

AMINO ACID AVAILABILITY IN THE SMALL INTESTINE OF SHEEP GIVEN
LABELLED PROTEINS TREATED WITH FORMALDEHYDE

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Formaldehyde, which protects protein against microbial degradation in the rumen (Ferguson 1975), reacts preferentially with specific amino acid side chains on the protein. These reactions can render the reacting amino acids nutritionally unavailable. Faichney and White (1979) observed a lower absorption coefficient of lysine than other amino acids from their highest protein diet treated with formaldehyde.

To measure more precisely the fate of specific amino acids in the small intestine casein was labelled with ^3H -tyrosine + ^{14}C -lysine or ^3H -lysine + ^{14}C -leucine by infusing labelled amino acids into the jugular vein of a lactating goat. The isolated milk casein was treated with formaldehyde at 0, 1 or 2 g/100 g casein. Treatments of an unlabelled batch of casein with ^{14}C -formaldehyde at 1, 2 or 3 g/100 g indicated that, respectively, 0.7, 1.4 and 1.7 g of the added formaldehyde was actually bound per 100 g casein. Labelled casein, suspended in a Cr-EDTA solution, was introduced in a single shot into the abomasum of a sheep with cannulas in the abomasum and terminal ileum. Samples were taken at half-hour intervals at the terminal ileum. The unabsorbed fractions of the labelled amino acids were calculated as the ratio of the areas under the concentration (fraction of dose/g) -v- time curves of the amino acids and Cr-EDTA. The results are summarized in Table 1.

TABLE 1. Unabsorbed labelled amino acids

Casein batch	Label	Formaldehyde (g/100 g casein)		
		0	1	2
		Fraction of Labelled Amino Acid Unabsorbed		
I	^3H Tyr	0.024	0.052	0.201
	^{14}C Lys	0.024	0.200	0.364
II	^3H Lys	0.029	0.176	0.272
	^{14}C Leu	0.014	0.027	0.065

The absorption of untreated casein in the small intestine was 97-98%, a value close to that obtained by conventional methods. The absorption of leucine which does not react with formaldehyde, was hardly affected by the 1 g treatment though there was a small effect at the 2 g level. The absorption of lysine which reacts strongly with formaldehyde, was greatly affected even at the lower level of treatment. Tyrosine, which presumably is less reactive than lysine, was affected only at the higher level of treatment. It is concluded that the absorption of individual amino acids from protected casein varies widely especially at higher levels of formaldehyde treatment. The technique described here provides a direct method of testing amino acid availability and determining optimal treatment levels of cross-linking agents for protecting dietary protein.

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