

# INGESTIVE BEHAVIOUR OF FISTULATED AND INTACT SHEEP GRAZING GRASSES AND LEGUMES INDOORS AND OUTDOORS

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## ABSTRACT

Components of short-term ingestive behaviour were recorded for fistulated and intact sheep grazing turves in indoor crates, and for esophageal-fistulated sheep grazing swards *in situ* in outdoor cages. Perennial ryegrass, orchard grass and white clover at vegetative and reproductive growth stages were offered to the sheep. Bite weight, depth, area and volume did not differ between sheep grazing indoors and outdoors, nor between intact and fistulated sheep. Bite rate of fistulated sheep was slower indoors than outdoors (25.3 versus 32.1 bites/min), and intact sheep had a higher biting rate (36.7 versus 25.3 bites/min) than fistulated sheep. Bite weight was over-estimated using extrusa collection, the average DM recovery coefficient being 1.32.

## KEYWORDS

Sheep, grazing, esophageal fistulate, ingestive behaviour, indoors, field

## INTRODUCTION

Measurement of ingestive behaviour of grazing animals in large-plot grazing trials is complicated by lack of control of grazing conditions, and close-confinement of experimental animals allows greater control of sources of variability. Forbes and Beattie (1987) concluded that fistulated and intact animals did not differ in grazing behaviour or diet composition. There is no available comparison of bite rate and dimensions for fistulated and intact animals.

Our earlier experiments examined short-term ingestive behaviour of animals confined indoors in metabolism crates (Gong et al., 1996a & b). In the current experiment we compared the components of short-term ingestive behaviour of fistulated and intact sheep grazing indoors, and fistulated sheep confined outdoors in cages but with access to defined patches of pasture *in situ*.

## EXPERIMENTAL

Perennial ryegrass (*Lolium perenne*) and orchard grass (*Dactylis glomerata*), and two white clover (*Trifolium repens*) cultivars (Grasslands Tahora and Grasslands Kopu), were grazed by sheep at vegetative and reproductive stages of maturity. Four intact and four esophageal-fistulated sheep individually confined in crates indoors were offered turves from monoculture swards growing in the field and allowed to take 12-17 bites on each sward type. The procedure was repeated outdoors with the fistulated sheep individually penned in a cage which allowed access to a defined area (the same as for the turves) of herbage in front of the animal. The intact sheep were 38 months old, 57.7 kg (SE: 1.9) liveweight, and had eight adult incisors. The fistulated sheep were of different ages, 50.3 kg (SE: 1.9) liveweight, and had two, four or eight adult incisors.

A number of sward and ingestive behaviour measurements were made before, during and after grazing (Gong et al., 1996a). The amount of herbage removed by 12-17 bites was determined indoors by weighing turves before and after grazing. Both indoors and outdoors, extrusa from fistulated animals were collected and weighed after drying. Sward and ingestive behaviour variables were obtained from the above measurements. Bite weight was calculated using both

extrusa collection ( $Bw_{eb}$ ) and turf weighing ( $Bw_{tb}$ ) methods. All results were subjected to analysis of variance using a factorial model with fixed effects.

## RESULTS AND DISCUSSION

Sward variables did not differ between the indoor grazed turves and the outdoor grazed swards ( $P>0.05$ ), giving confidence that turves extracted from the plots were representative of *in situ* swards. Sward height was generally greater for grasses than white clover at the same maturity stage, but bulk density was greater for the clover. Reproductive swards had greater mass but lower bulk density than vegetative swards (Table 1).

Bite weight, depth, area and volume did not differ for fistulates indoors and outdoors, nor for intact and fistulated sheep indoors (Table 2). However, bite rate was slower for indoor than outdoor fistulated sheep, and for indoor fistulated compared with indoor intact sheep (Table 2). Values for ingestive behaviour variables in the current experiment concur with those of Gong et al. (1996a), and fell within the range of values from previous work (Black & Kenney, 1984; Burlison et al., 1991). Although our fistulated sheep were trained (Gong, 1994), they were more timid than the intact sheep, and could be disturbed by the observer. This probably resulted in underestimates of bite rate. When the observer stood behind the fistulated sheep outdoors they displayed bite rates similar to those of indoor intact sheep (36.7 versus 32.1,  $P>0.05$ ).

Recovery coefficients calculated as  $BW_{tb}/BW_{eb}$  ranged from 1.00 to 1.41 for the forage x maturity stage combinations, the overall average being 1.32 (SE = 0.06). Adjustment for saliva contamination (Burlison 1987), reduced this mean to 0.96 (SE = 0.03).

Indoor crate grazing is an efficient technique for observation of short-term grazing behaviour. It provides an opportunity for detailed laboratory characterization of swards, and allows accurate measurement of short-term intake without surgically modified animals. Our work suggests that indoor results can be reliably extrapolated to short-term field grazing. As concluded by Forbes and Beattie (1987) but for a wider range of variables in this case, our results suggest ingestive behaviour of fistulated sheep does not differ significantly from that of intact animals of similar background and condition.

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**Table 1**

Least squares means of sward variables for four forages at two maturity stages, offered to intact and fistulated sheep (means for indoor and outdoor measurements)

Forage	Maturity stage	Surface height (cm)	Stem height (cm)	Herbage mass (g DM/m <sup>2</sup> )	Bulk density of grazed stratum (mg DM/cm <sup>3</sup> )	Bulk density of sward (mg DM/cm <sup>3</sup> )
Ryegrass	Vegetative	12.4	5.4	230	1.29	1.90
	Reproductive	26.6	16.8	260	0.56	0.97
Orchard grass	Vegetative	17.9	5.4	181	0.90	1.02
	Reproductive	47.8	20.9	290	0.50	0.62
Tahora	Vegetative	8.5	7.1	180	2.11	2.13
	Reproductive	19.0	13.7	265	1.40	1.10
Kopu	Vegetative	16.3	14.3	240	1.44	1.34
	Reproductive	22.6	17.9	280	1.24	1.14
SEM		0.5***	0.4***	14***	0.08***	0.06***

\*\*\* Significant at P<0.001.

**Table 2**

Least squares means for ingestive behaviour variables over four forages at two maturity stages for indoor and outdoor fistulated sheep, and indoor intact sheep.

	Indoor-fistulated	Outdoor-fistulated	Indoor-intact	SEM indoor-outdoor	SEM intact-OF
Bite weight <sub>cb</sub> (mgDM)	264.5	255.1		18 NS	
Bite weight <sub>tb</sub> (mgDM)	216.4		252.9		19 NS
Bite rate (bites/min)	25.3	32.1	36.7	1.6 ***	1.7 ***
Bite depth (cm)	11.0	11.7	10.7	0.5 NS	0.5 NS
Bite area (cm <sup>2</sup> )	10.9	10.1	12.5	0.5 NS	0.5 NS
Bite volume (cm <sup>3</sup> )	118.3	118.7	134.9	7.0 NS	7.3 NS

NS, Not statistically significant; \*\*\* Significant at P<0.001.