THE EFFECT OF LEVEL OF FEEDING OF PASTURE ON ITS DIGESTION BY LACTATING DAIRY COWS

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SUMMARY

In three experiments, each of 60 lactating cows was subjected to two levels of feeding, and apparent digestibility of organic matter (OM), energy (E) and nitrogen (N) estimated. Rations were protein-extracted, previously frozen or fresh pasture. When analysed on a within-cow basis, apparent digestibility of OM and E but not N decreased as feeding level increased. The extent of the decrease differed for each experiment. However, content of metabolizable energy in the ration was similar at each feeding level, since energy loss as urine and methane was less at the high than at the low level of feeding.

INTRODUCTION

The effect of level of feeding of ruminants on ration digestibility has been reviewed by Brown (1966). In most instances the rations were dried forages subjected to various physical treatments, or concentrate/roughage mixtures. Little information exists on the extent to which digestibility of fresh forages is influenced by level of feeding in the dairy cow.

Following completion of the calorimetric facilities at Ruakura Agricultural Research Centre (Bryant *et al.*, 1977), a programme of research has been initiated which aims to provide information on the energy metabolism of the pasture-fed lactating cow. Procedures have required balances of major nutrients to be estimated for each cow at two levels of feeding. Data from some of this work have been analysed to provide information on the effect of level of feeding on ration digestibility and metabolizable energy (ME) content.

SOURCE OF DATA

Data from the work described by Bryant (1976) and Trigg *et al.* (1979) have been used. They are referred to here as Experiments 1 and 2, respectively. In Experiment 1, one member of six sets of twins (mean liveweight 370 kg) in their sixth to eighth month of lactation was offered pasture, and the other protein-extracted pasture. Both rations were stored at −18°C, and

feeding arranged so as to avoid trends with time in ration quality. In Experiment 2a, 15 sets of twins in early (weeks 8 to 18) lactation, and in Experiment 2b nine sets in late (weeks 22 to 32) lactation, were offered freshly cut pasture. Mean liveweight was 366 and 354 kg, respectively.

In Experiment 1, the levels of feeding were approximately 90 and 75% *ad libitum*, whereas in Experiment 2 they were *ad libitum* and 75% of NRC requirements. Actual feeding levels are given in Table 1. Since in Experiment 1 there were no significant differences in intake within levels between rations or interactions of feeding level and ration, data for the separate rations have been pooled in subsequent tables.

TABLE 1: MEAN LEVELS OF FEEDING (kg OM/100 kg LW ± SE) IN EXPERIMENTS 1 AND 2

	Exp. 1			
	Pasture	*Protein-extracted Pasture*	*Exp. 2a Pasture*	*Exp. 2b Pasture*
High	2.41 ± 0.14	2.53 ± 0.07	3.24 ± 0.08	3.03 ± 0.03
Low	1.98 ± 0.05	1.97 ± 0.02	2.42 ± 0.08	1.81 ± 0.02

In both experiments each feeding level was maintained for 21 to 28 days, with nutrient balances and gas exchange being estimated during the last 7 to 10 days. The sequence of feeding levels was random. Pasture used was predominantly of ryegrass, paspalum and white clover.

The regression of digestibility on intake was analysed on a within-cow basis. In Experiment 2, allowances were made for effects of differences in herbage maturity.

RESULTS AND DISCUSSION

Apparent digestibility of OM, E but not N at the high level of feeding was consistently less than at the low level. The extent of the decrease in digestibility (Table 2) was generally greatest for Experiment 1 and least for Experiment 2b and did not appear to be associated with actual digestibility.

It may be that even after adjusting the data of Experiment 2 for stage of maturity of the rations, variation in pasture quality still concealed in part the effect of level of feeding. Further, since the high level of feeding in Experiment 2 was *ad libitum*,

TABLE 2: MEAN DIGESTIBILITY (%) AND DECREASE IN APPARENT DIGESTIBILITY (% UNITS) (± SE) RESULTING FROM AN INCREASE IN INTAKE OF 1 kg ORGANIC MATTER

	Exp. 1		*Exp. 2a*		*Exp. 2b*	
	Dig.	*Decrease*	*Dig.*	*Decrease*	*Dig.*	*Decrease*
OM	72.4	1.10 ± 0.30*	76.5	0.49 ± 0.17*	72.8	0.28 ± 0.07*
Nitrogen	64.7	1.92 ± 1.12 n.s.	69.5	0.11 ± 0.32 n.s.		0.11 ± 0.31 n.s.
Energy	67.5	1.51 ± 0.46*	72.8	0.54 ± 0.24*		0.19 ± 0.17†

animals at this level may have been able to select a ration of higher quality than those on restricted feeding levels, and this may have led to a systematic bias in the data. In contrast, selection was not possible in Experiment 1 and a significant effect of feeding level on digestibility indicates that any bias due to selection was unimportant in these data.

Hutton (1962), using non-lactating cows, found that energy digestibility increased by 0.8 units when intake was decreased from *ad libitum* to 40% of this level, a decrease of 2.19 kg OM. However, difficulty in defining feeding level makes quantitative comparison with published work difficult.

In both experiments, decreases of energy digestibility at higher levels of intake were compensated for by concomitant reduction of energy loss through urine and methane excretion (Table 3). This resulted in the metabolizable energy content of the feed per unit dry matter (ME/DM) remaining relatively constant irrespective of feeding level (Table 3). These data are in agreement with those of Flatt (1966), who showed similar effects with high-forage rations. Such compensation, however, may not occur with

TABLE 3: EFFECT OF LEVEL OF FEEDING ON AVERAGE (± SE) PARTITION OF GE (%) TO URINE, METHANE AND METABOLIZED ENERGY

		Urine E/GE	*CH_4 E/GE*	*ME/GE*
Exp. 1	H	5.1 ± 0.3	6.8 ± 0.1	55.6 ± 0.7
	L	6.0 ± 0.2	7.5 ± 0.1	56.9 ± 0.3
		†	*	n.s.
Exp. 2a	H	5.7 ± 0.1	6.1 ± 0.1	61.0 ± 0.7
	L	6.3 ± 0.2	6.8 ± 0.1	61.4 ± 0.5
		†	*	n.s.
Exp. 2b	H	6.1 ± 0.3	5.9 ± 0.1	55.0 ± 1.3
	L	7.1 ± 0.4	7.0 ± 0.2	53.8 ± 1.3
		*	*	n.s.

rations containing large proportions of highly digestible concentrates.

Thus, for dairy cows fed pasture it appears that although level of feeding has substantial effects on apparent digestibility of energy, this is of limited practical significance because effects on ME content are small. Effect of level of feeding on apparent digestibility of nitrogen is less conclusive because variation was greater than for either energy or OM, and no inferences can be drawn as to the quality of the nitrogen apparently digested.

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