

EFFECTS OF A HEAT ENVIRONMENT ON THE DISAPPEARANCE OF FEED FRACTIONS FROM NYLON BAGS INCUBATED IN THE RUMEN OF SHEEP

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Introduction

When sheep are exposed to heat environments their rectal and ruminal temperatures increase because of the decreased heat loss. Under these circumstances, it seems that the activity of rumen microorganisms changes. In goats, the net ruminal absorption amounts of volatile fatty acids increased during exposure to a heat environment (Sunagawa et al., 1988), but in sheep did not change (Sunagawa, unpublished). The present research was carried out to determine the effect of a heat environment on the ruminal digestion of feed fractions in sheep.

Materials and Methods

Three cross-bred wethers, weighing 55-68 kg, were used. The animals were kept in metabolic cages in a thermoneutral room at a temperature of 23 °C and a relative humidity of 80%. They were fed daily 900 g of alfalfa hay cubes at 10.00 and 18.00 h. Water was available continuously. Four nylon bags (14 x 9 cm), each containing 5.5 g of ground alfalfa hay cubes, were incubated in the rumen of each sheep for a period of 3, 5, 8, 12 or 24 h. Only one incubation experiment was

carried out in a day. The bags were suspended in the rumen within 0.5 h before the morning feeding. After withdrawal, the bags were rinsed with water according to the procedure described by Mehrez and Ørskov (1977). They were then dried for 24 h at 70 °C. Dry matter (DM), organic matter (OM), neutral detergent solubles (NDS) and neutral detergent fibre (NDF) were determined. The proportion of these feed fractions which had disappeared was calculated from the amount incubated and that left in the bag after incubation. Ten days after the thermoneutral experiments, the animals were placed in a climatic room controlled at an air temperature of 32 °C and a relative humidity of 80%. The same experiments as in the thermoneutral environment were carried out from the 8th to 12th day of the heat exposure. These experiments were repeated twice in both environments.

Results and Discussion

Rectal and ruminal temperatures before the morning feeding were significantly higher in the heat environment (39.7 ± 0.21 , 39.9 ± 0.28 °C) than in the thermoneutral environment (39.0 ± 0.15 , 39.1 ± 0.15 °C). On the other hand, the

TABLE 1. DISAPPEARANCE (%) OF FEED FRACTIONS FROM NYLON BAGS INCUBATED IN THE RUMEN OF SHEEP EXPOSED TO THERMONEUTRAL (T) AND HEAT (H) ENVIRONMENTS

Incubation time (h)	Dry matter		Organic matter		Neutral detergent solubles		Neutral detergent fibre	
	T	H	T	H	T	H	T	H
3	49.5	48.3	47.9	47.2	74.8	72.8	21.4	24.0
5	49.8	47.4	47.9	46.6	75.6	71.8	23.2	25.7
8	54.7	53.8	52.6	53.0	74.7	72.0	30.7	36.8
12	61.7	55.9	60.5	55.6	81.9	76.1	39.4	39.6
24	69.2	70.5	67.9	69.2	86.5	87.0	49.1	52.2

Values are means of six determinations from three animals. Approximate S.E. of the determinations was ± 1.2 .

disappearance of DM, OM, NDS and NDF from nylon bags incubated in the rumen of the sheep exposed to the heat environment were the same as those of the animals exposed to the thermoneutral environment. The results indicated that the rates of ruminal digestion of alfalfa feed fractions in the heat environment were the same as those in the thermoneutral environment when the retention time of each fraction in the rumen was equal in both environments. Lippke (1975) reported that the extent of digestion increased five percentage units for the steers but did not change for wethers at 32 °C. Sunagawa et al. (1988) found that the net absorption amounts of volatile fatty acids increased in goats with heat exposure, but did not change in wethers (Sunagawa, unpublished). These findings suggest that the responses of rumen in the sheep to a heat exposure may be different from those of the rumen in goats and

cattle.

(Key Words: Ruminant Digestion, Heat Exposure, Sheep)

Literature Cited

- Lippke, H. 1975. Digestibility and volatile fatty acids in steers and wethers at 21°C and 32° ambient temperature. *J. Dairy Sci.* 58: 1860-1864.
- Mehrez, A.Z. and E.R. Ørskov. 1977. A study of the artificial fibre bag technique for determining the digestibility of feeds in the rumen. *J. Agric. Sci., Camb.* 88:645-650.
- Sunagawa, K., H. Takahashi, Z. Kojia and F. Hongo. 1988. Net absorption amounts of volatile fatty acids in goats exposed to a heat environment. *Jpn. J. Zootech. Sci.* 59:787-792.