THE RELATIVE EFFICACY OF METHIONINE, CYSTEINE AND HOMOCYSTEINE FOR PROMOTING WOOL GROWTH

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Wool proteins are rich in cyst(e)ine but contain little methionine. Wool growth of sheep consuming roughage-based diets is stimulated by supplements (1-3 g/d) of either cyst(e)ine or methionine given in a way that avoids degradation in the rumen (Reis 1979). However, the precise role of each amino acid in relation to wool growth is uncertain. Methionine can provide cysteine via the transulphuration pathway and homocysteine, an intermediate on the pathway, can be converted to methionine and cysteine.

The effectiveness of homocysteine for stimulating wool growth was tested in three sheep receiving a roughage-based diet and given abomasal infusions of DL-methionine (2 g/d) and equimolar amounts of DL-homocysteine (given as the thiolactone) in separate periods. Homocysteine or methionine as a sole supplement were equally effective for stimulating wool growth. Clean wool growth as a % of the pre-treatment rate was 167% (140-206%) with homocysteine and 157% (136-185%) with methionine supplementation.

The effectiveness of methionine, cysteine and homocysteine for promoting wool growth, as assessed by autoradiography using [^{35}S]cystine, was also tested when the above diet was supplemented with mixtures of amino acids given via the abomasum. A complete mixture of amino acids (45 g/d) provided 10 essential amino acids, including 3 g/d methionine. In other mixtures methionine was omitted or replaced with equimolar amounts of sulphur-amino acids. In four experiments with 12 sheep the complete mixture substantially increased wool growth (178-204% of pre-treatment; see Table). The omission of methionine reduced wool growth to below pre-treatment levels (expt 1). When methionine was replaced by cysteine wool growth was markedly inferior to the complete mixture (expt 2), indicating a specific requirement for methionine. Abomasal infusions of gelatin (which provides no cyst(e)ine and c. 0.8% methionine) supplemented with amino acids suggested that this requirement may be relatively small. Experiment 3 confirmed that no more than one-third of sulphur-amino acid needs to be given as methionine in amino acid mixtures to maximize wool growth (see Table). When methionine was replaced by homocysteine wool growth was lower than with the complete mixture of amino acids (expt 4; see Table), but homocysteine was superior to cysteine in this situation.

Wool growth with abomasal infusions of mixtures of amino acids

Expt	Sheep (no)	Wool growth (% of pre-treatment)
1	2	Complete mixture; 180: methionine omitted; 72
2	4	Complete mixture; 186: methionine replaced by cysteine; 113
3	2	Complete mixture; 204: methionine replaced by 1 part methionine 2 parts cysteine; 195
4	4	Complete mixture; 178: methionine replaced by homocysteine; 145

The reason for the failure of cysteine and homocysteine to substitute for methionine in mixtures of amino acids is not known. The machinery for wool protein synthesis may not be able to function at a high rate without adequate methionine. Additional betaine or folic acid may be required to allow greater regeneration of methionine from homocysteine in experiment 4.

REIS, P.J. (1979). In 'Physiological and Environmental Limitations to Wool Growth', p. 223, eds J.L. Black and P.J. Reis. (University of New England Publishing Unit: Armidale).

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