AMMONIA-N TRANSACTIONS IN THE OMASUM OF SHEEP GIVEN CHOPPED OR GROUND LUCERNE HAY

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Introduction

Although rumen NH_3 kinetics can be studied by isotope dilution using ^{15}N (Nolan and Leng, 1974), NH_3 transactions in the omasum remain poorly understood because this organ is difficult of access. In this paper, ^{15}N enrichments of rumen NH_3 and abomasal N constituents have been combined with digesta flow values to obtain estimates of apparent production and absorption of NH_3 in the omasum of sheep.

Materials and Methods

Six Corriedale wethers (initial mean liveweight 43 ± SE 1 kg), fitted with rumen and abomasal cannulae, were given chopped lucerne hay (ad libitum intake 75 ± 3 g DM/(d. $kg^{3/4}$)) or the same hay ground to pass a 6 mm screen and pelleted (ad libitum intake 98 ± 3 g DM/(d. $kg^{3/4}$)) at rates ranging from 0.2 to 0.9 ad libitum. Rumen (R) digesta content and digesta flow from the abomasum (A) were determined by the double marker technique (Faichney, 1980) using primed continuous infusions of the solute marker ^{51}Cr-EDTA and the particle-associated marker ^{103}Ru-phen; $(^{15}NH_4)_2SO_4$ was included in the infusion to provide 1.66 mmole ^{15}N/d. Rumen mean retention times (MRT) for ^{51}Cr-EDTA were calculated from the decline in its rumen concentration during the 2 days following termination of the infusion and corrected for absorption (Faichney, 1986) to obtain solute MRT's. Plateau ^{15}N enrichments (fraction of infusion rate/g N) of $R.NH_3N$ and A. non-ammonia (NA) N were determined by mass spectrometry. Irreversible loss (IL) of $R.NH_3N$ was calculated as the reciprocal of its enrichment and transfer quotients (TQ) for $A.NH_3N$ and A. NAN were calculated as the ratios of their enrichments to that of $R.NH_3N$. Omasal (Om) transactions were calculated as follows:

$R.NH_3N$ absorption = IL − ($R.NH_3N$ flow + A. NAN flow x TQ.NAN)

$R.NH_3N$ flow = $R.NH_3N$ pool/MRT.solutes

Om absorption fraction (OmAF)
= ($R.NH_3N$ flow − $A.NH_3N$ flow x TQ.NH_3N) /$R.NH_3N$ flow

Om.NH_3N production = $A.NH_3N$ flow x (1−TQ. NH_3N)/(1−OmAF)

Om.NH_3N absorption = ($R.NH_3N$ flow + Om. NH_3N production) x OmAF

Results

Production of NH_3N in the omasum ranged from 0.5 to 2.1 g/d, increasing by 1.27 g/kg DM intake (38 mg/g N intake) whether or not the hay was ground (figure 1). Rumen flow, omasal absorption and abomasal flow tended to be greater when the chopped hay was given.

Irreversible loss of NH_3N from the rumen increased as DM intake increased, from 8.9 g/d to 23.5 g/d for the chopped hay and to 32.8 g/d for the ground hay; the rate of increase declined when DM intake exceeded about 0.9 kg/d. Irreversible loss declined from 80 to 63% of N intake for the chopped hay and from 74 to 62% of N intake for the ground hay as DM intake increased.

Discussion

The results showed that omasal NH_3N production was significant, being equivalent to 5-6.5% of rumen irreversible loss. Omasal NH_3N absorption was equivalent to 12-25% of rumen absorption.

Implicit in the calculations is the assumption that NH_3N and NAN produced in the omasum are not labelled with ^{15}N. Such labelling would lead to underestimation of the true values for rumen NH_3N absorption and omasal NH_3N production and absorption. However, rumen microbial recycling was estimated to range from 1.4 to 2.4 %/h (G.J. Faichney and E. Teleki, unpublished) and omasal MRT's are only 6-7% of R.

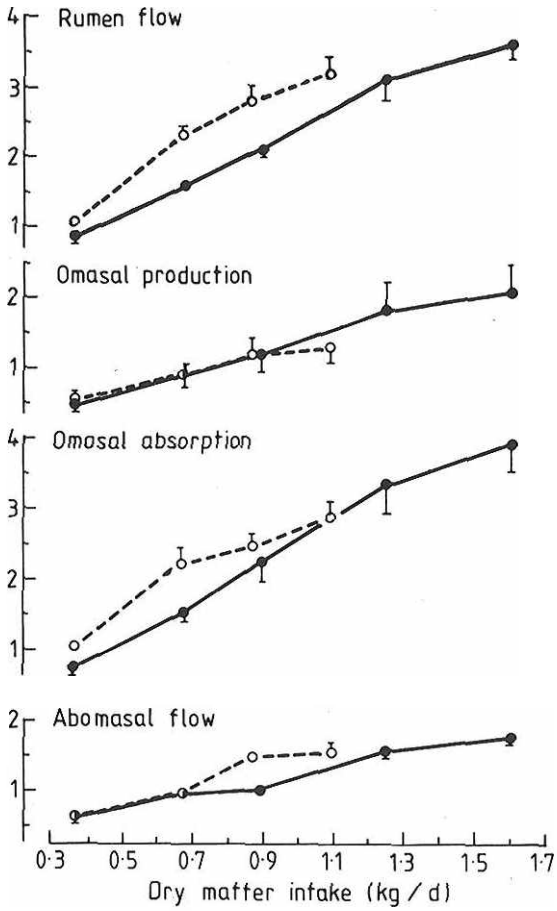

Figure 1. NH_3N (g/d) flowing from the rumen, produced in and absorbed from the omasum and flowing from the abomasum in sheep given chopped (○ —— ○) or ground (● —— ●) lucerne hay (means with SE).

MRT's (Faichney and Barry, 1986) so the errors are likely to be small.

(Key Words: Omasal Ammonia, Production, Absorption)

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