

Influence of time of concentrate feeding to sheep on diurnal pattern of intake and digestion of hay

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Introduction

The rôle of supplementary feeding of sheep in most hill and upland sheep systems is well recognized in supplying extra nutrients and in influencing resource management (Milne and Mayes, 1986). Mechanisms regulating grazing behaviour are modified during supplementary feeding and the time of supplementary feeding may affect the diurnal pattern of herbage intake. In supplement feeding studies grazing complicates interpretation because forage quality continually changes; therefore, most of these studies have been conducted with harvested rather than grazed forage.

The aim of this experiment was to evaluate if the time of supplementary feeding has any influence on the voluntary intake of a basal grass hay diet and on its diurnal pattern of intake.

Material and methods

The experiment was conducted with 12 Blackface wethers averaging 53.9 (s.e. 6.70) kg live weight, which were divided into two groups (A and M), according to live weight and body condition. Hay was offered *ad libitum* to all animals through the experiment from 08.30 to 09.30 h and from 16.30 to 08.30 h, in order to promote a high rate of intake in the morning and late afternoon.

After a 3-week period (period 1), half the animals were offered concentrate (700 g/day) at 09.30 h (group M) and the other half at 16.00 h (group A) for a further period of 3 weeks (period 2). The chemical composition of the hay and concentrate is shown in Table 1. In each period, voluntary intake of hay was measured for 10 days, during which hay was offered at proportionately 1.10 to 1.15 in excess of the previous day's consumption. Pattern of hay intake was measured by weighing refusals every 3 h on 2 days consecutively. In order to measure the digestibility, a total collection of faeces was made for

the last 8 days of each experimental period, during which the sheep were harnessed and equipped with collection bags. Rumen fluid samples were obtained on the last day of each experimental period at 12.00, 18.00, 24.00 and 06.00 h using a stomach tube and pH, volatile fatty acids (VFA) and ammonia concentrations were determined.

Data were analysed according to a 2 × 2 factorial analysis of variance with sheep as a blocking factor (Statistical Analysis System Institute, 1985). Effects included in the model were concentrate supplementation (CS), time of supplementation (TS) and the interaction CS × TS, and additionally for the fermentation measurements the time of sampling.

Results and discussion

When concentrate was offered in the morning the daily pattern of hay intake was not changed (Table 2) and animals had the highest rate of intake (about 0.39 of the daily intake) between 16.30 and 18.00 h. However, when animals were offered the concentrate in the afternoon the rate of hay intake was lowered between 16.30 and 18.00 h (about 0.25 of the daily intake). It may be due to the high ruminal digesta fill in this period (animals consumed 700 g concentrate within 15 min of feeding) and, as consequence, wethers were not able to have a high intake of hay.

In all, animals given concentrate in the morning had a higher ($P < 0.05$) intake of hay organic matter and higher ($P < 0.01$) rumen ammonia levels than those given concentrate in the afternoon (Table 3). However, there were no differences in the digestibility of the diet, rumen pH and molar proportions of the main VFA.

Table 1 Chemical composition (g/kg dry matter) of grass hay and concentrate

	Hay	Concentrate
Crude protein	105	235
Neutral-detergent fibre	626	267
Acid-detergent fibre	386	135

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Table 2 Effect of concentrate supplementation (CS) and time of supplementation (TS) on pattern of hay intake (g dry matter per day)

Group	Hay		Hay + supplement		Residual s.d.	Significance of		
	M	A	M	A		CS	TS	CS × TS
Time								
16.30–18.00	589	511	542 ^a	271 ^b	139	***	***	*
18.00–21.00	207	180	233	191	70.7			
21.00–24.00	164	185	144	142	54.3	*		
24.00–03.00	129	135	117	148	45.5			
03.00–06.00	89	109	92	82	41.2			
06.00–08.30	73	86	66	84	34.2			
08.30–09.30	199	181	112	103	62.5	*		

^{a, b} Means within each treatment in the same line with different superscripts differ significantly ($P < 0.05$).

Table 3 Effect of concentrate supplementation (CS) and time of supplementation (TS) on voluntary intake of hay, apparent digestibility and rumen parameters (pH, ammonia-N (mg/l) and VFA (mol/100 mol))

Group	Hay		Hay + supplement		Residual s.d.	Significance of		
	M	A	M	A		CS	TS	CS × TS
Hay intake (g/day)								
Organic matter	1044	1007	871 ^a	674 ^b	167.2	**		
Apparent digestibility								
Organic matter	0.685	0.686	0.712	0.696	0.0261			
Crude protein	0.644	0.656	0.708	0.702	0.0267	***		
Acid-detergent fibre	0.653	0.658	0.631	0.606	0.0372	*		
Rumen parameters								
pH	7.02	7.06	7.03	7.02	0.183			
Ammonia-N	69.2	63.19	148 ^a	123 ^b	22.27	***	***	*
Acetate	65.0 ^a	66.8 ^b	71.4	70.4	2.59	***		*
Propionate	23.4 ^a	22.0 ^b	16.9	17.5	2.03	***		*
Butyrate	9.13	8.74	9.23	9.47	1.193			

^{a, b} Means within each treatment in the same line with different superscripts differ significantly ($P < 0.05$).

Conclusions

Feeding concentrate in the morning instead of in the afternoon resulted in a higher ($P < 0.05$) total intake (881 and 1041 g digestible organic matter per day) for the A and M groups, respectively.

References

- Milne, J. A. and Mayes, R. W. 1986. Supplementary feeding and herbage intake. *Hill Farming Research Organisation, Biennial Report 1984-1985*, pp. 115-119.
- Statistical Analysis System Institute. 1985. *User's guide: statistics*. Statistical Analysis Systems Institute, Cary, NC.