Cattle and Sheep Skin Permeability: A Comparison of Frozen and Reconstituted Skin with that of Fresh Skin

Keyphrases □ Permeability—cattle and sheep skin, comparison of frozen and reconstituted skin with fresh skin □ Skin—permeability in cattle and sheep, comparison of frozen and reconstituted skin with fresh skin □ Topical drug delivery—cattle and sheep skin permeability, comparison of frozen and reconstituted skin with fresh skin

To the Editor:

It is known that freezing and reconstituting (*i.e.*, thawing) excised human skin does not significantly change the barrier properties it presents to the passive diffusion of drug molecules (1). This knowledge has led to substantial advances in the development of topical drug delivery systems for humans, because potentially useful systems can be identified from the results of *in vitro* screens using frozen and reconstituted human skin (2).

This communication presents data to establish that freezing and reconstituting cattle and sheep skin does not significantly alter their permeability.

It has previously been established (3) that the outer 1 mm of frozen and reconstituted cattle skin (*i.e.*, the stratum corneum, the viable epidermis, the papillary region of the dermis, and a portion of the reticular region of the dermis) acts as an homogeneous barrier to diffusing levamisole molecules. A corollary to this finding is that, for skin samples with thicknesses up to 1 mm, the product of the permeability constant (k_p in centimeters per minute) and the skin thickness (r in centimeters) (*i.e.*, k_pr) is a constant. A similar relationship has been observed for penetration of levamisole through the skins of Merino sheep (4).

To establish the relative permeabilities of fresh and reconstituted cattle and sheep skins, the following experiments were conducted.

Skin was harvested from an 8–9-month Shorthorn-Hereford cross calf in early spring and from a 12–18-month Merino cross ewe in mid-winter. The sheep was shorn and then finely clipped[1] and the calf finely clipped[1] immediately before skin samples were removed with a dermatome[2] set at 1.1 mm.

The permeability of fresh skin and skin that had been stored at −30° for 5–7 days and then thawed to levamisole from a 0.85% solution in an aqueous pH 8.9 buffer was determined using methods identical to those described previously (3).

Values of k_pr for levamisole penetrating through fresh and reconstituted skins are given in Table I.

There was no significant difference (at the 1 or 5% levels) between the values of k_pr for fresh and reconstituted cattle or sheep skin.

Table I—Permeability of Cattle and Sheep Skins to Levamisole[a]

Animal	Skin Thickness, cm	$10^6 k_pr$, $cm^2\ min^{-1}$
	Fresh	
Sheep	0.055	6.0
	0.066	7.7
	0.070	10.7
	0.071	9.2
	Frozen	
Sheep	0.077	7.2
	0.077	6.5
	0.077	8.4
	Fresh	
Calf	0.069	27.7
	0.071	26.8
	0.076	30.9
	0.092	33.7
	0.093	31.7
	Frozen	
Calf	0.065	26.5
	0.069	25.6
	0.071	29.3
	0.082	29.5
	0.086	30.2
	0.091	33.4

[a] From a 0.85% solution in an aqueous pH 8.9 buffer and water-bath temperature of 37°.

Although no relationship has been established between *in vitro* and *in vivo* permeability for cattle and sheep skins, it seems unlikely that live skin, with its blood supply and sweat and sebum secretions, would be appreciably less permeable than excised skin, unless the latter was damaged by the receptor solution.

Consequently, it is concluded that screens for cattle and sheep skin permeability that employ reconstituted skin (5–7) and utilize normal saline as a receptor phase have the potential to provide useful information to developers of veterinary topical dosage forms.

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[1] Andis R400 Oster A5 Clippers.
[2] Brown Electro Dermatome, model 902.

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