THE INFLUENCE OF SLAKED LIME AND AVOPARCIN IN COMPLETE GRAIN-BASED DIETS FOR THE LIVESHEEP TRADE

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SUMMARY

The potential for slaked lime and avoparcin to influence intake and liveweight change for sheep under a feeding regime similar to that used in the livesheep trade, but with pellets replaced by a complete grain-based diet, was investigated. It was found that, generally, slaked lime substantially increased grain intake and liveweight change. However, the addition of avoparcin decreased grain intake and liveweight change. The results suggest that a chemical which can aid rumen buffering, such as slaked lime, might be preferable to an antibiotic, such as avoparcin, as a feed additive to regulate ruminal fermentation.

Keywords: slaked lime, avoparcin, livesheep trade, complete grain diets, ruminal fermentation.

INTRODUCTION

The livesheep trade to the Middle East uses large quantities of pelleted rations. An alternative to pelleted rations is a complete diet based on whole cereal grains. This type of diet has an advantage for use in the livesheep trade because of the high energy concentration of cereal grains. This reduces operating and transportation costs (Round 1986a). However, wethers fed diets containing large amounts of whole grain have lower voluntary intake and greater liveweight loss than those fed standard pelleted rations (Round 1986b).

Watson *et al.* (1986) showed that rumen pH decreases with increasing levels of grain in pelleted diets. This is consistent with the reduction in voluntary intake and increase in liveweight loss in whole grain-based diets being due to clinical or subclinical acidosis.

The antibiotic, avoparcin, can reduce lactic acid concentration in the rumen (Rowe and Aitchison 1986). Sodium bicarbonate can be used as a rumen buffer to reduce rumen lactate, albeit less effectively than avoparcin (Aitchison *et al.* 1987). As lactic acid is an important intermediate of carbohydrate fermentation, this indicates that avoparcin and appropriate rumen buffers will have beneficial effects in reducing acidosis.

This paper investigates the influence of slaked lime used as a rumen buffer, and avoparcin on voluntary grain intake and liveweight change of merino wethers fed complete cereal grain-based diets. The feeding conditions used were similar to those used in livesheep shipping to the Middle East.

MATERIALS AND METHODS

One hundred and twenty eight adult Merino wethers, from each of 3 sources, (384 wethers in total, fasted mean liveweight = 52.5 kg, s.d. = 5.1 kg) were allocated by stratified randomisation based on liveweight and source to 1 of 64 groups of 6 sheep. Two of the 3 sources of sheep were familiar with intensive feeding from a previous experiment. Each group was maintained in an outside pen (39 m^2 with 0.30 m/head trough space).

The experimental design was 1 replicate of a fully randomised 4×2^4 factorial. The treatment factors were: 4 levels of rice hulls (0, 10, 20, 30%), 2 grain types (whole wheat or whole oats), 2 levels of feeding (maximum of 1 .0 kg/wether.day or *ad libitum*), 2 levels of slaked lime (1.9% limil, or 1.0% finely ground limestone) (David Mitchell Estates Ltd, approximately 90% calcium hydroxide) and 2 levels of Avotan (0.43% or none) (Cyanamid Australia Pty Limited, estimated 10% avoparcin).

The diets were mixed, using a paddle mixer, in batches containing 200 kg of grain and ricehulls. In addition all diets contained molasses (1.9%), common salt (0.5%) and a trace mineral/vitamin premix (0.1%). Similar to the practice in the livesheep trade, diets were gradually introduced to sheep, following a 24 h fast, by replacing a hay diet with the grain/rice hulls rations over a 'feedlotting' period of 6 days. Thereafter the sheep were offered only their assigned rations, during a 3 week 'shipping' phase.

Residues were collected each day and separated into rice hull and grain contents. Jugular blood samples were taken from all sheep (5-7 h after feeding) on day 2 of the 'shipping' phase. On each of

these samples measurement of D-lactate, using an enzymatic UV test was carried out. Twenty-four hour fasted liveweights were measured immediately prior to allocation to pens, and immediately after the end of the 'shipping' phase of the trial.

Analysis of variance was carried out on pen means for grain intake, fasted liveweight change and D lactate, using 4 and 5 factor interactions as error. The D-lactate pen means were calculated after using a log (y + 0.3) transformation on each wether. In most pens fed a maximum of 1.0 kg/wether.day, on most occasions, the feed was not completely consumed. This allowed analysis (the residuals were checked) of grain intake using all pens.

The results suggested that slaked lime, avoparcin and rice hull responses are additive at each grain type by level of feeding combination, and thus can be considered separately. This paper is restricted to the responses to slaked lime and avoparcin under various combinations of grain type and level of feeding. The results for rice hulls under the various grain type by feeding level combinations were presented separately (Verstegen *et al.* 1990).

RESULTS

Grain intake and liveweight change increased substantially with the addition of slaked lime (Table 1). However, grain intake and liveweight change decreased with the addition of avoparcin (Table 2). The differences in the size of the responses to slaked lime and avoparcin between *ad libitum* and 'restricted' diets reflect the degree of restriction in intake imposed by feeding a maximum of 1.0 kg/wether.day.

Table 1. Effect of addition of slaked lime to complete grain based diets on grain intake (kg/wether.day) and liveweight (LW) change (kg/head)

Diet	Slaked lime	Grain intake	LW change
Wheat (max. 1.0 kg/wether.day)	No	0.62	–4.0
	Yes	0.74	–1.2
Wheat *(ad libitum)*	No	0.64	–2.9
	Yes	0.86	+0.1
Oats (max. 1.0 kg/wether.day)	No	0.75	–1.1
	Yes	0.84	–1.1
Oats *(ad libitum)*	No	0.78	–1.1
	Yes	1.15	+1.2
s.e.d.		0.036	0.73

Table 2. Effect of addition of avoparcin to complete grain based diets on grain intake (kg/wether.day) and liveweight (LW) change (kg/head)

Diet	Avoparcin	Grain intake	LW change
Wheat (max. 1.0 kg/wether.day)	No	0.69	–1.9
	Yes	0.67	–3.3
Wheat *(ad libitum)*	No	0.77	–0.9
	Yes	0.72	–2.0
Oats (max. 1.0 kg/wether.day)	No	0.81	–1.1
	Yes	0.77	–1.1
Oats (*ad libitum*)	No	1.04	+0.6
	Yes	0.89	–0.4
s.e.d.		0.036	0.73

There was no evidence ($P > 0.5$) of any effect of avoparcin or slaked lime on the day 2 D-lactate level despite effects of grain type ($P = 0.004$), level of feeding ($P = 0.012$) and amount of ricehulls ($P = 0.049$) on the D-lactate level.

DISCUSSION

In the diets where slaked lime was left out, limestone was added to meet the calcium required when feeding diets with a high proportion of cereal grain. While limestone (calcium carbonate) has been shown to have some effect on increasing intake and rumen pH in lambs fed high concentrate diets (Ha *et al.* 1983), it is likely to be less effective in preventing acidosis than slaked lime (calcium hydroxide). Slaked lime has a greater capacity to neutralize acid due to it having a higher solubility and being a stronger base. It thus serves as a sensible control.

Grain intake, rather than total intake, is presented since grain intake is more clearly related to liveweight change (Verstegen *et al.* 1990), and thus nutritional status of the animal.

Round (1984) reported that a rumen buffer, sodium bicarbonate, increased intake and reduced liveweight loss in pelleted diets with 60% wheat content. Thus his responses to the buffer, sodium bicarbonate, agree with our results to the buffer, slaked lime. Both his and our experiments were carried out under similar 'livesheep trade' feeding regimes.

Rowe (1988) found that addition of the antibiotic, lasalocid, reduced feed intake and liveweight gain during a 'shipping' phase when added to pellets similar to those used in the livesheep trade. This is similar to our result for the antibiotic, avoparcin. However, Rowe found that liveweight change was increased with the addition of lasalocid during a 'pre-shipping feedlot' stage, so that there was no effect of lasalocid on liveweight change for the whole experiment. Rowe *et al.* (1988) briefly reported no response of voluntary feed intake and liveweight gain to the presence of avoparcin in a pelleted diet.

It is surprising that on day 2 of the 'shipping' phase neither avoparcin nor slaked lime affected D lactate levels, despite diet effects on D-lactate levels. The result suggests that the effects of buffers and antibiotics, in whole grain-based diets, on intake and liveweight change might not be due to the control of lactic acid production, per se.

To conclude, the results suggest that under feeding regimes similar to those in the livesheep trade and with complete cereal based diets, it might be preferable to use a chemical which can aid rumen buffering, such as slaked lime, rather than an antibiotic, such as avoparcin, as a feed additive to regulate ruminal fermentation.

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