TIME SPENT EATING AND RUMINATING IN SHEEP FED A RICE STRAW SUPPLEMENTED AND/OR PRETREATED WITH UREA

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Introduction

Many factors are involved in the regulation of intake, and increases in the intake of low quality roughage are often related to the capacity of the reticulo-rumen (ReRu) to accomodate digesta, and rates of digestion and passage. Higher intake in animals fed a urea treated compared to an untreated rice straw diet, accompanied by reduced ReRu fills and/or dry matter loads suggest that the disappearance of digesta from the ReRu must have increased.

In an attempt to understand more of the mechanism involved in the regulation of intake, Djajanegara and Doyle (1988) found that despite the increased intake in sheep fed urea-treated rice straw, ReRu fill and dry matter loads were similar. While the digestion rate of fibre of the treated straw increased, passage rates were similar between diets. Passage out of the rumen was largely regulated by the restriction of large particles through the reticulo-omasal orifice, and for passage, the size of particles needed to be reduced to about 1.2 mm. Reduction in particle size was believed to be largely accomplished by chewing (Pearce, 1967) and the present paper reports on some measurements made of the time spent chewing during eating and ruminating in sheep given a rice straw supplemented and/or pretreated with urea diets.

Materials and Methods

Two groups of 10 Merino x Corriedale wethers, fitted with rumen and abomasal cannulae were fed diets containing an untreated or urea-treated rice straw diet. Treatment with urea (6%; w/w) increased the nitrogen content of the straw (1.31 vs 0.65%). The diets were comprised of (g/kg) 920 rice straw or urea-treated rice straw, 50 molasses and 20 minerals. In addition, urea mixed with Na_2SO_4 (ration 1: 0.204) was infused into the rumen providing 11.5 g/kg dry matter intake/animal. Voluntary intake and the amount of digesta in the ReRu and flowing through the abomasum were measured (see Djajanegara and Doyle, 1988). In this study, 4 wethers in each group were selected and their eating and ruminating patterns over 2 consequtive days were measured in two animals at any one time. An accelerometer (differential transducer) was attached to the lower jaw and the movements were recorded on a chart recorder (speed 0.5 cm/min). Particle size distribution in the diets and RuRu digesta was measured by the wet sieving method (Pearce, 1967). Potential digestibility was measured by incubating samples over 72 h in the rumen.

Results and Discussion

The intake of the urea-treated rice straw and supplemented with urea diet was greater ($p < 0.01$) than that when the straw was only supplemented (table 1). Treatment with urea has increased the potential digestibility of NDF in the straw by 12% unit (69 vs 57%). The apparent dry matter and organic matter digestibility was also higher than those of the untreated-supplemented rice straw diet (54.8 vs 48.5% and 61.8 vs 53.8%, respectively). The distribution of particle size in feed dry matter was the same in both diets. However, there were differences in the proportion of different particles in rumen digesta dry matter (table 2). The proportion of fine particles (< 1 mm; not retained on a 1 mm sieve) was higher in

TABLE 1. INTAKE AND DIGESTIBLE INTAKES OF DIETARY CONSTITUENTS (g/d)

	Untreated n=10	Urea treated n=10	SEM	Sign P<0.01
Dry matter	987	1,150	32.5	**
digestible	480	619	18.5	**
Organic matter	833	967	27.2	**
digestible	450	572	16.9	**
Nitrogen	11.6	21.1	0.67	**

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TABLE 2. PARTICLE SIZE DISTRIBUTION IN FEED AND RUMEN DIGESTA DRY MATTER (%)

Sieve apperture	Dry matter retained on 2.0	1.0	0.5	0.25	0.125	Not retained –
In diets						
untreated	84.1	0.9	0.3	0.3	0.2	14.2
treated	80.1	1.7	0.6	0.2	0.2	17.2
In rumen digesta						
untreated	30.6	20.5	19.5	12.3	4.8	12.3
treated	32.9	16.0	15.6	10.4	4.3	20.6
Difference	NS	**	**	*	NS	**

* $P<0.05$; ** $P<0.01$; NS not significant

rumen digesta dry matter of sheep on the treated rice straw diet. This may in part be due to reduced resistance of the straw to particle breakdown, as indicated by the increased potential digestibility. It is not clear why small particles which can pass through a 1 mm sieve are retained. Many studies have also indicated that a high proportion of small particles are retained in the ReRu (Pearce, 1967; Waghorn, 1986). The different proportion of particle sizes in rumen digesta dry matter in sheep fed untreated and urea-treated rice straw-based diets can be associated with differences in the effectiveness of breakdown of particles by chewing. Time spent eating and ruminating are only qualitative assessments of activities related to particle breakdown during chewing. For both diets, sheep spent about 16-17 h/d chewing during eating and ruminating (table 3). Weston

TABLE 3. CHEWING PATTERN IN SHEEP FED UNTREATED AND UREA-TREATED RICE STRAW DIETS

	Untreated	Urea-treated	SEM
Dry matter intake (g)	1014	1129	85.5
Eating time,			
h/d	6.4	7.7	0.89
min/100 g DM	38	42	7.8
Ruminating time			
h/d	10.2	8.2	0.55
min/100 g DM	60	42	3.3
Ruminating/eating	1.67	1.05	0.19
Total chewing time (h/d)	16.6	16.1	0.97
No. boluses/d	503	434	22.7
/h ruminating	49	54	1.7

(1985) indicated that this is about the maximum time spent each day in chewing by sheep fed low or medium quality forages. The time spent ruminating was 10.2 h on the urea-treated rice straw diet, and only 8.2 h were spent ruminating by sheep on the untreated-supplemented diet. While the time spent eating and ruminating were not significantly different, due to variability between sheep and the small number of animals used, it indicates that the animals spent more time ruminating when given the untreated rice straw diet or more chewing to allow for passage from the ReRu.

It appears that the time spent ruminating by sheep on the untreated rice straw diet may be at maximum. Weston (1982) indicated that ruminants spend a maximum of about 10 h/d ruminating, which is similar to that by sheep on the untreated-rice straw diet. If ruminating time is at maximum, then the time left for eating and the rate of eating determines intake. This may have limited the intake of the untreated-rice straw diet. The ratio of time spent ruminating to time spent eating was significantly greater in sheep given the untreated-rice straw diet than that in sheep given the urea-treated rice straw diet. This might imply that eating was not as effective in reducing particle size of ingested material on the untreated-rice straw diet which would be consistent with the necessity for more rumination to achieve reduction in particle dimensions for passage to the omasum. It seems logical to accept that the higher intake of the treated-rice straw diet would necessitate more time for eating as the particle size distribution of the two straws were similar. The increased susceptibility of the urea-treated straw diet to physical breakdown is consistant with the trend for less time spent ruminating and it was observed that sheep given the untreated rice straw diet regurgitated more boluses (543 vs 434) each day. Although their intake was less, similar amounts of digesta in the ReRu of sheep on both diets were found (see Djajanegara and Doyle, 1988). Weston (1985) indicated a positive relationship may exist between ReRu dry matter load and the time spent ruminating on forage fed lambs. There is insufficient data from the current work to confirm such a relationship.

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(**Key Words:** Rice straw, Chewing, Particle size)

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