EFFECTS OF FASTING ON INGESTIVE BEHAVIOUR OF SHEEP GRAZING GRASS OR WHITE CLOVER MONOCULTURES

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ABSTRACT

Effects of fasting sheep for 24 h (F), compared with controls (NF), on their ingestive behaviour and particle size in extrusa was investigated using oesophageally fistulated animals, grazing monocultures of *Lolium perenne* (G) or *Trifolium repens* (C). Bite masses tended to be lower on G than C and tended to increase with fasting (40, 64, 61 and 70 mg DM bite^{-1}) for treatments GNF, GF, CNF and CF, respectively. Prehension rate was lower (52 vs. 69 bites min^{-1}) and masticating rate was higher (106 vs.86 mastications min^{-1}) for G and C treatments, respectively. Over 24 h following fasting, NF animals grazed less (458 vs. 578 min 24 h^{-1}) and ruminated less (276 vs. 348 min 24 h^{-1}) than F animals. Particles in extrusa < 0.18 mm were 48 vs. 55 %, for G and F, and 49 *vs.*54% for F and NF treatments.

KEYWORDS

Sheep, grazing, ryegrass, white clover, behaviour, fasting, ruminating, bite mass

INTRODUCTION

Ruminants are often considered to be intake rate maximisers but this is not always the case, as it can be shown that at pasture they generally ingest herbage at lower rates than they are capable of achieving. For example, Newman *et al.* (1994), found ewes fasted for 24h subsequently increased their intake rate compared with controls grazing the same sward. Penning *et al.* (1993) showed there was an interaction between hunger status and herbage species with fasted animals increasing bite masses and intake rates when grazing grass but not white clover. In a theoretical analysis, Parsons *et al.* (1994) suggested this increase in intake rate was associated with a reduced handling time per unit of food ingested. It is not known whether this reduction in handling time, decreases the efficiency of particle size reduction with a concomitant increase in the retention time of the forage in the rumen. This may have consequences for the longer term intake of nutrients, measured over days. The objective of this experiment was to examine the effects of fasting on bite mass and ingestive behaviour by sheep grazing ryegrass or white clover swards, and its effects on particle size reduction of the ingested herbage.

MATERIALS AND METHODS

Four groups of non-lactating, non-pregnant 3-year old Scottish Halfbred ewes (Border Leicester x Cheviot) grazed 2 plots (0.34 ha) of ryegrass (*Lolium perenne* cv. Melle; G) and 2 plots of white clover (*Trifolium repens* cv. Huia; C). Each group comprised one ewe fistulated at the oesophagus (OF) plus three intact ewes (mean live weight 83 kg). The swards were maintained at 6 cm sward surface height (SSH, Bircham, 1981) using continuous variable stocking. SSH was estimated from 50 heights measured on each plot twice per week. A 4 x 4 Latin square change-over design, was used to measure the effects of fasting (F), compared with unfasted controls (NF), on particle size reduction of herbage ingested by the fistulated ewes from G and C swards. Sheep were accustomed to G or C swards for 5 days, F animals were then fasted for 24 h starting at 17.30 h. Both NF and F ewes were then allowed to graze and extrusa was collected for 10 to 15 min from each OF, fitted with a throat plug below the fistula to ensure recovery of ingested herbage. In each of the 4 periods of the Latin square, extrusa was collected in a randomised sequence, immediately frozen and stored for subsequent processing. Recordings of grazing behaviour (Penning *et al.*, 1984) were made over 48 h from the start of collection of extrusa using an automatic recording system. Briefly, jaw-movement sensors were used to determine the predominant activity (eating, idling or ruminating) in each minute and jaw movements associated with these activities were recorded. Herbage mass was measured from quadrats cut to ground level with scalpels in each period. A wet-sieving technique (Jones and Moseley, 1977) was used to estimate particle size distribution in the extrusa.

RESULTS AND DISCUSSION

SSH and herbage masses were greater for G than C swards (P<0.001) but there were no significant differences between NF and F treatments (6.9 vs. 6.9 and 5.8 vs. 5.6 s.e.d. ± 0.37 for SSH; 6.7 vs. 6.8 and 3.9 vs. 4.2 s.e.d. ± 0.35 t DM ha^{-1} for herbage mass) for GNF, GF, CNF and CF treatments, respectively. Bite mass (Table 1) tended to be lower for treatment G compared with C and fasting tended to increase bite masses for both G and C treatments, however, none of these differences was significant. Prehension rate (jaw movements where herbage is severed from the sward) was lower on G than C treatments and was not increased by fasting, whilst mastication rate (chewing and manipulation of herbage harvested by prehensions, but not including rumination) was higher on G than C treatments and was increased by fasting. Total jaw movement rate tended to be higher for F compared with NF treatments but the differences were not significant. Total jaw movements g^{-1} DM ingested were higher on G than C treatments (P=0.04) and fasting tended to decrease total jaw movements g^{-1} DM ingested for G but not C treatments. Sheep on treatment GF increased their intake rate by increasing bite mass and masticating ingested material less than those on treatment GNF. For C treatments, where bite masses were relatively high and mastications per unit of herbage DM ingested were relatively low, there was less opportunity for ewes to increase bite mass and intake rate in response to fasting, because masticating rate by CNF animals was low and they were already eating at near maximum rate (Parsons *et al.*,1994; Penning *et al.*,1995). During the 24 h following fasting, fasted animals increased the time spent grazing and ruminating and decreased the idling time. Over the period 25 to 48 h, all treatment effects had largely disappeared. Particle size of ingested herbage (Table 2) was reduced to a greater extent on NF compared with F treatments and particles tended to be larger on the G than C treatments.

In conclusion, sheep tended to have greater bite masses on clover than grass and the proportion of small particles in the extrusa was greater for clover than grass. Animals also tended to increase bite mass in response to fasting and, for grass, fasting caused mastications g^{-1} of herbage ingested to decrease. This reduction in mastication tended to give a greater percentage of larger particles in the extrusa. Fasting also caused an increase in grazing and ruminating time that persisted for 24 h following the fast.

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Table 1
Bite mass and biting rate during extrusa collection; grazing, ruminating and idling time (min 24 h^{-1}) over 48 h following extrusa collection.

	GNF	GF	CNF	CF	F Probabilities Herbage	Fasting	Fast.x Herb.
Bite mass (mg DM $bite^{-1}$)	40	64	61	70	0.56	0.46	0.73
Prehension rate (bites min^{-1})	52	52	75	63	0.02	0.21	0.20
Mastication rate (bites min^{-1})	100	112	73	98	0.01	0.01	0.24
Total preh. + mast. (bites min^{-1})	151	164	149	161	0.74	0.14	0.96
Total jaw movements g^{-1} DM intake	100	83	37	41	0.04	0.74	0.57
0 to 24 h after collection of extrusa							
Grazing	424	621	492	534	0.80	0.02	0.08
Ruminating	314	348	239	348	0.26	0.05	0.26
Idling	703	471	709	559	0.32	0.01	0.39
25 to 48 h after collection of extrusa							
Grazing	455	543	479	469	0.42	0.23	0.15
Ruminating	331	289	369	389	0.18	0.82	0.51
Idling	654	608	592	581	0.50	0.66	0.78

Table 2
Particle size DM distribution (%) in extrusa.

Mesh aperture size (mm)	GNF	GF	CNF	CF	F Probability Herbage	Fasting	Herb. x Fast.
2.4	19.8	19.7	16.6	18.6	0.52	0.66	0.78
1.2	11.1	13.5	11.6	12.1	0.38	0.08	0.23
0.6	10.4	11.3	7.6	9.8	0.11	0.18	0.51
0.3	5.0	5.4	3.0	4.7	0.15	0.20	0.36
0.18	4.5	4.2	2.8	3.5	0.17	0.70	0.49
<0.18	49.2	46.0	58.4	51.3	0.16	0.25	0.62