



EDITORIAL

Animal Skin Models for Percutaneous Absorption Studies

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Introduction

Transdermal drug delivery systems are evaluated mainly with percutaneous absorption studies. The certain skin absorption data can be obtained with human studies but it is not applicable at the beginning of development stage of the formulations. Animals or isolated skin of animals are used both *in vitro/ex vivo* and *in vivo* studies to shorten and economize the process of drug development and minimize the number of human studies [1]. There are different types of animal skin models used in the literature. The suggested animal models instead of human skin include primates, porcine, mouse, rat, guinea pig and snake skin models [2]. Netzlaff et al. [3] showed that the amount of free fatty acids and triglycerides and the density of hair follicles are important factors causing differences between the skin barriers among species [3]. Porcine skin model is mostly preferred because of the restriction of using primates and because of its similarity to human skin in terms of physical characteristics such as stratum corneum (SC) thickness, the vascular anatomy and collagen fiber arrangement in the dermis, as well as the contents of SC glycosphingolipids and ceramides, density of hair growth and structures (presence of Langerhans cells, rete ridges and close adhereness to underlying structures) [2, 4]. The viable epidermis thickness (66-72 µm) and follicular structure and density per cm² (20 hairs) of pig ear skin is very similar to human skin (70 µm and 14-32 hairs respectively), especially the ear of 6 months old pig is the most similar to human skin [1, 2, 5].

Rodent skin (mice, rats and guinea pigs) is the most commonly used animal model in *in vitro/ex vivo* and *in vivo* percutaneous absorption studies due to its availability, low cost, easy handling and small size. The hairless species of rats are more relevant than the hairy skin because of giving more similar results to human skin, and also avoids the problems of skin damage due to hair removing. Rodent skin is commonly preferred in *in vivo* studies and is often not used for *in vitro* permeation studies. Rat skin is more preferred for skin permeation studies compared with the other rodents because it has more structural similarities compared to human tissue and gives more comparable results with human skin. Rat epidermis is thinner than pig epidermis and studies showed that pig skin

was found to have a closer permeability character than rat skin to human skin, particularly for lipophilic penetrants [2, 5]. Snake skin is also a suggested membrane for drug diffusion studies. The main advantages of this membrane are obtaining it without animal sacrifice, storing easily without degradation, ecologically safe and suitable for experimental animal ethics. Besides having some structural similarities to human skin, snake skin does not have follicles [5, 6]. Porcine ear skin and hairless mouse skin is remaining as the general choice for penetration studies [6].

Conclusion

In conclusion; where excised human skin is not possible to obtain, a convenient animal skin model can be used in skin-permeation studies. The choice of the most applicable animal model for the particular purpose should be based on the interplay between the availability, easiness of the use, cost and the respective limitations.

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