# DIETARY CONTROL OF URINARY pH IN SHEEP DURING LIVE EXPORT

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Urinary pH in ruminants is normally neutral to slightly alkaline. Nitrogenous constituents of urine are influenced by pH, e.g. urea, the main nitrogenous compound in urine, is degraded by bacteria to a mixture of ammonium ions and ammonia gas. At normal pH ($\geq$7), the chemical equilibrium favours volatilisation of ammonia gas. In this paper, we focus on long haul voyages in the live export industry where atmospheric ammonia is generally 15 ppm or less on vessels used for live export (Stacey 2001). These concentrations do not present any respiratory or occupational health problems. However, high temperature and humidity can result in the rapid breakdown of effluent by bacteria with increases in ammonia gas to higher concentrations in some areas of some vessels (Stacey 2001). A complicating factor is that the live export industry uses pelleted diets that can result in a urinary pH of approximately 8. One of the major influences on urinary pH is lime (calcium oxide) which is commonly incorporated at 1-2% as a binder in export pellets. Lime has the potential to form calcium hydroxide upon hydration and, hence, increase urinary pH.

We investigated the use of gypsum as an alternative binder to lime because it should lead to acidification of urine. Acidifying the urine should decrease atmospheric ammonia by shifting the equilibrium to ammonium ions. The efficacy of these 2 binders, lime and gypsum, on urinary pH was tested using 45 merino ewes, housed in individual pens. During the first 7 days, the ewes were fed 950 g of oaten chaff every morning (representing a maintenance diet), and then randomly allocated (based on liveweight) to 1 of 4 experimental diets (see Table 1). During the period, day 7-14, the pelleted diets were introduced in 25% increments at 2-day intervals. Urinary pH was measured on days 14, 19, 28 and 35. Daily feed intakes and weekly liveweights were recorded for each animal. At day 35, a blood sample was taken and blood gases were analysed.

**Table 1. Mean urinary pH (± s.e.m.) for sheep fed 1 of 4 pelleted diets for 14 days.**

| Diets | Urine pH |
|---|---|
| 18% lupins/30% barley/51% oaten hay/1% gypsum | $6.55 \pm 0.254^{a}$ |
| 18% lupins/30% barley/50% oaten hay/2% lime | $7.64 \pm 0.260^{b}$ |
| 18% lupins/30% barley/49% oaten hay/1% gypsum/2% lime | $6.61 \pm 0.260^{a}$ |
| 18% lupins/30% barley/52% oaten hay | $7.21 \pm 0.233^{b}$ |

Each value is the mean of a single urine collection from 9 sheep. Means with different superscripts are significantly different ($P<0.001$).

The experimental diets did not significantly ($P>0.05$) affect intake, weight gain, blood pH, $pO_2$ or $pCO_2$. Mean urinary pHs on day 28, after each sheep had been fed its respective experimental diet for 14 days, are shown in Table 1.

Gypsum significantly decreased the urinary pH in sheep compared with lime. However, gypsum was not as effective as lime as a binder. We predict that the decreased urinary pH will lead to a reduction in ammonia gas emission. Results from this research can be utilised by both the live export industry, and intensive, indoor farming systems, to reduce ammonia gas emission. Future work should investigate dietary alternatives to gypsum that will enhance urinary acidification.

STACEY, C. (2001). In 'MLA and LiveCorp Project Number SBMR.002).' (July 2001).

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