BRIEF COMMUNICATION

Physical breakdown of forages during rumination

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Sheep and cattle may spend up to 12 h/d ruminating, however, there is little quantitative information available on processes of bolus formation and particle breakdown that take place during rumination and how these may be influenced by diet. In this study 6 2-year-old Romney wether sheep were trained to allow boli to be collected via an oesophageal fistula while the sheep ruminated. The sheep were fed hourly (950 g dry matter (DM)/d) the following forages providing a range of digestibilities: fresh vegetative perennial ryegrass (PR1, 79%); fresh mature ryegrass (PR2, digestibility not determined); fresh red clover (RC, 79%); fresh lucerne (FL, 72%); chaffed meadow hay (MH, 60%) and chaffed lucerne hay (LH, 54%). Particle size distribution in digesta was determined by wet sieving with 4, 2, 1, 0.5 and 0.25 mm sieves. Preliminary reports on cell wall chemical composition and digestibility (John and Waghorn, 1986) and particle breakdown during eating (John and Reid, 1986) have been given.

During each rumination cycle the regurgitated (Up) bolus on arrival at the mouth is separated into a fraction (Tail) which is immediately reswallowed and a fraction (Retained) which is retained in the mouth, chewed on and then reswallowed (Down). There were some large differences between diets in the weights of Up and Tail boli (Table 1). Although a smaller variation occurred with the weights of Retained digesta, differences in DM content of digesta resulted in a nearly 2-fold range in Retained DM. Down boli were larger than Retained digesta for each of the forages with the difference being due to addition of saliva during rumination (5.3, 4.5, 6.3, 4.0, 4.9 and 8.7 $\pm$ 0.72 g/bolus respectively).

When compared to concentrations of DM and large particles (LP; particles too large to pass a 1mm sieve) in rumen digesta, the digesta in Up boli had a lower DM content and a lower LP content. These differences probably reflect the composition of digesta in the anterior rumen from which the Up bolus is selected. Digesta selected in the mouth for

TABLE 1 Weight and composition of rumination boli and rumen digesta.

Component	Bolus	Forage[1]						
		PR1	PR2	RC	FL	MH	LH	SE
Digesta (g)	Up	52	58	54	65	75	73	2
	Tail	18	19	20	24	32	33	2
	Retained	34	38	34	41	44	40	2
	Down	39	43	40	45	49	49	1
DM (g)	Up	3.27	3.41	4.35	5.02	6.12	7.43	0.16
	Tail	0.97	0.94	1.48	1.69	2.24	3.11	0.13
	Retained	2.31	2.47	2.88	3.32	3.88	4.32	0.12
DM content (%)	Rumen	8.2	—	8.7	9.5	9.9	10.6	0.2
	Up	6.3	5.8	8.0	7.8	8.1	10.0	0.1
	Tail	5.3	4.9	7.4	7.0	7.1	8.7	0.2
	Retained	6.8	6.4	8.5	8.2	8.9	10.8	0.1
Large particles (% of DM)	Rumen	24.7	—	18.0	14.4	28.8	29.4	1.7
	Up	14.2	15.3	14.7	13.8	18.9	16.1	0.7
	Tail	11.3	9.8	11.4	7.2	13.0	12.5	0.5
	Retained	15.7	17.3	18.2	15.3	22.3	17.5	0.7
	Down	9.7	9.5	9.3	5.7	7.9	7.2	0.6

[1] PR1 Fresh vegetative perennial ryegrass; PR2 Fresh mature ryegrass; RC Fresh red clover; FL Fresh lucerne; MH Chaffed meadow hay; LH Chaffed lucerne hay; SE Pooled standard error.

TABLE 2 Large particle (LP) breakdown and extent of chewing during rumination.

	Forage[1]						
	PR1	PR2	RC	FL	MH	LH	SE
Large particle breakdown (mg/bolus)	130	193	263	310	577	476	10
(mg/chew)	1.9	2.8	4.2	5.1	7.2	7.3	0.6
Proportion of large particles broken down (%)	36	45	50	61	64	58	4
Chews/g retained DM	30.1	27.8	21.8	17.4	18.5	16.7	1.2

[1] Abbreviations given in Table 1.

Tail bolus formation had a lower DM content (mean ratio Tail DM%/Up DM % = 0.88 ± 0.013) and LP content (mean ratio Tail LP%/Up LP% = 0.70 ± 0.043) than Up digesta. The digesta thus retained for chewing had a higher DM and LP content than Up digesta. However, with PR1, MH and LC diets, LP content of Retained digesta was lower than that found in rumen digesta.

The weights of LP reduced to pass a 1mm sieve by chewing during each rumination cycle (Retained-Down), the weights reduced per chew and chews/g Retained DM are shown in Table 2. These results show that:

1. Rate of LP breakdown (mg/bolus) with fresh ryegrass was lower than with fresh legumes and that this appears to be due to higher resistance to chewing (mg LP reduced/chew) with fresh ryegrass.
2. Dry forages had a higher rate of LP breakdown than fresh forages, this appeared in part to be due to lower resistance to chewing with dried forage while the higher DM content of rumen digesta contributed to increased amounts of LP retained for chewing. However, as the rate of chewing (chews/sec) during rumination was higher with fresh forage (1.79 ± 0.001) than dried forage (1.43 ± 0.001) other explanations such as differences in the force applied per chew cannot be excluded.

REFERENCES

John A., Reid C.S.W. 1986. Factors affecting rate of feed intake by sheep. *Proceedings of the Nutrition Society of New Zealand* **11**: 108.

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