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A STUDY OF THE AMINO ACID STATUS
OF SHEEP FED SILAGE,
WITH PARTICULAR REFERENCE TO METHIONINE

A thesis submitted for the
degree of Doctor of Philosophy
at Massey University, New Zealand

by

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ABSTRACT

The amino acid status of sheep fed silage appears to be an important factor in controlling voluntary intake. The basic aim of the experiments described in this thesis, was to study the digestion and utilisation of silage, in response to increased availability of methionine and protein. The treatments chosen to increase protein availability, were formalin-treatment of silage (Expt. 1) and supplements of formaldehyde-treated casein and a readily available energy source (Expt. 2). Methionine availability on untreated silage was increased by I/P infusion in Expt. 1, and methionine availability on all three treatments was increased by duodenal infusion in Expt. 2. These treatments provided from 0.8 to 6.0g/day of methionine available for absorption, and from 33 to 167g/day of total amino acids entering the duodenum. The response to increased methionine availability was measured in terms of N balance, plasma amino acid concentration and the percentage of L-methionine-C14 (U) oxidised to carbon dioxide.

Intake was restricted to near maintenance, but the amount offered was seldom completely eaten. There were no treatment differences in intake in Expt. 1, but intake of the basal silage diet decreased in Expt. 2. This decrease was partly prevented by the two supplements, and intake was increased by duodenal infusion of L-methionine on all treatments. The differences in amino acid intake accounted for 67% of the difference in flow of amino acids into the duodenum in the data from both experiments. In addition, the energy supplement increased the flow of amino acids into the duodenum, ^{apparently} by increasing the conversion of non-protein-nitrogen to protein-nitrogen in the rumen. An adequate supply of amino acids to the tissues is required for efficient utilisation of a feed. Thus, high amino acid and water soluble sugar

contents will improve the nutritive value of silage, by increasing the flow of amino acids into the duodenum.

N balance increased, and total plasma amino acid concentration decreased, in response to methionine infusion on all three treatments in Expt. 2. These results suggest that methionine was limiting tissue protein synthesis. Intake, was also decreased, but to a greater extent at lower levels of duodenal amino acid flow in Expt. 2. However, there was no depression of intake in Expt. 1, despite low flow rates of amino acids into the duodenum. This appeared to be due to a lower requirement for methionine in the sheep in Expt. 1, compared to Expt. 2.

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ABBREVIATIONS

AA	amino acid
C	carbon
DAP	2:6 diaminopimelic acid
DM	dry matter
DNA	deoxyribonucleic acid
I/P	intraperitoneal
ME	metabolisable energy
MHA	methionine - hydroxy - analogue
N	nitrogen
NA	nucleic acid
NAAN	non-amino acid-N
NPN	non-protein-N
OM	organic matter
RNA	ribonucleic acid
S	sulphur
SA	specific activity
WSC	water soluble carbohydrates
w/v	weight per volume
w/w	weight per weight