that of the reticulo-rumen and weighed about 1 kg on as is basis. Other tracts contained less than 0.5 kg of digesta on as is basis. The distribution of digesta on dry-matter basis in the digestive tracts showed a similar pattern to that on as is basis. Weights of digesta totaled about

1 kg on dry-matter basis.

Dry-matter concentrations of digesta tended to decrease in each site of the digestive tracts with time after feeding, although significant negative correlations were found only in such sites as the reticulo-rumen and the cecum ($p < 0.05$). Digesta in the omasum, and the colon and rectum contained about 270 g of dry matter per

kg of fresh contents. Those in the other tracts contained 80 to 150 g/kg. The dry-matter concentration of digesta in the whole tracts averaged 107 ± 13 g/kg. Thus, distribution of water in the digestive tracts changed parallel to that of fresh digesta.

Statistical analyses revealed that there were positive correlations between weight of fresh digesta and time after feeding in the omasum, small intestine and colon + rectum ($p < 0.05$) as shown in table 1. Digesta in the whole tracts, however, showed no significant correlation with time after feeding. Fresh digesta in the reticulo-

rumen, cecum and whole tracts (FDRR, FDC and FDWT, kg) significantly and positively correlated with feed intake (FI, kg/day) ($p < 0.01$, table 1). Live weight at slaughter did not influence on the amounts of digesta in the digestive tracts ($p > 0.05$). Regression analyses resulted in following equations:

$$\text{FDWT} = 14.5 (+2.9) \text{ FI} + 3.0,$$

$$r^2 = 0.65, \text{ s.e. } \pm 0.27,$$

$$\text{FDRR} = 10.9 (\pm 2.7) \text{ FI} + 2.0,$$

$$r^2 = 0.54, \text{ s.e. } \pm 0.26,$$

$$\text{FDC} = 1.2 (\pm 0.3) \text{ FI} + 0.4,$$

$$r^2 = 0.45, \text{ s.e. } \pm 0.03.$$

TABLE 1. COEFFICIENTS OF CORRELATION BETWEEN FRESH DIGESTA IN THE DIGESTIVE TRACTS AND POSSIBLE VARIATES

	Digesta in the						
	RR ¹	O	A	SI	C	C+R	W
Time ²	-0.13	0.54	0.29	0.63	0.47	0.63	0.12
Wt.	0.16	-0.07	-0.09	-0.18	0.20	0.08	0.07
FI	0.73**	0.40	0.38	0.44	0.67**	0.45	0.80**

¹ RR: Reticulo-rumen, O: Omasum, A: Abomasum, SI: Small intestine, C: Cecum, C+R: Colon and rectum, W: Whole tracts

² Time: Time after feeding (hr), Wt.: Weight at slaughter (kg), FI: Feed intake (as is, kg/day)

Discussion

Time after feeding positively correlated with digesta in the omasum, small intestine, and colon and rectum. Weights of digesta in those three cites of the digestive tracts contributed only 13 % of total digesta in the whole digestive tracts. Digesta in the reticulo-rumen tended to decrease with time, but significant correlation was not found. No correlation was found between total fresh digesta and time after feeding. Thus, time after feeding is inferred to have no influence on weights of digesta in the digestive tracts.

Mean weight of fresh digesta in the reticulo-rumen was amounted to 75% of the total. Fujikura et al. (1990) have studied digesta contents and particle size distribution of digesta in cattle, sheep and goat and found that fresh digesta in the reticulo-rumen contributed over 80% to that in the whole digestive tracts. A precise

estimation of digesta in the reticulo-rumen, therefore, may contribute to an accurate prediction of the contents in the gastro-intestinal tracts in the ruminants.

Distribution of amounts of water in the digestive tracts paralleled with that of fresh digesta irrespective of time after feeding. Thus, water compartments in the gastro-intestinal tracts are suggested to be one of good indices for determinations of digesta weight in vivo.

Although feed intake was not significantly different among mean values for slaughter time groups, the amount consumed varied among individuals irrespective of time after feeding. Significant positive correlations were found between weights of digesta in the reticulo-rumen, cecum and whole tracts. Thus, feed intake is inferred to influence amounts of contents in the digestive tracts.

Results presented significant regression equa-

tions to estimate weight of digesta in the whole tracts by feed intake. Relatively lower coefficients of determination than that postulated by Snedecor (1966), however, revealed that the extent of relation of a cause and an effect appeared to be very minute. Feeding level used in the present study was 1.5% of live weight, which is considerably lower than that for practical feeding regimes. Thus, considerations on feeding level require further studies on diverse levels of feed intake.

From above discussion, it is concluded that time after feeding has no influence on weights of digesta in the digestive tracts, but feed intake is an influential factor to amounts of contents in the digestive tracts under relatively low feed intake. Further study is required to consider the level of feed intake.

Literature Cited

- Agricultural Research Council. 1980. The Nutrient Requirements of Ruminant Livestock. Commonwealth Agricultural Bureaux. Slough.
- Brody, S. 1945. Bioenergetics and Growth. Reinhold Publishing Corporation. New York.
- Fujikura, T., R. Oura and J. Sekine. 1990. Comparative morphological studies on digestion physiology of herbivores II. Size and distribution of particles of digesta in large and small ruminants. *J. Fac. Agric., Tottori Univ.* 26: in press.
- Sekine, J., S. Morita, T. Morooka, S. Kondo, M. Okubo and Y. Asahida. 1985. Fasting heat production of calves at 4 to 6 months of age. *Jpn. J. Zootech. Sci.* 56:787 (in Japanese with English summary).
- Snedecor, G. W. 1966. *Statistical Methods* (5th ed.). Iowa State Univ. Ames. Iowa.