

## D-PENICILLAMINE, CYSTINE METABOLISM AND WOOL GROWTH IN SHEEP

P.J. REIS

The supply of amino acids, especially cyst(e)ine, to wool follicles is an important factor controlling the rate of wool growth. D-Penicillamine might be expected to interfere with wool growth in sheep by depleting the animal of cyst(e)ine through the excretion of a cysteine-penicillamine disulphide (Jocelyn 1972), and may also cause depletion of pyridoxal-5-phosphate, a co-factor for many reactions involved in the metabolism of amino acids (Asatoor 1964). D-Penicillamine is a chelating agent (Jocelyn 1972) and may inhibit wool growth by causing a temporary deprivation of copper or zinc. Deficiency of these elements causes weakened fibres and a reduction or cessation of wool growth (Purser 1979).

Sheep receiving a diet on which wool growth responds to cyst(e)ine supplementation were given continuous intravenous infusions of 5 or 10 g D-penicillamine over 2 or 4 d. The effects on the incorporation of [<sup>35</sup>S]cystine into wool fibres were measured in two sheep. Following an intravenous injection of a tracer dose of 37 µCi L-[<sup>35</sup>S]cystine, the incorporation of <sup>35</sup>S into plucked wool fibres reached a level of 42-44 counts/min/mg in 6 d. Incorporation was reduced to 15-20 counts/min/mg at 6 d when the above procedure was repeated, but a 2-d infusion of 5 g D-penicillamine was commenced 19 h before the injection of [<sup>35</sup>S]cystine.

Effects of penicillamine on wool growth and plasma concentrations of copper and zinc were measured in five sheep. Changes in length growth rate, diameter and volume of wool fibres were determined by autoradiography. Two sheep were given 5 g and two 10 g penicillamine over 2 d. The volume of wool grown during a 4-d period from the start of infusion was reduced to 88-89% of pre-treatment values in all sheep, due mainly to a reduction in length growth rate. However, changes in fibre diameter due to treatment were probably underestimated. A fifth sheep was given 10 g penicillamine over 4 d. The volume of wool grown during this period was reduced to 73% of the pre-treatment value, and was 69% during a 6-d post-infusion period. Diameter and length growth rate were reduced during the infusion to 81% and 92% respectively of pre-treatment values. Penicillamine caused a considerable reduction in the extent of incorporation of cystine into wool, as judged by the intensity of autoradiographed marks at the end of infusion. Plasma copper values in the above five sheep of 0.7 to 1.1 µg/mL before infusion were unaltered or slightly increased during infusion. In contrast, zinc values were reduced from 0.7-0.8 µg/mL to 0.2-0.4 µg/mL during the infusion of penicillamine. Levels recovered rapidly when the infusion stopped.

The reduced incorporation of cystine into wool indicates that penicillamine probably depletes the supply of cyst(e)ine available to wool follicles. However, this depletion was insufficient to have a marked effect on the rate of wool growth, and wool fibres were not weakened by this treatment. Also, the depletion of zinc, as judged by reduced plasma levels, was insufficient to cause wool fibre shedding.

ASATOOR, A.M. (1964). *Nature, Lond.* 203: 1382.

JOCELYN, P.C. (1972). 'Biochemistry of the SH Group'. (Academic Press: London.)

PURSER, D.B. (1979). In 'Physiological and Environmental Limitations to Wool Growth', p.243, eds J.L. Black and P.J. Reis. (University of New England Publishing Unit: Armidale.)