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VOLUNTARY INTAKE AND DIGESTION IN RED DEER AND SHEEP

P. F. FENNESSY, G. J. GREER and D. A. FORSS
Invermay Agricultural Research Centre, Mosgiel

SUMMARY

The *ad libitum* intake and digestion of a high-quality pelleted feed and a mature meadow hay by young stags and young rams during winter were compared. At the same intake the deer appeared to digest the structural carbohydrates, hemicellulose and cellulose more efficiently than sheep.

INTRODUCTION

The rapid growth of the deer farming industry and the high monetary value of the animals have created a demand for information about their nutrition. The seasonal pattern of food intake of stags and the effects of nutrition on antler growth are now important research topics. As part of these studies a trial with young stags commenced in winter 1978. The deer were fed *ad libitum* either meadow hay or a high-quality pelleted diet, and the intake and digestion of these diets by the deer were compared with those of sheep.

EXPERIMENTAL

Five 6-month-old red stags (*Cervus elaphus*) and five 9-month-old Suffolk × Perendale ram lambs, confined in pens indoors, were allocated to each diet for 10 weeks from the start of the experiment in June. The initial mean weight was 49 kg for the stags and 35 kg for the rams. Liveweights were recorded at 2-weekly intervals.

The pelleted diet consisted of 55% barley, 35% lucerne and 10% linseed; the hay was chopped. The animals were offered about 30% more feed than the intake for the previous day. Sodium chloride (4 g/day) was sprinkled on the feed daily and water was freely available. All animals received an anthelmintic, selenium (3 mg) and Vitamins A, D and E at monthly intervals.

During the final 4 weeks, faecal collections were made daily over two consecutive 10-day periods, and samples of feed offered, feed residues and faeces were collected daily for calculation of dry matter (DM) intake and faecal DM output;

organic matter (OM) was determined after incineration of samples in a muffle furnace. Samples of feed, residues and faeces were freeze-dried and carbohydrate analyses performed on finely ground samples using essentially the methods of Bailey (1967). Nitrogen (N) was determined using an Autoanalyzer technique following Kjeldahl digestion.

One sheep fed the pellets died early in the experiment and another went off its feed during the digestibility period, while one of the stags was nervous and unsuited to faecal collection. Consequently, the digestion data for the pellets include only three sheep and four deer.

BIOMETRICAL ANALYSES

Comparisons involving voluntary intake, liveweight gain and chemical composition of feeds and residues were analysed by *t* tests.

Regression relationships were derived between digestibility and intake for each species and each diet for OM, hemicellulose and cellulose. If the slopes were not significantly different between species, then adjusted means were compared. The regression relationships have been calculated using the mean value of the two 10-day periods for each animal. Deviations between slopes from each period were small and not significant.

RESULTS AND DISCUSSION

Table 1 presents the mean values for intake and liveweight gain over the 10-week period. The sheep ate more pellets and grew faster than the deer. The intakes and weight gains for both species fed hay were similar. The low rate of liveweight gain for the stags fed pellets resulted from depressed winter intake, since during the following 6 months on the same diet their intakes

TABLE 1: DRY MATTER INTAKE (DMI) AND LIVEWEIGHT GAIN (LWG) FOR SHEEP AND DEER DURING THE 10-WEEK WINTER PERIOD (MEAN ± SE)

Diet	*DMI ($g/kg^{0.75}/day$)* Sheep	Deer	*LWG (g/day)* Sheep	Deer
Pellets	80.4 ± 1.6†	65.3 ± 4.9 *	257 ± 9†	88 ± 22**
Meadow hay	54.8 ± 2.8	53.7 ± 1.7 n.s.	−17 ± 8	−10 ± 11 n.s.
Between diets	**	*	**	**

† n = 4 sheep.

reached higher levels giving an average growth rate of 320 g/day (Fennessy and Greer, unpublished data).

The chemical composition of the feeds is shown in Table 2. There were no differences between the sheep and deer in the composition of feed residues. However, the hay residues contained a higher level of cellulose (35.1% of the DM) and a lower level of N (0.84%) than the feed (30.7 and 0.97%, respectively), indicating the selection of material by both species.

TABLE 2: CHEMICAL COMPOSITION OF THE FEEDS (% OF DM)

	Pellets	*Meadow Hay*
Organic matter	93.8	94.4
Hemicellulose	8.3	24.5
Cellulose	8.8	30.7
Lignin	5.8	12.3
Nitrogen	2.75	0.97
Soluble carbohydrate	45.3	10.2

The regression relationships between digestibility and intake (per unit of metabolic body size, $kg^{0.75}$) were derived for each species for OM, cellulose and hemicellulose. When compared by analysis of covariance, only the OM digestibility (OMD%) – OM intake (OMI) relationships for both pellets and hay were significantly different in regression slopes. The equations were:

Pellets: OMD sheep = 104.6 – 0.449 OMI, r^2 = 0.987**
OMD deer = 82.5 – 0.087 OMI, r^2 = 0.668*
Hay: OMD sheep = 82.4 – 0.687 OMI, r^2 = 0.936**
OMD deer = 63.1 – 0.248 OMI, r^2 = 0.654**

These relationships are shown in Fig. 1. For both diets it is apparent that the rate of decline in digestibility with an increasing *ad libitum* intake was greater for the sheep than for the

TABLE 3: INTAKE AND THE APPARENT DIGESTIBILITY OF THE HEMICELLULOSE AND CELLULOSE IN THE TWO DIETS

	Intake	*Adjusted Mean Digestibility (%)*		
	(g/kg $^{0.75}$/day)	*Sheep*	*Deer*	*SE*
Pellets:				
Hemicellulose	5.6	42.7	52.4	4.39 *
Cellulose	5.9	32.9	38.3	3.39 n.s.
Meadow hay:				
Hemicellulose	12.6	50.4	55.6	0.93 **
Cellulose	14.8	41.7	47.6	2.62 *

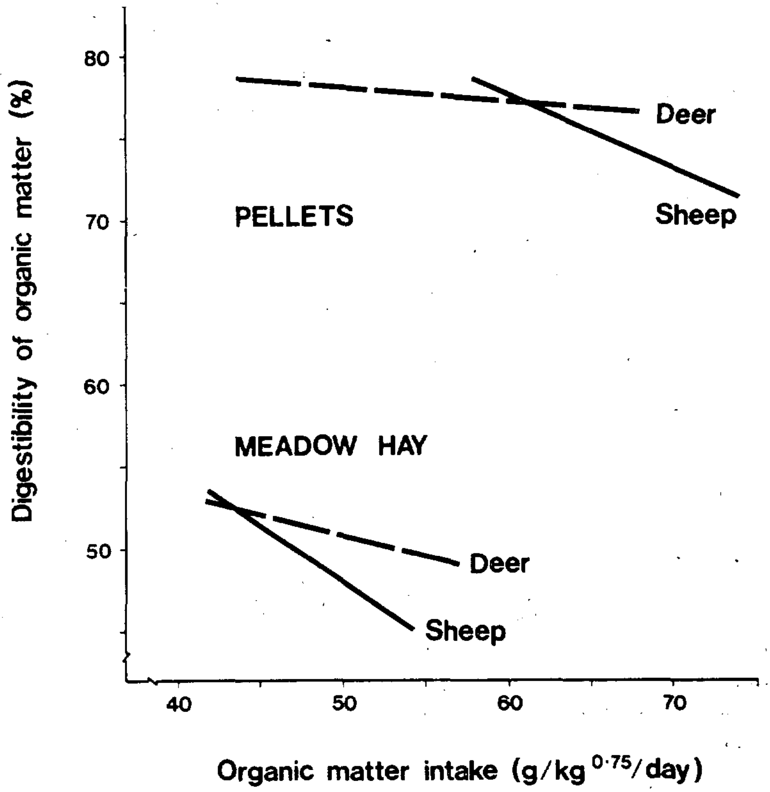

FIG. 1: *Relationships between apparent digestibility of organic matter and intake for the sheep and deer fed two diets.*

deer. Consequently, over much of the range of intake, especially for the hay diet, the apparent digestibility of OM was greater for the deer than for the sheep.

Since the regression slopes were not significantly different between species for hemicellulose and cellulose, the adjusted mean values have been compared (Table 3).

The apparent digestibility of the hemicellulose component of each diet by the deer was significantly higher than that by the sheep. The large difference between species in cellulose digestibility was significant only for the hay diet. For both diets, the differences in digestibility of the structural carbohydrates are more than sufficient to explain the differences in OM digestibility.

The results of this work where deer appear to digest the diets more efficiently than sheep are in contrast to the general trend in overseas work with red deer (Kay and Goodall, 1976; Simpson, 1976; Milne *et al.*, 1978). Generally, Scottish deer tended to digest feeds (with the exception of heather) less efficiently than sheep when compared at the same intakes. Where the digestibility by sheep was higher it appeared to be associated with a slower rate of passage through the digestive tract. Ruminal retention time, a component of the rate of passage, may be a particularly important factor. Milne *et al.* (1978) found the higher digestibility of heather by deer was associated with a longer ruminal retention time, whereas the lower digestibility of the *Agrostis/Festuca* diet was associated with a shorter retention time in the deer than in the sheep. Although ruminal retention time was not measured in the present study, it seems that possible differences in this respect could explain the differences in digestibility recorded between the species. Additional studies with young females fed hay during winter in which similar differences in digestibility were recorded support the differences between species reported here (Fennessy, unpublished). However, any reasons for the differences between deer and sheep in New Zealand and Scotland would be speculative at this stage but it would seem that neither the sex of the animals nor time of the year can satisfactorily explain the differences.

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