

COMPARISON OF METHODS FOR ESTIMATING THE LYSINE REQUIREMENT OF LAMBS

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Amino acid requirements of animals are often estimated by giving increasing levels of an amino acid in otherwise similar diets and establishing the intake at which there is an abrupt change in some criterion. Various criteria have been used but the resulting estimates of requirement have not been compared adequately. In this study the lysine requirement of lambs estimated from 7 previously used criteria were compared.

Nine male lambs, weighing 10 kg were each given by continuous abomasal infusion for 16 days, graded levels of lysine in liquid diets. These diets contained synthetic amino acids and were balanced for all nutrients except lysine and glycine which were interchanged isonitrogenously to produce 9 diets of 20% dry matter, 4.98% nitrogen, 0.24 to 3.50% lysine and supplying 1.38 M.J./kg^{0.75}/day. Nitrogen balance was measured from days 7 to 13 and a pulse dose of 50 µCi of ¹⁴C[u]L-lysine hydrochloride was given intravenously on day 16 to each lamb. Expired CO₂ was collected continuously, plasma samples were taken at intervals and the animals slaughtered 10 hours after injection. The carcasses, stripped of gut and bladder contents, were immediately frozen and subsequently homogenized and ¹⁴C incorporated into body protein determined. Each criterion was regressed against lysine intake using the two-phase piecewise linear method of Griffiths and Miller (1973). The intersection of the linear regimes provided an estimate of lysine requirement.

TABLE 1. Lysine requirement of lambs estimated from various criteria

Criterion used to estimate requirement	Measurement Period	Estimated requirement (g/kg ^{0.75} /day) ± SE
Live weight gain	Days 1-15	0.26 ± 1.30
Nitrogen balance	Days 7-13	0.82 ± 0.09
Plasma urea concentration	Day 16 (10 hrs)	0.23 ± 0.05
¹⁴ C excretion in urine	Day 16 (10 hrs)	0.28 ± 0.01
Plasma lysine concentration	Day 16 (10 hrs)	0.74 ± 0.14
¹⁴ C expired in CO ₂	Day 16 (10 hrs)	0.55 ± 0.04
¹⁴ C in body protein	Day 16 (10 hrs)	0.66 ± 0.10

There are large differences in the lysine requirement estimated from the various criteria (Table 1). An accurate measurement of live weight gain is difficult and both plasma urea concentration and ¹⁴C excretion in urine gave estimates considerably lower than those obtained with other criteria. Nitrogen balance, measured from days 7 to 13, could provide a higher estimate than that measured on day 16, since nitrogen requirement decreases with increasing live weight, Black and Griffiths (1975). Plasma lysine concentration will also provide a high estimate because it does not rise until all pathways of lysine utilization become saturated. Incorporation of ¹⁴C lysine into body protein should provide the most accurate estimate of requirement. However, difficulties in representatively sampling the carcass homogenate are indicated by the high error for this procedure. Recovery of ¹⁴C in expired CO₂ may theoretically slightly overestimate requirement, but it is a simple technique with a small standard error.

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