HOW QUICKLY DOES WETTING AFFECT THE SKIN OF MERINO SHEEP

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SUMMARY

When strong-wool Merino ewes and lambs were kept wet to the skin, small areas of superficial dermatitis, leucocytic invasion of the overlying epidermis and increased vascular permeability were detected at 6 h. The extent of these changes increased during 9 days of wetting, and epidermal microabscesses formed in some sheep after 4 days. Leakage of albumin on to the skin surface in increasing amounts and progressive epidermal acanthosis commenced during the first day. Hyperkeratosis increased markedly after 4 days. Lysis of fibre cells and subsequent formation of inner root sheath "plugs" occurred in a small number of follicles at variable times during wetting. The skin returned to normal more quickly in the lambs than in the ewes after wetting ceased.

INTRODUCTION

Several studies have been made of the morphological changes in the skin of sheep after wetting for 4 or more days (Hayman 1953; Nay and Watts 1977; Burrell et al. 1982a, 1982b). Because these studies described changes after fleece-rot had developed, the present study was undertaken to examine how quickly the skin of Merino sheep responds to wetting during the development of fleece-rot. A more detailed account is given in Hollis et al. (1982).

MATERIALS AND METHODS

Four adult strong-wool Merino ewes with 10 months' growth of wool and 2 ewe lambs, 6 months old, were saturated to the skin by immersion in a bath of clean tap water and kept wet for 9 days with continuous artificial rain at 4.5 mm/h. After 4 h of wetting, each sheep was injected i.v. with sterile 5% (w/v) Pontamine Sky Blue 6 BX dye in 0.9% (w/v) saline (25 mg/kg live weight) to examine vascular permeability (Lancaster and Vegad 1967). The presence of albumin on the skin surface was assessed with Albym-Test strips (Boehringer Mannheim GmbH), and a skin sample was biopsied from the trunk of each sheep before wetting, at intervals from 6 h onwards during wetting, and up to 13 days after wetting ceased. The skin samples were fixed in Serra's fluid, embedded in paraffin wax, sectioned at 8 μm thickness and stained with haematoxylin, eosin and picric acid for examination by light microscopy. Epidermal thickness was measured as in Lyne and Hollis (1968).

RESULTS

Patchy blue coloration had developed in the skin of all the sheep 2 h after the dye was injected (i.e. after 6 h of wetting) indicating a patchy increase in vascular permeability. Also at this time small areas of superficial dermatitis were detected microscopically in all the sheep and leucocytes had begun to invade the epidermis of 2 ewes (Fig. 1). Further wetting exacerbated these conditions and by 3 days leucocytes were invading the epidermis of all the sheep, except for 1 lamb, in which this did not occur until the ninth day of wetting. Epidermal microabscesses developed in the 2 ewes and the lamb which first exhibited epidermal invasion.
Fig. 1. Section of adult sheep skin showing an inflammatory response (IR) in the dermis (D) and leucocytes (→) invading the epidermis (E) after 6 h of wetting. (After Hollis et al. 1982).

Fig. 2. Section of a wool follicle bulb in which cells with pycnatic nuclei (→) are adjacent to the upper part of the dermal papilla (DP). (After Hollis et al. 1982).

Fig. 3. Section of the lower part of a wool follicle in which fibre cells are lysed in the bulb (B), suprabulbar region (SB) and keratogenous zone of the fibre (F). The inner root sheath (IRS) is relatively unaffected. (After Hollis et al. 1982).

Albumin was detected on the skin surface during the first day of wetting and increased more than 30-fold during the next 8 days. However, it was not until after 3 days that serous exudate was visible to the eye on the skin surface of some of the sheep. By this time small scattered spots of green colour were also obvious on the skin, and the extent of this discoloration increased while the skin remained wet.
Epidermal thickness increased c. 3-fold during wetting. The thickening during the first 4 days was due mainly to acanthosis, and during the next 5 days to hyperkeratosis without further acanthosis in the lambs, and to both acanthosis and hyperkeratosis in the ewes. After wetting ceased, the dermatitis cleared and the epidermal thickness returned to normal more quickly in the lambs than in the ewes.

Lysis of fibre cells in 1-13% of follicles was observed at various times during wetting. It commenced in cells adjacent to the upper half of the dermal papillae (Fig. 2) and progressed proximally into the bulbs and distally into the keratogenous zones of affected follicles (Fig. 3). The inner root sheaths in such follicles remained, and because they were not sloughed into the lumen as usual, they became folded and formed the "plugs" described by Nay and Watts (1977).

DISCUSSION

This study has revealed that increase in vascular permeability, dermatitis and leucocytic invasion of the epidermis commence in sheep skin after only a few hours of wetting, and serous exudation within 1 day. The more extensive changes evident when fleece-rot has developed (Hayman 1953; Burrell et al. 1982a, 1982b) are consequences of these initial responses.

The proliferation of Pseudomonas aeruginosa on wet sheep skin has been shown to increase the severity of the skin changes (Burrell et al. 1982a, 1982b). However, the actual agent responsible for triggering the initial inflammatory response is unknown.

The impaired keratinization of fibres and formation of inner root sheath "plugs" (Nay and Watts 1977) are now known to result from lysis of fibre cells in the lower half of the affected follicles. However, the cytolytic agent is also unknown. Perhaps it is a by-product of the dermatitis and gains access to some follicles due to altered permeability of the basal lamina of the dermal papilla.

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REFERENCES
