Degradation of canola and lupin meals in the rumen

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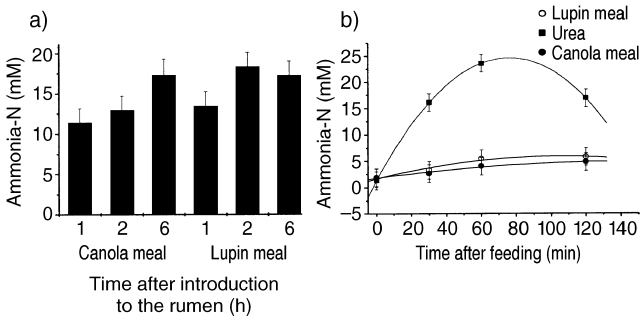
Urea and dietary protein usually are hydrolysed rapidly by rumen microbial populations. Because the rate and extent of breakdown of dietary proteins determine their nutritive value, breakdown of canola and lupin meals in the rumen was investigated in two studies reported here.

In the studies mature merino wethers fitted with rumen cannulae were used. In one, six sheep were given 1000 g (air-dry) chaffed oaten hay once daily. At feeding either 75 g heat-extracted canola meal (C, 33.4% crude protein (CP)) or 75 g lupin meal (L, 32.0% CP) was put into the rumen. Rumen contents were sampled in a Latin square design (two nitrogen (N) sources, three times (1, 2 or 6 h after feeding), for six days). Ammonia-N was determined. In the other study sheep were given 900 g (air-dry) chaffed wheaten hay (8.0% CP) and 25 g/d minerals (Siromin®) once daily. Either 10 g urea (U), 70 g heat-extracted canola meal (C, 31.8% CP) or 90 g lupin meal (L, 26.2% CP) was mixed into the feed (four sheep per N source). Estimated intakes of N over 10 days (g/d) were similar (15.5 [U], 14.6 [C], 15.0 [L], SE 0.28) ($P > 0.05$). In rumen contents from before feeding, 0.5, 1, and 2 h after feeding pH and ammonia-N were determined. Urine collected daily for 4 days was analysed for urea-N and total N.

The concentration of ammonia-N (mM) was unchanged ($P > 0.05$) with time after lupin meal was put into the rumen, but with canola meal it was low ($P = 0.05$) and then increased to similar concentrations as with lupin meal (Figure, a). Ammonia-N concentrations (mM) did not change with time after feeding in sheep given canola or lupin meals as dietary N supplements, but they increased after feeding and remained high in sheep given urea (Figure, b)). In these sheep pH in the rumen decreased with time after feeding, but there was no effect of source of dietary N (6.68, 6.58, 6.38, 6.37, SE 0.05). Total N excreted (g/d) did not differ with source of dietary N ($P > 0.05$) (5.6 [U], 5.2 [C], 5.1 [L], SE 0.66), but sheep given urea excreted the most urea-N (g/d) ($P < 0.001$) (4.5 [U], 2.7 [C], 3.4 [L], SE 0.39). Rates of hydrolysis of proteins in canola and lupin meals were similar and exceeded rates of assimilation of ammonia-N by the rumen microbial populations, with N excreted as urinary urea. Variance (%) in rumen ammonia-N concentrations between sheep was high (Study 1: 73 [L], 35 [C]; Study 2: 65 [L], 39 [C], 12 [U]). These may reflect wide variation in the proteolytic enzymes found in the rumen between animals eating the same diets, and a poor adaptation by the proteolytic microorganisms to these proteins (1).



1. Wallace RJ, Onodera R, Cotta MA. Metabolism of nitrogen-containing compounds. In Hobson PN, Stewart CS (eds). The rumen microbial ecosystem. London: Chapman and Hall, 1997; 283–328.